DISSERTATION

VALUATION OF NATURAL RESOURCES IN A SMALL MOUNTAIN COMMUNITY:
THREE ESSAYS IN NON-MARKET VALUATION AND RURAL DEVELOPMENT

Submitted by:

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY SARAH A. CLINE ENTITLED VALUATION OF NATURAL RESOURCES IN A SMALL MOUNTAIN COMMUNITY: THREE ESSAYS IN NON-MARKET VALUATION AND RURAL DEVELOPMENT BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

VALUATION OF NATURAL RESOURCES IN A SMALL MOUNTAIN COMMUNITY:
THREE ESSAYS IN NON-MARKET VALUATION AND RURAL DEVELOPMENT

Natural resources are important to rural economies in terms of the amenities they provide and the economic opportunities they generate for the surrounding communities. In many rural areas, open space provided by ranchlands provides important amenities to tourists and residents. In addition, land use may also affect the local water quality and thus produce further impacts on local amenities and regional economic opportunities.

This dissertation looks at the value of ranchland open space and water quality in Chaffee County, Colorado. The value of ranchland open space and water quality to visitors to Chaffee County is estimated using non-market valuation techniques. Two joint-methods are used to obtain values for ranchland open space and water quality. The first method combines travel cost and contingent behavior data, while the second method uses travel cost, contingent behavior and contingent valuation information to estimate values for these resources. A third application combines regional economic analysis with the non-market valuation data to estimate the impacts of decreased natural resource quality on the local economy. The results show loss of ranchland open space will result in welfare losses to visitors to the county and that associated impacts from decreased water quality could significantly increase those losses.

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CHAPTER ONE

Introduction

Natural resources are an important part of rural communities. They have traditionally been valuable to local rural economies in terms of extraction and use of those resources through industries such as mining, agriculture and forestry. Today, in many rural areas, natural resources are also important for the amenity values that they provide. Low density, or dispersed, and, as a result, often low intensity, land use defines ruralness. Low intensity land uses tend to enhance the nonconsumptive amenities and ecosystem services created by rural lands. These amenities can benefit both residents and visitors to rural areas.

Residents in rural areas may benefit from the natural resources available in terms of the amenities they provide and their contribution to residents' quality of life. Recently, rural populations have been growing in many areas. Beginning with initial gains in the 1970s, growth in rural areas has varied – slowing in the 1980s, increasing again in the early 1990s, followed by another decline in the late 1990s and a rebound after 2001 (Johnson 2006). Some research suggests that a large part of this growth stems from the presence of natural resource-based amenities in these areas, and that growth rates tend to be larger in rural areas with higher levels of amenities. A recent study by McGranahan (1999) found that high amenity rural counties tended to double their population over the 25 year period from 1970 to 1996 (about 3% annual growth rate), while those with low amenities grew on average by only 1 percent, with some low-amenity rural counties actually showing declining population.

In addition to the benefits provided to residents, natural resources can also provide benefits to non-residents in terms of tourism. Tourism is an important economic driver in many rural areas in the United States, particularly those areas with high levels of natural resources or outdoor recreation benefits (English et al. 2000). It is often suggested that tourism in rural areas will increase local employment. Reeder and Brown (2005) found that employment grew by 24 percent in recreation counties[1] compared to 10 percent in other rural counties during the 1990s. Although tourism jobs are often criticized as being low paying compared to other options, several studies have found to the contrary. Reeder and Brown (2005) found that earnings per resident worker were around $2,000 higher for recreation non-metropolitan counties than for other rural counties. They also found that average per capita income was about 10 percent higher for recreation counties than for other non-metropolitan counties (Reeder and Brown 2005). This finding is likely influenced by the higher non-earning incomes of wealthy migrants to rural recreation counties. Using data from 1990, English et al. (2000) also found that non-metropolitan counties that were dependent on tourism (defined as having more than double the national percentage of jobs and income due to nonresident recreation visitation) had significantly higher per capita incomes than non-dependent counties.

The open space provided by ranchlands and farmland is one bundle of natural resource attributes that is important in many rural communities. In many rural communities, especially those near urban areas (in the rural-urban fringe), increasing

[1] The authors follow the typology of Johnson and Beale (2002) that identify non-metropolitan counties as recreation counties based on several empirical measures of recreation activity, such as levels of tourism-related employment and income and seasonal housing (Reeder and Brown 2005).

development has threatened this type of open space. Between 1992 and 2001, an average of 2.2 million acres of farmland in the United States was converted to urban uses per year (Nickerson and Hellerstein 2007). This has led to increased emphasis on the policy analysis of farm and ranchland open space in the past 20 years (Bergstrom and Ready 2009). Several authors have used hedonic methods to estimate the value of agricultural or ranchland open space to residents (Geoghegan 2002, Ready et al. 1997), while others have used hedonic methods to estimate these values for tourists by looking at rental prices for cottages in rural areas (Vanslembrouck et al. 2005, Le Goffe 2000). A number of other authors have estimated the value of agricultural lands to residents using contingent valuation methods (Bergstrom et al. 1985, Bowker and Didychuk 1994, Ready et al. 1997, Rosenberger and Walsh 1997). A few studies have been conducted to estimate the value of farm and ranchlands to tourists using contingent behavior and travel cost information (Rosenberger and Loomis 1999, Ellingson et al. 2007).

The conversion of agricultural and ranchland open space to more urban uses can have impacts on water quality as well. Although the link between land use and water quality is recognized, it has not often been considered in economic studies. As Walls and McConnell (2004) note, although many studies consider the efficiency of non-point source pollution control policies, they generally include land use as an exogenous factor. Economic valuation studies that consider land and water resources simultaneously have been lacking as well.

Perhaps one reason that these links have not been adequately considered is because the exact trade-off in water quality between residential and agricultural uses is not always clear and may depend on the extent and type of land use. For example, high intensity residential development may increase runoff into streams due to additional paving. The impact of maintaining agricultural working landscapes may vary based on the type of use. For example, if the area is used for high intensity livestock production or cropping, water quality could decline because of additional pollutants in runoff that eventually reach the water source. Less intensive agricultural development, however, might lead to a lower level of water pollution than if the land were converted to urban uses. While the linkages between the quality of these two resources are uncertain, it is likely that changes in either (or both) would effect the benefits they provide to residents and tourists in a given community.

Open space (including that provided by private landowners) is a good that many individuals value but it is generally not priced in the market. In order to measure the values that individuals place on environmental goods (such as open space and water quality), economists often employ non-market valuation methods. These methods are used to obtain values for goods that are not traded in a market but nonetheless provide benefit to users (or non-users) of the resource. Non-market valuation methods generally fall into two broad categories: stated preference and revealed preference methods.

Revealed preference (RP) methods use data from other related markets to impute values for non-market goods. In essence, values for the non-market good in question are "revealed" from the consumer's behavior in a related market. Two of the most common RP methods include hedonic models and travel cost models. Hedonic methods can include property or wage models. Hedonic property models are more commonly used in environmental economics and use data on home purchases to value environmental goods in a given community. In this case, demand for home, neighborhood and environmental characteristics can be disentangled from the choices that individuals make when purchasing a home. The other primary type of RP method, which will be considered in this research, is the travel cost model. Travel cost (TC) models consider the recreation behavior of individuals and the amount that they spend to travel to a given site. Site characteristics can then be valued based on the amount that individuals spend to visit the location.

Stated preference (SP) methods ask individuals what value they place on a given environmental good or service, or how their behavior might change with a change in environmental quality. Two SP methods that are often used in environmental economics include contingent valuation (CV) and contingent behavior (CB) techniques. Both of these methods are employed in the research presented here. The CV method utilizes carefully prepared surveys to obtain information from individuals about their willingness to pay for a particular environmental good or service. Individuals are commonly asked their maximum willingness to pay to improve the quality or ensure the provision of a specified environmental good. CB methodology uses similar survey techniques to obtain information about how a respondent's behavior would change given a change in the price, quantity or quality of a particular environmental good. CB models are often used to estimate recreation demand under different hypothetical situations.

There are several limitations often cited for each of the categories of models described above. One of the limitations of RP models is that it is not possible to obtain values for levels of environmental quality outside of what has historically been observed. In addition, RP methods are unable to capture non-use values (i.e., bequest and existence value). SP methods are often criticized for their hypothetical nature.

In order to deal with these criticisms, several authors have begun to develop methods that combine RP and SP data in order to increase efficiency. Some of the benefits obtained from combined RP and SP data sources that are often mentioned by authors include the ability to analyze situations outside of historical events, increasing econometric efficiency by increasing sample size, and grounding choices in actual behavior (Whitehead et al. 2005, Whitehead et al. 2000). Several authors have combined TC and CB data, which allows for the estimation of welfare effects for changes in visitation to a recreation site due to changes in environmental quality or price (Englin and Cameron 1996, Rosenberger and Loomis 1999, Grijalva et al. 2002, Hanley et al. 2003, Alberini et al. 2007). Other authors have developed models that combine TC and CV techniques to obtain estimates that are able to take advantage of the strengths of each method. Since the first publication combining TC and CV methods (Cameron 1992), several other authors have further extended the methodology for combined methods (Adamowicz et al. 1994, Niklitschek and León 1996, Eom and Larson 2006).

Other authors have combined non-market valuation information with regional economic analysis to provide additional information for policymakers. Loomis (1995) addressed the idea of incorporating forecasts of future visitation under environmental change with regional economic input-output (I-O) analysis. Since then, several authors have used results from non-market valuation surveys along with I-O analysis to determine economic implications of environmental changes at the regional scale (Loomis and Caughlan 2004, Seidl, Ellingson and Mucklow 2009, Orens and Seidl 2009, Unsworth and Paterson 1999). Previous studies have linked non-market valuation surveys to visitation for National Parks or other public lands. Additional studies of more general tourism impacts can provide useful information for stakeholders in terms of rural development and community planning.

In this dissertation, the methods discussed above – combined RP and SP techniques and combined non-market valuation and I-O analysis – will be used in the context of valuation of ranchland open space and water quality. One innovation introduced by this research is the consideration of land use and water quality simultaneously in valuation research. Previous research efforts have tended to address each resource separately. The efforts in this dissertation can be further expanded upon in the future to consider these interactions across a greater range of situations. In addition, we compare two options for estimating a combined TC and CB model. In order to deal with endogeneity problems that exist when considering multiple-day trips in a traditional travel cost formulation, we propose a model similar to Bell and Leeworthy (1990) which estimates number of days as a function of travel cost and on-site cost as well as the traditional explanatory variables. A second combined method applies a model used by Eom and Larson (2006) in a single-site context, utilizing revealed preference data along with two types of stated preference data to obtain use and non-use values. Input-output analysis is also combined with the non-market valuation results in order to present a method for future planning and policy analysis at a community level. The method presented in this dissertation provides a starting point for future comprehensive planning of integrated land use and water quality management.

The issues presented above will be addressed with regard to a study site in Chaffee County, Colorado. Chaffee County is located in Colorado's central mountains, south of the I-70 and west of the I-25 development corridors. The headwaters of the

Arkansas River as well as 15 of Colorado's 54 "fourteeners" (14,000 foot peaks) are found in the county. The mountain location and unique geographic features of Chaffee County make the area a prime location for tourism and outdoor recreation, particularly whitewater rafting, fishing, off-road vehicle (jeep and ATV) recreation, and hiking. Chaffee County hosts numerous visitors per year, primarily due to its vast outdoor recreation opportunities.

A large portion of the county's total land area is managed by federal, state and local government agencies including the United States Forest Service (USFS), the Bureau of Land Management (BLM), the State Land Board and the State Divisions of Wildlife and Corrections. Approximately 79 percent of the county's total land area is federal land, while another three percent is administered by the state of Colorado. The federally-owned land includes 455,804 acres in the San Isabel National Forest, managed by the USFS, and another 53,866 acres managed by the BLM. Approximately 120,000 acres of land in Chaffee County are privately owned (excluding the municipalities of Salida, Buena Vista, and Poncha Springs). Farmland and ranchland makes up 71,188 acres of privately owned land in Chaffee County with 26,257 acres in cropland and 8,818 acres in irrigated land (National Agricultural Statistics Service 2006).

Ranching and farming have historically been important land uses in the county, with agricultural uses making up about 13 percent of total land use, and around 71 percent of private ("developable") land use. Agricultural lands not only provide a stimulus for the regional economy but also contribute to the local atmosphere and culture through the management of valley floor wildlife habitat and open working landscapes. Water quantity and quality are also important issues for residents and tourists since many of the outdoor recreational opportunities are centered on the region's widely known water resources.

In recent years, the local population has been increasing, with an overall increase of 33 percent between 1990 and 2005 to reach an estimated resident population of 16,879 (United States Bureau of the Census 2007). This increase in population and increased interest in local tourism are likely to lead to future pressures to convert low density private lands (largely farmland and ranchland) to higher density residential and tourism uses. These concerns are the basis of this research effort.

The remainder of this dissertation addresses each of the issues outlined above in more detail. Chapter 2 uses a combined TC and CB model to estimate the potential changes in consumer surplus to the tourist population of a decrease in the amount of farm and ranch open space, and potential subsequent decreases in water quality. Chapter 3 addresses potential changes in welfare from a different perspective, estimating a model that combines travel cost, contingent valuation and contingent behavior information for tourists to Chaffee County to obtain measures of use and non-use value. Chapter 4 assesses the broader regional economic impacts of potential changes in the amount of farm and ranchland open space as well as several different policies that could be adopted to protect the current agricultural open space in the county. Chapter 5 presents concluding remarks.

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CHAPTER TWO

Valuing Natural Resources Using Contingent Behavior and Travel Cost Methods: A Panel Data Analysis

INTRODUCTION

In the Intermountain West and other rural areas throughout the United States, tourism and related development have been increasing. This type of increased development has placed additional pressure on rural landscapes, particularly agricultural lands and ranchlands. These concerns have led to a number of recent studies valuing agricultural and ranch lands (Bergstrom et al. 1985, Beasley et al. 1986, Bowker and Didychuk 1994, Ready et al. 1997, Rosenberger and Loomis 1999, Fleischer and Tsur 2000).

While different land uses can affect other types of natural resources such as water quality, these interaction effects have not been considered in previous research studies. Since the type of land use (i.e. the amount of land in working landscapes versus urban development) can have significant impacts on water quality, the valuation of both open space and water quality may be important in policy decisions. This is particularly the case in areas where water-based recreation is an important part of the tourism industry.

Although many previous studies have addressed issues related to agricultural land use in terms of local residents, the preferences of visitors to the area are also important when tourism is a significant economic driver. Non-market valuation methods are the most common way to obtain the values that visitors place on specific features of a given site. These non-market valuation methods include revealed preference (RP) methods such as travel cost techniques and stated preference (SP) methods such as contingent valuation and contingent behavior analysis. Recently, revealed and stated preference techniques have been combined in the literature in order to exploit the strengths of each method. This paper uses combined RP-SP methods to estimate the value of both ranchland open space and water quality to tourists. In addition, since studies of tourism often deal with visitors who are on multiple day trips, we estimate a model that attempts to deal with this issue by estimating the number of days spent on site instead of the number of trips taken to the site. This type of model begins to give some insight into the tourism decision on the extensive (number of trips) versus intensive (number of days) margin.

LITERATURE REVIEW

Revealed preference methods are able to uncover or "reveal" the value that individuals place on an environmental good by observing their behavior in a related market. For example, travel cost (TC) analysis is often used to estimate values for different site characteristics by observing (generally through survey data) the amount individuals are willing to incur in travel costs to visit sites with different attributes or different levels of environmental quality. Stated preference methods take a different approach by asking individuals what value they place on a particular environmental good or service. Contingent valuation (CV), perhaps the most common stated preference technique, uses survey methodology to derive values for different levels of environmental quality. In CV methods, respondents are generally asked directly how much they would be willing to pay for the provision of or the change in the quality or quantity of a given environmental good. The contingent behavior (CB) method is another stated preference technique that is used to assess how individuals would change their behavior given a change in price or environmental quality. Individuals are asked to state how their behavior (for example trips taken per year or season) might change given a particular change in environmental quality, price or access to the site. These values can then be combined with travel cost information to econometrically estimate the impact of the quality change on visitation. The value of the behavioral change (measured as the change in consumer surplus) can then be imputed from these econometric estimates. Contingent behavior is an appealing valuation method because it allows for the valuation of changes in price or environmental quality beyond the current level. The consideration of such changes is often desirable for public policy purposes and is not possible in single-site travel cost models that use only revealed preference data.

Since the mid-1990s, it has become more common to combine revealed and stated preference methods in valuation studies of environmental goods and services. Several recent studies have used TC and CB data to estimate the impact of potential changes in price or quality (or both) on potential visitation to a site (Englin and Cameron 1996, Rosenberger and Loomis 1999, Grijalva et al. 2002, Hanley et al. 2003, Alberini et al. 2007). One of the primary reasons for undertaking joint RP-SP modeling is the ability to obtain additional information about different hypothetical policy relevant scenarios, while anchoring the analysis in actual behavior. In addition, many researchers note that the method allows for a more efficient means of sampling since two or more observations are collected from each individual (Englin and Cameron 1996, Hanley et al. 2003).

Englin and Cameron (1996) completed one of the first studies combining TC and CB data. Their analysis used panel data methods (Poisson fixed effects (FE) model) to combine actual trip data with hypothetical data on changing trip behavior under different prices. Several other studies have undertaken similar analyses using panel data estimation methods or pooled models to address specific policy issues. Many of these studies have analyzed changes in environmental quality instead of changes in price.

Rosenberger and Loomis (1999) applied an approach similar to that used by Englin and Cameron (1996) to address a change in environmental quality. Their study combined responses on actual and hypothetical trips based on changing levels of ranchland open space. They applied a panel data Poisson technique with random effects (RE) in their estimation. Hanley et al. (2003) apply a similar technique to address the issue of changing levels of coastal water quality, using a negative binomial random effects model instead of the Poisson technique.

Eiswerth et al. (2000) also apply a combined TC-CB model to an issue of changing environmental quality. Their paper uses a simple pooled Poisson model (instead of FE or RE panel data methods) to address the effects of changing water levels on water-based recreation. Grijalva et al. (2002) use pooled Poisson and negative binomial models to assess the impact of access to rock climbing sites on visitation. Alberini et al. (2007) extend previous models by including several potential scenarios which allow them to address potential changes in price as well as changes in environmental quality. They use random effects estimation of their pooled data to estimate the value of sport fishing.

One additional issue that often comes up in tourism related research is how to deal with multiple-day trips. While the traditional travel cost approach is meant to deal with single day trips to a recreational site, researchers often want to address interesting policy issues related to travel behavior instead of recreation behavior. Models of travel behavior introduce another dimension that does not exist in pure recreational demand models. In addition to the choice of number of trips to take to a given site, travel behavior models must also deal with the choice of length of stay on-site. These issues can be thought of as traveler decisions on the extensive (number of trips) and intensive (length of trip) margins. Previous research has dealt with this issue in several ways. Some authors have included number of days on-site as an independent variable in their model (Martínez-Espiñeira and Amoako-Tuffour 2008, Rosenberger and Loomis 1999, Shrestha, Seidl and Moraes 2002), while others have tried to develop alternative models that deal more explicitly with the issue (Bell and Leeworthy 1990, Font 2000, Shaw and Ozog 1999). The inclusion of days spent on-site in a traditional travel cost formulation leads to concerns about endogeneity of this variable with number or trips. However, some of the alternative approaches have also garnered some criticism in the literature (Shaw 1991, Hof and King 1992). One alternative method that has been more well accepted in the literature is the nested multinomial logit model in which the decision of which site to visit (and sometimes whether or not to visit) and the choice of overnight versus single day trips are both included in the same model (Shaw and Ozog 1999). While these models are useful in some situations, they are not applicable in the case of a single-site tourism behavior model.

In this paper, we use actual and contingent behavior observations to estimate the value of ranchland open space and water quality in Chaffee County, Colorado. First, we use a panel data random effects Poisson model which includes the days on-site as an independent variable in the model, following the approach of Rosenberger and Loomis (1999). However, since we are considering ranchland open space and water quality variables in our analysis, we included three scenarios in our CB questions that describe different situations for these two environmental quality variables. This is similar to the analysis by Alberini et al. (2007), although they were considering changes in price and quantity instead of changes in two environmental variables. We also address the issue of multiple day trips by estimating an additional model similar to Bell and Leeworthy (1990) which estimates the model with number of days as the dependent variable instead of number of trips as in the traditional travel cost analysis. We compare these results to a traditional travel cost model that includes number of days spent on-site.

The remainder of the paper is organized as follows. The next section discusses the theoretical underpinnings of our model, followed by a description of the survey methodology. Next, we provide a description of the empirical model, followed by the econometric results and calculations of welfare changes. The final section concludes.

THEORETICAL MODEL

We begin the theoretical foundation of this model with a utility maximization problem for tourists visiting a given site. The objective of individual visitors in the model is to maximize the utility they receive from visiting the site based on their individual travel costs to visit the site, characteristics of the site (such as environmental quality) and their budget constraint. The maximization of this function yields an equation for tourism demand at the site. A simple formulation of utility maximization problem is shown in Equation 2.1. In this function, each individual maximizes their utility, which depends on the environmental quality of the site (*EQ*), the amount of time spent at the site (or number of visits to the site) (*V*), and the quantity consumed of a numeraire good (*X*) (Freeman 1993).

$$Max\ u(V, EQ, X) \tag{2.1}$$

The monetary and time budget constraints for the utility maximization function are shown in Equation 2.2 (Freeman 1993).

$$\begin{aligned} M + p_w * t_w &= X + c * V \\ t^* &= t_w + (t_1 + t_2) * V \end{aligned} \tag{2.2}$$

Where p_w is equal to the individual's wage rate, t^* is the total time budget, t_w is the time spent working, t_1 is the time spent traveling to the site, and t_2 is the time spent on-site.

In the traditional formulation of the travel cost model, the individual's choice variable is the number of visits to the site (*V* in Equations 2.1 and 2.2). This type of model is appropriate for addressing visits to a recreational site that only last for one day or a portion of a day. In many situations, however, tourists stay overnight at a site and visit for multiple days. Dealing with multiple day trips has been a challenge in the environmental economics literature for some time. In many cases, researchers discard responses from individuals with multiple day trips. This may be an acceptable solution when looking at a specific outdoor recreation site (for example, a rock climbing venue or mountain biking trail) but would result in a significant loss of information in a more general tourism context since a large percentage of visitors would not be considered in the analysis. Since there are often many policy questions relevant to the broader tourism industry, it is worthwhile considering alternative models that may be able to deal with this issue.

This problem stems from the fact that multiple day visitors have two relevant choice variables: how many trips to take and how many days to spend on-site. One way that this problem has been addressed in the past is to include the number of days spent on-site as an independent variable in a traditional travel cost formulation. However, this variable is endogenous to the decision of how many trips to make and thus leads to concerns about bias and inconsistency in regression results. Other authors have tried to address this issue by developing an alternative to the traditional travel cost formulation. Bell and Leeworthy (1990) try to address this issue by developing a model that estimates the number of days spent on site per year as a function of variables traditionally included in travel cost models, as well as on-site costs. Their results confirm the hypothesis that travel costs will be positively related to the number of days and on-site costs will be negatively related to the number of days. Shaw (1991) criticized their use of a single-site model for a "Florida beach" which actually includes multiple sites, as well as their modeling of the decision process, indicating that a three-stage process (the decision to recreate out of state, the decision to recreate at Florida beaches, and the decision to visit a particular Florida beach) is more appropriate than a single stage decision model. Hof and King (1992) have described the Bell and Leeworthy (1990) model an "on-site cost model" rather than a travel cost model and provide further theoretical justification for the model but also point out some potential empirical problems related to the on-site cost variable.

We suggest a variation on the Bell and Leeworthy (1990) model in order to deal with single site models[2]. In order to deal with the choice of number of days and number of trips, we develop a model similar to that used by Bell and Leeworthy (1990), using number of days as the dependent variable in order to introduce information about both tourist decisions. This formulation would be similar to Equations 2.1 and 2.2, except in this case, V is equal to number of days per year instead of number of trips.

The tourism demand model derived from the utility maximization function described above can then be used to see how demand might change for a given change in environmental quality. The shift in demand can be used to measure the subsequent change in consumer welfare from the change in environmental quality. In this study, we use the estimated demand functions to measure the welfare change due to decreases in ranchland open space and water quality. Consumer surplus is a frequently used welfare measure that is equal to the amount of benefit obtained by consumers above what they pay for a good. Graphically, this can be represented as the area beneath the demand curve but above the price the consumer must pay (the shaded area in Figure 2.1). In order to measure a change in welfare due to a change in environmental quality, this can be measured as the difference between the areas between the two demand curves above the price (the area between x and x' in Figure 2.1). Mathematically, the consumer surplus for a decrease in quality is shown in Equation 2.3.

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[2] Although Bell and Leeworthy (1990) classified their model as a single-site model, as mentioned by Shaw (1991), since they were considering multiple beaches, a multiple-site model would have been more appropriate.

$$CS = \int_{p^0}^{p^{max}} x(\cdot, EQ_0)dp - \int_{p^0}^{p^{max'}} x'(\cdot, EQ_1)dp \qquad (2.3)$$

Where p^0 is the price paid for the good, p^{max} is the maximum price the consumer would be willing to pay (choke price) under the initial quality, $p^{max'}$ is the maximum price the consumer would be willing to pay (choke price) under the lower quality, x is the initial demand, x' is the demand under lower quality, EQ_0 is initial environmental quality, and EQ_1 is the lower environmental quality. The relationship between the variables is the same in both of our models, however, the quantity variable is number of trips and the price is travel cost in the traditional travel cost model, while in the on-site cost model quantity is measured as number of days and the price variable is measured as on-site costs.

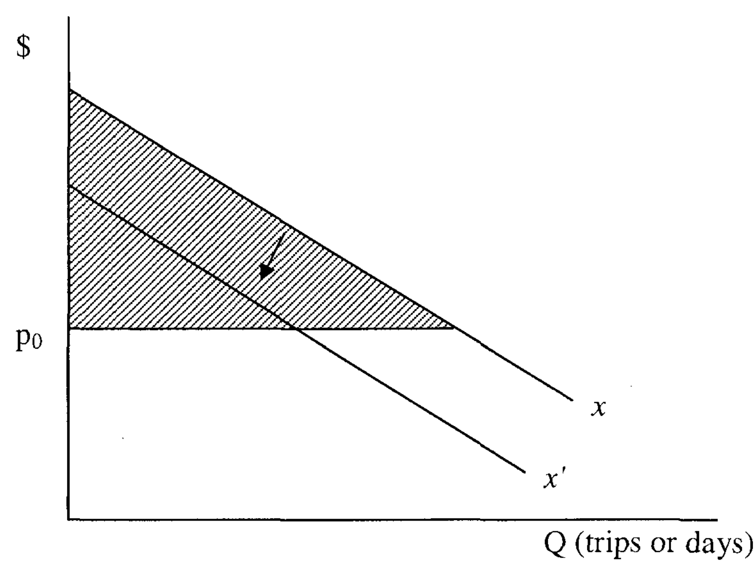

Figure 2.1. Tourism demand at initial (x) and lower (x') environmental quality

In both cases (number of trips and number of days), we would hypothesize the following relationship between consumer surplus and the two environmental quality measures $\frac{\partial CS}{\partial OS} > 0$ and $\frac{\partial CS}{\partial WQ} > 0$. This indicates that with a higher level of environmental quality (more open space or increased water quality), we would expect a decrease in consumer surplus for visitors to the county. Figure 2.1 shows this hypothesized relationship for a decrease in environmental quality.

DATA

Study Area

This study was undertaken in Chaffee County, located in Colorado's central mountains. The mountain location and unique geographic features of Chaffee County make the area a prime location for summer tourism and outdoor recreation, particularly whitewater rafting, fishing, off-road vehicle (jeep and ATV) recreation, and hiking. Chaffee County is similar to many other mountain areas in Colorado in that recent increased interest in tourism has led to greater development pressures. However, to date, Chaffee County has maintained much of its rural character, avoiding the resort-style development that has occurred in other areas of Colorado.

Much of the county's land area is publicly owned, with approximately 79 percent under federal ownership, and three percent administered by the state of Colorado. The federally-owned land includes 455,804 acres in the San Isabel National Forest, managed by the United States Forest Service (USFS), and another 53,866 acres managed by the Bureau of Land Management (BLM). Ranching and farming have historically been important uses of private land in the county; with agricultural uses making up about 13 percent (71,188 acres) of total land use, and around 71 percent of private land use (National Agricultural Statistics Service 2006).

The local population has been increasing in the past two decades, with an overall increase of 33 percent between 1990 and 2005 to reach an estimated resident population of 16,879 (United States Bureau of the Census, 2007). This increase in population and increased interest in tourism in the area are likely to lead to future pressures to convert low density private lands (largely farmland and ranchlands) to higher density residential and tourism uses. Higher density land uses may provide more direct economic returns to the local economy. However, stakeholders may also value the preservation of the working landscapes provided by ranchlands in the area, potentially providing equivalent or higher indirect economic returns to the local economy. These potential changes in land use are also likely to affect local water quality. The exact trade-off in water quality between residential and agricultural uses, however, is not clear and may depend on the extent and type of land use.

This study was undertaken in cooperation with the local Chaffee County government in order to obtain additional information about the values visitors to the area place on these important local natural resources. Since urban land development in Chaffee County is still in the relatively early stages, this is an opportunity to determine what might happen to area tourism if the quality of natural resources were to decline. This study will provide information that will be important for future local planning efforts in determining the proper balance of future urban development and the current rural charm of the area.

Survey Design

A questionnaire was designed in order to determine the value that visitors to Chaffee County placed on the natural resources in the county. The questionnaire was used to collect information about various aspects of the respondent's visit to the area as well as relevant demographic information about the respondent. Individuals were asked to report the importance of various natural and human attributes to their decision to visit Chaffee County and to list the activities they participated in during their trip. Information on spending patterns and observed and contingent behavior was also collected. Respondents were asked to report the number of trips and total number of days that they had spent in Chaffee County in the past year.

Contingent behavior information was collected to determine how the respondent would alter their behavior given a change in the quality of ranchland open space and/or water quality. Each respondent was asked to consider three scenarios: A) a decrease in amount of ranchland open space, B) a decrease in the level of water quality, and C) a decrease in both ranchland open space and water quality. Respondents were asked if they would take more trips, fewer trips or the same number of trips if the scenario described were to occur. If they stated that they would take more or fewer trips, they were asked to state the change in number of trips. The exact wording of the questions was as follows (this example is for Scenario A): "Suppose that this scenario became a reality in Chaffee County. Would this change in land use (with no change in water quality) cause you to make fewer (or more) ***trips*** to Chaffee County during the year? (Check one, and fill in the appropriate blank)".

For each scenario, experimental variation was included for the level of quality change. Respondents were randomly assigned a decline of 25 percent, 50 percent or 75 percent from current ranchland open space area[3]. Respondents were provided with information about the current acreage of privately-owned land in the county and where this land is located. The change in water quality was specified as a decline from the current swimmable level to a fishable or boatable level of water quality and also randomly assigned to survey respondents. We measured water quality in terms of recreational use due to the concern that many survey respondents would not fully understand more scientific measures of water quality (such as BOD). Details about the changes considered under each scenario are shown in Table 2.1.

Table 2.1. Actual and Contingent Scenarios

Scenario	**Ranchland Open Space**	**Water Quality**
Actual Behavior	No Change	No Change
Scenario A	Change from Current Level (25%, 50%, or 75% Decrease)	No Change
Scenario B	No Change	Change from Current Level (Decrease to Fishable or Boatable)
Scenario C	Change from Current Level (25%, 50%, or 75% Decrease)	Change from Current Level (Decrease to Fishable or Boatable)

Table 2.2 provides a description of the variables included in the model. Several different variables related to the respondent's trip are considered, including number of visits, number of days spent on site (both per year and per trip), number of people traveling in the party, and the cost of travel to the site. On-site costs are measured as the respondent's daily expenditures on lodging, food and outdoor recreation. Travel cost is

[3] We did not include a 100 percent decrease as one of the scenarios since a complete loss of all privately-owned ranchlands did not seem realistic.

calculated as the direct costs of traveling to the site plus the opportunity costs of time. The direct costs of travel per person are calculated as the round-trip distance from the respondent's home to the site (using zip code information) multiplied by the variable costs of operating a vehicle for 2007 of $0.17 per mile (BTS 2009), and divided by the number of people traveling in the group as reported by the respondent. Variable costs of operating a vehicle exclude the fixed ownership costs of operating a vehicle, including insurance, license, registration, taxes, depreciation, and finance charges.

The inclusion and calculation of the opportunity cost of time is an area that has been the subject of discussion and several research efforts throughout the years (McConnell and Strand 1981; Shaw and Feather 1999; Larson, Shaikh, and Layton 2004). Although some authors choose to ignore these costs because of the controversy surrounding its calculation, it is generally accepted that these costs are a valid part of the measure of travel costs and has been shown that consumer surplus and other measures can be sensitive to the calculation and inclusion of travel costs (Bishop and Heberlein 1979; Smith, Desvousges and McGivney 1983; Freeman 1993). Based on this reasoning the opportunity cost of time is included in our calculations. The opportunity cost of time is calculated here as a percentage of the wage rate (calculated as the respondent's reported income divided by 2000 working hours) multiplied by the travel time (round-trip distance divided by a speed of 40 miles per hour[4]). In this study, one-third of the wage rate is used to estimate the opportunity cost of time, which has often been used in other studies (Englin and Cameron 1996; Siderelis and Moore 2006). Englin and Shonkwiler

[4] Although the speed of 40 mph is slower than the speed limit on many roads in Colorado, it was chosen in this context due to the mountainous terrain on much of the drive to Chaffee County which may necessitate driving at a slower speed.

(1995a) found that the value of travel time was 39.7 percent of the wage rate, giving empirical support for this assumption.

Data was collected on several attitude variables as well. *Ranches* is a Lickert scale variable measuring the importance of ranch amenities to respondents in their decision to visit Chaffee County (1 is very unimportant, 5 is very important). *Rivers* is a similar variable measuring the importance of rivers, lakes and wetlands in the respondent's decision to visit Chaffee County. *LU_WQ* is a variable measuring the respondent's perception of the relationship between land use and water quality. This variable is equal to one if the respondent perceives a positive relationship between agricultural land use and water quality and equal to zero otherwise.

Table 2.2. Description of Variables

Variable Name	Description
Trips	Number of annual visits to Chaffee County
Days/Year	Number of days spent in Chaffee County annually
Travel Cost	The roundtrip costs of travel to the site per person (including opportunity costs of time)
On-Site Costs	The daily expenditures per person on lodging, food and outdoor recreation
Days	Length of stay in days
People	Number of people traveling in group
Income	Annual household income before taxes
CB	Dummy variable = 1 if contingent behavior data, = 0 if actual behavior data
Ranches	A scale variable indicating the importance of ranch amenities to the respondent (5 = very important, 1 = very unimportant)
Rivers	A scale variable indicating the importance of rivers, lakes and wetlands to the respondent (5 = very important, 1 = very unimportant)
LU_WQ	A dummy variable equal to 1 if the respondent perceives a positive relationship between the amount of ranchland open space and water quality, and zero otherwise
OS_Change	Change in percentage of privately-owned ranchland open space
WQ_Change	Change in water quality
OSxTC	Interaction term between *OS_Change* and *Travel Cost*
WQxTC	Interaction term between *WQ_Change* and *Travel Cost*

The environmental quality variables are measured as the level of decrease for the given variable. In the case of *OS_Change*, the variable is coded as the percentage decrease in ranchland open space area, so a higher number would indicate lower quality, assuming ranchland open space is considered a good by the survey respondents. *OS_Change* takes on the following possible values 75, 50, 25 and 0. In order to obtain a meaningful quantitative measure for our recreation-based water quality measure, we code this as the decrease in number of possible recreation activities (*WQ_Change* is equal to 0 for swimmable, 1 for fishable, and 2 for boatable).

Table 2.3. Descriptive Statistics

Variable Name	**Units**	**Mean**	**Standard Deviation**
Trips	Number of trips/year	2.63	5.21
Days/Year	Days/year	10.38	18.79
Travel Cost	$/trip	413.08	641.16
On-Site Cost	$/day	40.12	43.29
People	People/group	3.04	2.26
Days	Days/trip	8.05	16.67
Income	$/year	95,314	66,310
Education	Level of education (0=junior high; 1=high school; 2=2 year college; 3=4 year college; 4=graduate or professional school)	3.00	1.04
Age	Years	50.06	13.36
Ranches	Lickert scale ranking the importance of ranches to respondent's visit (1=unimportant; 5=very important)	3.51	1.05
Rivers	Lickert scale ranking the importance of rivers, lakes & wetlands to respondent's visit (1=unimportant; 5=very important)	4.45	0.69

Table 2.3 shows descriptive statistics for most of the trip and demographic variables in the sample. The average visitor made 2.63 trips to Chaffee County per year and spent an average of 8 days in the county per trip. Visitors tended to spend 10.63 days in the county per year on average. An average of 3.04 people traveled in each group with average travel costs of $413 per trip. The average visitor spent $40 on-site per day during their trip. The average respondent was 50 years old, with a 4-year college degree and an annual household income of $95,314. Respondents tended to place a high value on the importance of rivers and related resources on their decision to visit Chaffee County, with an average ranking of 4.45 on a scale from 1 to 5. Ranches were somewhat less important, with an average value of 3.51.

Survey Methodology

A survey of adult tourists visiting Chaffee County was conducted during the summer of 2007. The survey was implemented during the summer months since most Chaffee County tourists visit in the summer and many of the popular outdoor recreation activities that draw visitors to the area, such as whitewater rafting, fishing and hiking, are undertaken primarily during the summer months.[5] In order to reach a diverse sample of tourists, visitors were contacted on-site during seven alternating weekends throughout the summer at various locations around the county.[6] Two screening questions were used to ensure that all respondents were non-resident adults (age 18 and over).

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[5] A previous study found 86% of tourists visited in the summer months (Leisure Trends Group 2006).

[6] On-site sampling leads to concerns of biased results due to endogenous stratification (oversampling of more frequent visitors to a recreation site). A further discussion of correction for endogenous stratification is included in the empirical model section.

The survey method was a combination mail and Internet survey. Visitors were contacted in person and asked to take part in the survey. If they agreed to participate, they were provided with a survey packet that could be returned by mail (which included a cover letter, the questionnaire and a self-addressed stamped envelope) or a postcard describing the project and explaining how to fill out the survey on-line. The survey type was alternated among intercepted individuals to ensure that the same number of each type was distributed, and that the survey type received was random among the survey respondents.

Paper surveys were distributed to 446 individuals and Internet survey cards were distributed to 456 individuals, for a total of 902 surveys distributed. A total of 219 paper surveys were returned for a response rate of 49 percent. The response rate for the Internet surveys was somewhat lower, with 158 surveys filled out for a response rate of 35 percent. Overall, 377 surveys were returned for a total response rate of 42 percent. When on-site refusals are included, the overall response rate falls to 36 percent.

EMPIRICAL MODELS

The empirical models used in this paper combine stated and revealed preference data to estimate the value of avoiding decreases in the amount of ranchland open space and water quality levels in terms of changing visitation at a single destination. The models are estimated using a count data specification that combines actual and contingent observations in a panel data format. The data set is created by using observations of actual visits to Chaffee County and creating additional observations for each of the three contingent scenarios by subtracting (or adding) the stated change in number of trips to the observed visitation level for each individual. In order to deal with concerns related to multiple-destination trips, we only included those respondents who reported that Chaffee County was their sole destination or the primary purpose of their visit, which reduced the total number of respondents included in our sample to 184.

The way the data set was constructed leads to up to 4 separate observations for each individual in the sample. In our data set, we have included all individuals that have at least 2 observations, so all individuals in the sample have at least one revealed and one stated preference observation. The sample includes 179 groups, with an average of 3.9 observations per group. Although there are some concerns with estimating the model with an unbalanced panel (panels that do not have the same number of observations for each individual), Cameron and Trivedi (2005) note that RE estimators for unbalanced panel data can be used with very little adjustment. Based on the small number of individuals that are missing observations in this case, the likelihood of reduced efficiency because of the unbalanced panel is quite small.

In our initial model, we employ a single-site travel cost model in order to estimate the demand for recreational travel to Chaffee County. As shown in Equation 2.4, this model estimates the number of trips (V) taken by an individual as a function of the costs of travel to the site, including opportunity costs (TC), demographic and other attributes of the individual (X), number of days spent on-site per trip (*Days*), and environmental quality variables for a given scenario (EQ). In our panel data format, the number of trips to the site is indexed by the individual i, and the hypothetical scenario j (or within-individual observations) as shown in Table 2.1, while the travel costs and respondent characteristics are defined by individual, and the environmental quality is defined by the hypothetical scenario.

$$V_{ij} = f\,(TC_i, X_i, Days_{ij}, EQ_j) \tag{2.4}$$

The specification of the model includes several explanatory variables that are similar to those included in other previous studies. Demographic variables include the annual household income of the respondent. In addition, two attitude variables are included to capture the effect of the importance of ranchlands (*Ranches*) and rivers and related resources (*Rivers*) to the respondent's decision to visit the site. The level of environmental quality for the two resources in the hypothetical scenario is represented by the variables *OS_Change* and *WQ_Change*. A dummy variable (*CB*) is included to indicate if the observation is actual data or from a hypothetical scenario (hypothetical scenario=1, 0 otherwise). Data on the respondent's trip includes the length of stay (*Days*) and the costs of travel to the site, including opportunity costs (*Travel Cost*).

The general model specified above is estimated empirically using a panel data Poisson random effects technique.[7] Poisson models are frequently used to estimate travel cost models due to the count nature of travel cost data. The semi-log function that is estimated is shown in Equation 2.5, with *TC* = individual specific travel cost, *X* = a vector of individual specific characteristics, *EQ* = the environmental conditions in the actual or hypothetical scenario, and λ_{ij} = the expected number of trips.

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[7] We also attempted a random effects Negative Binomial specification, which provided qualitatively similar results.

$$\ln(\lambda_{ij}) = \beta_1 TC_i + \beta_2 X_i + \beta_3 Days_{ij} + \beta_4 EQ_j + u_i + \varepsilon_{ij} \quad (2.5)$$

The coefficient on travel cost (β_1) is expected to be negative as in traditional travel cost models, while the coefficient on days (β_2) is expected to be positive. The main hypotheses tested in this research are related to the environmental quality variables (*EQ* in Equation 2.5). We test the hypothesis that each of the environmental quality variables (measured as change in open space and water quality) has no effect on the number of trips taken to Chaffee County, as shown in Equation 2.6.

$$\begin{aligned} &H_0 : \beta_4 \left(OS\_Change\right) = 0 \text{ versus } H_a : \beta_4 \left(OS\_Change\right) \neq 0 \\ &H_0 : \beta_4 \left(WQ\_Change\right) = 0 \text{ versus } H_a : \beta_4 \left(WQ\_Change\right) \neq 0 \end{aligned} \quad (2.6)$$

In a panel data model, random or fixed effects specifications are often used to address the unobserved heterogeneity specific to individuals in the data set and the potential bias it may introduce. The fixed effects model assumes that the heterogeneity is unobserved but is correlated with the regressors, and estimates a group-specific constant term. The random effects formulation assumes that the unobserved individual heterogeneity is uncorrelated with any of the included variables. One of the advantages of the RE model is that it reduces the number of parameters that must be estimated since a single constant term is estimated. Both RE and FE specifications have been estimated for combined RP-SP models using actual and contingent behavior (Englin and Cameron 1996; Rosenberger and Loomis 1999; Whitehead, Haab and Huang 2000). We use a random effects specification, which allows for unobserved individual effects in the error term due to the multiple observations for each individual in the data set. The number of trips V_{ij} taken by individual i in a given scenario is drawn from the Poisson distribution for the random effects model as shown in Equation 2.7.

$$\Pr\left(V_{ij} | \alpha_i, X_i\right) = \left(\prod_{j=1}^{n_i} \frac{\lambda_{ij}^{V_{ij}}}{V_{ij}!}\right) \exp\left\{-\exp(\alpha_i)\sum_{j=1}^{n_i} \lambda_{ij}\right\} \exp\left(\alpha_i \sum_{j=1}^{n_i} V_{ij}\right) \tag{2.7}$$

In our estimation, we assume a gamma distribution (with mean one and variance θ) for the error term ε_i (where $\varepsilon_i = \exp(\alpha_i)$), and obtain the following distribution (Stata 2007, p.354):

$$\Pr\left(V_{ij} | X_i\right) = \left(\prod_{j=1}^{n_i} \frac{\lambda_{ij}^{V_{ij}}}{V_{ij}!}\right) \frac{\Gamma\left(\theta + \sum_{j=1}^{n_i} V_{ij}\right)}{\Gamma(\theta)} \left(\frac{\theta}{\theta + \sum_{j=1}^{n_i} \lambda_{ij}}\right)^{\theta} \left(\frac{1}{\theta + \sum_{j=1}^{n_i} \lambda_{ij}}\right)^{\sum_{j=1}^{n_i} V_{ij}} \tag{2.8}$$

The log-likelihood function for the random-effects Poisson panel data model is shown in Equation 2.9.

$$L = \sum_{j=1}^{n} \{\log \Gamma\left(\theta + \sum_{j=1}^{n_i} V_{ij}\right) - \sum_{j=1}^{n_i} \log \Gamma\left(1 + V_{ij}\right) - \log \Gamma(\theta) + \theta \log u_i \tag{2.9}$$

$$+ \log(1 - u_i)\sum_{j=1}^{n_i} V_{ij} + \sum_{j=1}^{n_i} V_{ij}\left(X_{ij}\,\beta\right) - \left(\sum_{j=1}^{n_i} V_{ij}\right) \log\left(\sum_{j=1}^{n_i} \lambda_{ij}\right)\}$$

One concern that occurs with on-site sampling is endogenous stratification, which refers to the oversampling of more frequent visitors to a site. In previous research, Englin and Shonkwiler (1995b) have shown that it is possible to correct for endogenous stratification in the Poisson model by subtracting one from the number of trips. This correction adjusts the number of trips downward to help deal with potential upward bias in the model. While this method offers a simple method for dealing with endogenous stratification, challenges arise in this method with an RP-SP model since zero trip observations exist in the sample. Egan and Herriges (2006) develop a correction for panel data estimation which would be useful for dealing with this issue in future work.

Although several previous studies have included number of days spent on site (Martínez-Espiñeira and Amoako-Tuffour 2008, Rosenberger and Loomis 1999) or time on site (Bowker et al. 1996) as an explanatory variable in travel cost models, such specifications introduce potential endogeneity problems. This problem stems from the fact that when making trip decisions, individuals are simultaneously deciding whether to take the trip (or how many trips to take in a given year) as well as how long to stay at the given site (or how many days to visit in a given year). A few authors have tried to deal with this problem of endogeneity by developing variations on the traditional travel demand models (Bell and Leeworthy 1990, Kerkvliet and Nowell 2000, Hof and King 1992).

Our second set of empirical models attempt to deal with this issue by introducing number of days spent in Chaffee County per year as the dependent variable in our regression in order to address the endogeneity problem. As in the approach used by Bell and Leeworthy (1990), we also include two different prices as independent variables in our estimation. These models are similar to the models presented above although the dependent variable is number of days (*Days/Year*) instead of number of trips, and the on-site costs are added as an independent variable (*On-Site*). The empirical specification of the model is shown in Equation 2.10 below.

$$\ln(Days/Year_{ij}) = \beta_1 TC_i + \beta_2 On-Site_i + \beta_3 X_i + \beta_4 EQ_j + u_i + \varepsilon_{ij} \qquad (2.10)$$

The first price variable (*TC*) is the travel cost to the site (including the opportunity cost of travel and calculated in the same way as our variable in the previous estimations). The coefficient on travel cost (β_1) would be expected to have a positive sign, contrary to expectations under a traditional travel cost model. This is because we anticipate that individuals would tend to stay at the site for a longer period of time if their travel costs to reach the site are higher. The second price variable (*On-Site*) introduced in these estimations is the on-site cost per person per day, or the additional daily costs incurred during the vacation. We define this variable as the costs of lodging, food and outdoor recreation during the respondents' stay as reported by the respondent on the survey. We would expect the coefficient on on-site cost (β_2) to be negatively related to the number of days, indicating that the more expensive it is to stay additional days, the fewer days the individual would spend on-site. The relationship between these two price variables essentially represents the trade-offs that individuals consider between travel costs and on-site costs.

In addition to the two hypotheses related to environmental quality as described in the travel cost model, in this case we will also test hypotheses related to the two price variables. We have two additional null hypotheses: 1) travel cost has no effect on the number of days spent in Chaffee County per trip and 2) on-site cost has no effect on the number of days spent in Chaffee County per trip. These hypotheses along with the two hypotheses related to environmental quality are shown in Equation 2.11.

$$\begin{aligned} &H_0 : \beta_1 (TC) = 0 \; versus \; H_a : \beta_1 (TC) \neq 0 \\ &H_0 : \beta_2 (On-Site) = 0 \; versus \; H_a : \beta_2 (On-Site) \neq 0 \\ &H_0 : \beta_4 (OS\_Change) = 0 \; versus \; H_a : \beta_4 (OS\_Change) \neq 0 \\ &H_0 : \beta_4 (WQ\_Change) = 0 \; versus \; H_a : \beta_4 (WQ\_Change) \neq 0 \end{aligned} \qquad (2.11)$$

The following section presents results for the travel cost and on-site models using actual observations only, followed by the RP-SP travel cost formulation as shown in Equation 2.5, and RP-SP on-site model as shown in Equation 2.10.

ECONOMETRIC RESULTS

Revealed Preference Only

The first set of results considers revealed preference data only. Table 2.4 shows the results from both the travel cost and on-site cost models described above for the sample of *actual observations only*. Many variables included in the travel cost model were found to be statistically significant at the 1 percent level and of the anticipated sign. Price, or *Travel Cost* in this model, is negatively related to the number of trips, consistent with demand theory. The number of days spent on the current trip (*Days*) was also found to be negatively related to the number of trips taken in a given year, which would be expected since if one spends more time in a given location, he or she would be less likely to return for additional trips in a given year. Annual household income (*Income*) is negatively related to the number of trips but was not statistically significant in this model.

Table 2.4. Travel Cost & On-Site Cost Models – Revealed Preference Only

Variable	Travel Cost	On-Site Cost
Constant	-0.645 (0.4008)	0.420** (0.1995)
Travel Cost	-0.0003*** (0.0001)	0.0004*** (0.00004)
On-Site Cost		-0.011*** (0.0008)
Days	-0.031*** (0.0062)	
Income	-0.000001 (0.00000083)	-0.000002*** (0.0000004)
Education	-0.145*** (0.0370)	-0.1081*** (0.0195)
Age	0.006* (0.0034)	0.0291*** (0.0016)
Gender	0.326*** (0.081)	0.1747*** (0.0434)
Rivers	0.345*** (0.0780)	0.2640*** (0.0382)
Ranches	0.171*** (0.0437)	0.0119 (0.0235)
Observations	178	177
Log-likelihood	-560	-1264

*** significant at the 1% level; ** significant at the 5% level; Std. errors in parentheses.

Several demographic variables were also included in the estimation. The coefficient on *Gender* was positive and statistically significant at the one percent level, indicating that males in the sample were more likely to take a greater number of trips. *Education* was negatively related to the number of trips and statistically significant at the one percent level, indicating that individuals with lower education levels were more likely to take a greater number of trips. The coefficient on *Age* is positively related to the number of trips and statistically significant at the 10 percent level in the travel cost model.

Two additional variables were included to try to capture the effect of the importance of different natural characteristics to the respondent on the number of visits that they made to Chaffee County during the year. The variable *Ranches* was found to be positively related to the number of trips and highly significant, indicating that individuals placing a greater level of importance on ranchlands in the area are more likely to take a greater number of trips to Chaffee County per year. The variable *Rivers* was also found to have a positive relationship with the number of trips taken per year and was statistically significant at the one percent level in the travel cost model.

In the on-site cost model formulation using revealed preference data, both price variables are statistically significant at the one percent level. The coefficient on *Travel Cost* is positive in this model, indicating that respondents with higher travel costs tend to spend a larger number of days in Chaffee County per trip. *On-Site Cost*, however, has a negative coefficient, indicating that respondents that have greater daily on-site costs tend to stay fewer days in Chaffee County annually. As in the travel cost model, the coefficient on *Income* is negative, indicating that higher income respondents will tend to stay fewer days on-site per trip to Chaffee County. All of these variables were significant at the one percent level.

Education was found to be negatively related to the number of days and was statistically significant at the one percent level, indicating that respondents with higher levels of education tended to spend fewer days on-site. *Age* was positively related to number of days and statistically significant at the one percent level. This indicates that older respondents tend to spend more days in Chaffee County per year. The coefficient on *Gender* was positive and statistically significant in the on-site cost model, consistent with the results of the travel cost model. This indicates that males in our sample were more likely to spend more days in Chaffee County per year.

The *Rivers* variable was positively related to number of days and was statistically significant at the one percent level in the on-site cost model, meaning that respondents with a greater preference for water resource amenities will spend more days vacationing in Chaffee County. The *Ranches* variable was positively related to the number of days in the on-site cost model but was not statistically significant at the 10 percent level.

Own-price and income elasticities and their 95% confidence intervals for the travel cost and on-site cost model estimates using revealed preference data only are shown in Table 2.5. The own-price elasticity for travel to Chaffee County in the travel cost model is less than one in absolute value, indicating that demand for trips is inelastic. In the on-site cost model, the own-price elasticity is also less than one in absolute value, but larger than the value for the travel cost model, indicating that the demand for days is inelastic as well, but not as inelastic as the demand for trips in the travel cost model. The income elasticity in the travel cost and on-site cost models are negative and less than one. This indicates that travel (number of trips and number of days) in this case is considered an inferior good, differing from the case of international travel, which is often considered a luxury good. Demand for inferior goods declines when incomes rise, resulting from consumers switching to a substitute good. In this case, respondents with higher income may substitute trips to other more "luxury" destinations in Colorado or to other vacation spots that are farther away from home. These results may indicate that the visitors coming to Chaffee County are somewhat budget-conscious.

Table 2.5. Elasticity Estimates for Travel Cost and On-Site Cost Models

Elasticity	95% CI Lower	Coefficient	95% CI Upper	Standard Error
Travel Cost Model				
Own-price	-0.17	-0.10	-0.02	0.04
Income	-0.25	-0.09	0.06	0.08
On-Site Cost Model				
Own-price	-0.48	-0.42	-0.36	0.03
Income	-0.27	-0.19	-0.11	0.04

Panel Data Models

After the initial estimation of the travel cost and on-site cost models using actual observations only, several different specifications of a panel data model using RP and SP data were estimated based on the models presented in the previous section. The results of two travel cost models (using number of trips as the dependent variable) are shown in Table 2.6. These models incorporate the variables *OS_Change* and *WQ_Change* in order to measure the change in these environmental quality variables for the contingent behavior data. These variables represent the level of change, which is represented as the percentage decrease in ranchland open space (*OS_Change*) and a variable representing the decrease in number of recreational activities allowed based on water quality levels, equal to one for fishable water quality and equal to two for boatable water quality (*WQ_Change*). Model 2 also includes interaction terms between the environmental quality variables and the travel cost parameter.

In both Model 1 and Model 2, the price variable (*Travel Cost*) is shown to have a negative on number of trips taken to Chaffee County, as expected and as shown in the RP travel cost model in Table 2.4. The RP-SP results are less significant than in the RP travel cost, however, with *Travel Cost* significant at the 5 percent level in Model 1, and insignificant in Model 2. The number of days spent in Chaffee County on the most recent trip (*Days*) was found to have a negative relationship with the number of trips taken and is statistically significant at the 1 percent level in both models. This is consistent with our expectations that if an individual stays on-site for a longer period of time, they would be likely to take fewer trips during the year. *Income* does not have a significant relationship with number of trips taken annually in either model.

The importance of water related attributes, including rivers, lakes, and wetlands (*Rivers*) to the respondent has a positive and statistically significant relationship (at the 5 percent level) with the number of trips in both models, indicating that individuals who place a greater level of importance on water related attributes in their decision to visit Chaffee County would be more likely to take more trips to the area. Ranchland attributes (*Ranches*) also has a positive relationship with the number of trips and is significant at the 1 percent level in both models, indicating that individuals with a greater preference for ranchlands are more likely to visit Chaffee County more frequently. The respondent's perception of the relationship between land use and water quality (*LU_WQ*) did not have a significant effect on the number of trips taken per year.

In Models 1 and 2, a dummy variable (*CB*) is also included indicating if the observation is a hypothetical or actual observation. This variable is not significant in either of the models. This indicates that there is not a statistically significant difference in the real and hypothetical (CB) data. These results support the hypothesis that there is no hypothetical bias in the data.

Table 2.6. Poisson RE Panel Models using Trips as the Dependent Variable

Variable	Model 1	Model 2
Constant	-0.3075	-0.3138
	(0.5488)	(0.5487)
Travel Cost	-0.0004**	-0.0003
	(0.0002)	(0.0002)
CB	-0.0795	-0.0779
	(0.0792)	(0.0792)
Days	-0.0211***	-0.0212***
	(0.0057)	(0.0057)
Income	0.0000001	0.00000003
	(0.000001)	(0.000001)
Rivers	0.2523**	0.2514**
	(0.1231)	(0.1231)
Ranches	0.1887***	0.1874***
	(0.0700)	(0.0700)
LU_WQ	-0.1543	-0.1518
	(0.1540)	(0.154)
OS_Change	-0.0020*	-0.0016
	(0.0011)	(0.0011)
WQ_Change	-0.1992***	-0.1869***
	(0.0386)	(0.0410)
OSxTC		-0.000002
		(0.000002)
WQxTC		-0.0001
		(0.00007)
α	0.8567	0.8557
$\ln(\alpha)$	-0.1547	-0.1559
Observations	700	700
Log-Likelihood	-1230	-1229

*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level; Standard errors in parentheses.

As expected, in Models 1 and 2, the change in environmental quality variables are both negatively related to the number of trips. The change in the open space variable (*OS_Change*) indicates that the number of trips taken annually will fall as more open space is converted to urban uses. The open space change variable was significant at the 10 percent level in Model 1 and insignificant in Model 2. The water quality variable (*WQ_Change*) shows that a larger decrease in water quality from the current level would have a negative effect on the number of trips. *WQ_Change* was significant at the 1 percent level in both models. In Model 2, the interaction terms between the environmental quality change variables and travel cost were not found to be statistically significant.

We can also perform a likelihood-ratio test of $\alpha=0$ to determine if a panel data model is appropriate or if a pooled Poisson estimator would be more appropriate. If $\alpha=0$, there is no variation in the individual errors u_i, and a pooled model can be used instead of a panel data model. Our results show that in both Models 1 and 2, the number of trips is significantly different across individuals and that the random effects model is significantly different than the pooled model.

Table 2.7 presents the results for two different specifications of the on-site cost model. Model 3 is an on-site cost model that includes variables for the level of change in open space and water quality without the change in quality and price interaction terms. Model 4 includes the same variables as Model 3 but also includes environmental quality and on-site cost interaction terms. These results show a positive and significant (at the 1 percent level) coefficient for *Travel Cost* in Model 3 and Model 4, indicating that individuals with higher travel costs would spend a greater number of days on site, as was hypothesized. The coefficient for *On-Site Cost* was negative in both models, as expected, and statistically significant at the 1 percent level. This indicates that individuals with higher on-site costs spend fewer days in Chaffee County.

Table 2.7. Poisson RE Panel Models using Days per Trip as the Dependent Variable

Variable	Model 3	Model 4
Constant	1.7479***	1.7040***
	(0.5631)	(0.5623)
Travel Cost	0.0007***	0.0007***
	(0.0002)	(0.0002)
On-Site Cost	-0.0099***	-0.0076***
	(0.0018)	(0.0018)
CB	-0.0409	-0.0292
	(0.0425)	(0.0426)
Income	-0.000004***	-0.000004***
	(0.000001)	(0.000001)
Rivers	0.1827	0.1791
	(0.1217)	(0.1214)
Ranches	0.1291*	0.1292*
	(0.0696)	(0.0694)
LU_WQ	-0.1578	-0.1520
	(0.1488)	(0.1484)
OS_Change	-0.0036***	-0.0034***
	(0.0006)	(0.0007)
WQ_Change	-0.2408***	-0.1441***
	(0.0203)	(0.0238)
OSxOSC		-0.00001
		(0.00002)
WQxOSC		-0.0048***
		(0.0006)
α	0.8701	0.8653
$\ln(\alpha)$	-0.1391	-0.1447
Observations	696	696
Log-Likelihood	-2443	-2411

*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level; Standard errors in parentheses.

The coefficient on the respondent's household income is statistically significant at the 1 percent level with a negative sign in both models, indicating that individuals with a higher income spend fewer days in Chaffee County per year. Of the preference or attitude variables (*Rivers*, *Ranches,* and *LU_WQ*), only Ranches was statistically significant in Model 3 or Model 4. Ranches was positively related to the number of days and significant at the 10 percent level in both models, meaning that respondents with a greater preferences for ranchland attributes are likely to spend more days in Chaffee County annually.

The coefficients on *OS_Change* and *WQ_Change* are negative and statistically significant in both models. These results indicate that respondents will tend to fewer days in Chaffee County annually with larger decreases in the amount of ranchland open space and water quality levels. Model 4 also includes two interaction terms between on-site cost and the two environmental quality change variables. In this case the interaction term with water quality is statistically significant at the 1 percent level, while the open space interaction term is insignificant. Again, in Models 3 and 4, the likelihood test of $\alpha=0$ indicates that the random effects model is significantly different from the pooled model and the choice of the RE panel data model is appropriate.

WELFARE CALCULATIONS

Based on the estimates from the panel data models, we can calculate individual consumer surplus and the potential loss in consumer surplus based on different changes in the amount of ranchland open space and water quality. Consumer surplus allows us to see the value that visitors place on their trip above what they must pay in the market, and by using data from stated preference observations we can estimate the change in tourists' welfare due to changes in environmental quality. The coefficient on the price variable can be used to directly calculate the consumer surplus obtained from a trip to the site under current conditions. Based on the form of the Poisson model, consumer surplus per person per trip in a travel cost model can easily be calculated as $-1/\beta_{TC}$, where β_{TC} is the estimated coefficient on the travel cost parameter (Parsons 2003). In the on-site cost model, we can also use the relevant price, *On-Site Cost,* to make a similar consumer surplus calculation. We use Model 4 for the consumer surplus calculations presented in this section based on the superior model results for the on-site cost model, particularly since the travel cost and travel cost environmental quality interaction parameters in Model 2 were insignificant.

In addition to the overall consumer surplus, in non-market valuation studies, the main consumer surplus calculation of concern is the change in consumer surplus due to changes in environmental quality. To determine the consumer surplus received when there are changes in the environmental variables, we can calculate the per person consumer surplus with the change as follows $-1/(\beta_{OSC} + \beta_{ChangexOSC}*\text{Change})$, where $\beta_{ChangexOSC}$ is the coefficient estimated on the interaction term being considered, and Change is the level of environmental quality change under consideration. For example, in the case of open space for Model 4, we would use the estimated coefficient for the term *OSxOSC*, and calculate the new consumer surplus for different levels of change in open space (25, 50 and 75 percent decrease). The addition of the coefficient for the interaction term allows us to see how the demand for trips changes based on the change in quality. The calculation of the consumer surplus with environmental change can then be compared to the current (or status quo) level of consumer surplus to obtain the change in consumer surplus due to changing environmental quality.

Consumer surplus estimates and changes in consumer surplus based on changes in environmental quality are calculated for Model 4, the on-site cost model with interaction terms between environmental quality and price. We first consider the consumer surplus under current levels of environmental quality by equating the change in the environmental quality variables to zero (no change in environmental quality). Under current levels of environmental quality (Status Quo in Table 2.8), per person consumer surplus per day is $131. Using the 95% Confidence Interval we have a lower bound of $89 and an upper bound of $247.

Table 2.8 also shows the mean consumer surplus for a 25, 50 and 75 percent decrease in the amount of ranchland open space in Chaffee County. The consumer surplus for a 25 percent decrease is 125, or a $5 decrease in consumer surplus compared to the status quo. With a 50 percent decrease, the mean consumer surplus would fall to 120 or an $11 loss, and with a 75 percent decrease, consumer surplus falls to 116 or a $15 loss. Few studies have calculated consumer surplus accruing to visitors based on changes in the agricultural or ranchland landscape. Rosenberger and Loomis (1999) estimated a change in consumer surplus due to a loss of ranchland open space of zero since their sample included both individuals that would visit more often and less often with a decrease in the amount of ranchlands. The difference in their result and what we found in this study is likely due to differences between Steamboat Springs (their study site) and Chaffee County. Another study by Fleischer and Tsur (2000) estimates the consumer surplus owing to agricultural landscape in Israel to be on the order of $49 - $167 per visitor. While these values are somewhat higher the values calculated in this study, we would expect our values to be somewhat lower since we are considering a loss of only a portion of the ranchland landscape.

Consumer surplus values with a decrease in water quality are much smaller than those with a decrease in open space. With a decrease to fishable water quality (a decrease of one water-related activity), consumer surplus fell to $81, decreasing $50 below the status quo level. For a change to boatable water quality (a decrease of two water-related activities), the consumer surplus falls to $58, resulting in a loss of $73 from the status quo level. The change in consumer surplus estimated here for water quality is slightly higher a previous combined travel cost/contingent behavior model by Whitehead et al. (2000) that estimated a $34 increase in consumer surplus for a water quality improvement. However, their study did not address variation in water quality and it is not clear the extent of the improvement that they were modeling.

Table 2.8. Consumer Surplus Calculations for Model 4

	Per Person CS per day ($)		
	95% CI lower	**Mean**	**95% CI upper**[8]
Status Quo	89	131	247
OS Change			
25% Decrease	80	125	286
50% Decrease	73	120	340
75% Decrease	67	116	419
WQ Change			
Fishable	58	81	132
Boatable	43	58	90

[8] The upper bound for OS Change is larger than the status quo due to the very small coefficient on the *OS_ChangexOSC* interaction term. If the coefficient is restricted to be positive, this would result in no change in consumer surplus for the upper bound value (or a consumer surplus of $247).

The results from Model 4 indicate that a decrease in the amount of ranchland open space would result in a relatively small decrease in consumer surplus per person. However, if the change in open space results in decreased water quality as well, the overall welfare effects would be much larger.

CONCLUSIONS

This paper assessed the welfare implications of loss of ranchland open space and declining water quality for visitors to Chaffee County, Colorado. We combined revealed and stated preference survey data in a panel data analysis to evaluate the effects of these environmental quality changes. The analysis expanded upon the previous literature by including two related environmental quality variables in the analysis. In addition, we addressed the issue of multiple day trips in a single-site model by comparing the results of a traditional travel cost model to an on-site cost model.

Two types of panel data models were estimated using the survey data in order to deal with multiple day trips. The first model uses number of trips as the dependent variable. The second model includes number of days as the dependent variable in order to attempt to deal with endogeneity problems that may exist when using number of trips as the dependent variable and including days per trip as an independent variable. Both models showed the expected relationships between travel cost and/or on-site costs and demand for trips.

The estimation of both panel data models indicated that there was no significant difference between hypothetical and actual observations in the data set. Since the estimation of a joint TC-CB model requires that the actual and hypothetical trips are based in the same set of preferences, it is important that the results of the model show no evidence of hypothetical bias. This concurs with research by Alberini et al. (2007) and Rosenberger and Loomis (1999) who also found no evidence of hypothetical bias in similar estimations.

Another innovation on previous work was the inclusion of scenarios that address the quality level of two different resources in the same analysis. Previous studies had included scenarios addressing changes in quality of one resource, changes in price, or changes in price and quality, but not changes in the quality of two different resources simultaneously. Moreover, the consideration of land use and water quality together in non-market valuation research is an addition to the previous literature. The models presented in this paper allowed us to estimate the value of both resources simultaneously and assess whether respondents' perception of the relationship between the two variables affected these values. The results showed that in this case, the perception of the relationship between land use and water quality does not influence the valuation of the resources. Our econometric results show that both environmental quality variables examined in this study were found to negatively affect the number of trips taken to Chaffee County, indicating that if the quality of the resource were to decline, individuals would make fewer trips to the area. We find similar results in models that estimate the demand for number of days per trip. Water quality has a stronger effect on the number of trips than open space.

The on-site cost model was used to calculate changes in consumer surplus given changes in environmental quality due to its better performance than the travel cost model. The loss in consumer surplus due to a decline in the amount of ranchland open space was found to be smaller than the calculated loss due to declining water quality. These results indicate that policymakers should place greater emphasis on maintenance of ranchland open space if greater levels of urban development lead to decreased water quality. This is particularly important since frequently developers do not have incentives to consider the impact of their land use on water quality. Policymakers may want to consider creating incentives for developers to consider their impacts on water quality or incentives to maintain open space in order to mitigate potential impacts on local tourism.

Future research is warranted to further consider the explicit relationship between current and future land uses in the county and water quality. Our assumption for this particular study is that urban development may reduce water quality, but this is likely to vary significantly depending upon the intensity of land uses in a particular area. Since both of these resources are important to the tourist population, more information about the linkages between the two resources may be useful when considering future policy options.

Another area of this research that could be expanded in the future is the specific trade-off that tourists make between days and trips when making visitation decisions. In this analysis, we obtained information from respondents about their change in trips due to an environmental quality change. Future research could collect specific information about changes in trips as well as changes in the number of days spent on site in order to better model the trade-offs that visitors may make on the intensive and extensive margins.

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CHAPTER THREE

Combining Revealed and Stated Preference Data to Value Open Space and Water Quality

INTRODUCTION

Traditionally, environmental valuation approaches have included revealed preference techniques such as the travel cost method or hedonic property models, and stated preference techniques such as contingent valuation or contingent behavior methods. While earlier studies often compared the results of revealed and stated preference techniques (Carson et al. 1996; Fix and Loomis 1998; Whitehead 2006), more recent studies use methods that combine revealed and stated preference information (Cameron 1992; Niklitschek and León 1996; Eom and Larson 2006; Boxall, Englin and Adamowicz 2003; Azevedo, Herriges and Kling 2003; Huang, Haab and Whitehead 1997). These recent developments in non-market valuation research have emphasized the information gains that can be obtained from combining the two types of data in economic analyses (Cameron 1992; Azevedo, Herriges and Kling 2003).

Cameron (1992) published one of the first examples of using a combined method in environmental economics by augmenting information from contingent valuation (CV) surveys with travel cost (TC) information from consumer behavior. Her empirical application included a discrete choice CV question in which the respondent was asked if they would stop using the resource if they had to pay a given tax, along with travel cost information for each respondent. The TC and CV models were estimated jointly to impose the requirement that the two decisions reflect the same underlying preference structure. Niklitschek and León (1996) devised a similar model that combines two sources of information, although their model combines CV data for an improvement in environmental quality with intended recreational visitation under improved quality conditions. In addition, in this case the authors included both participants and non-participants in their sample. The calculation of welfare estimates from this paper indicates that the benefit estimates derived from the combined model generally lay between the estimates of the individual TC and CV models. Boxall, Englin and Adamowicz (2003) estimate a model that combines revealed preference data with two types of stated preference data to place a value on aboriginal artifacts. In addition to information on actual trips, the authors first asked respondents if they would change their original trip to a different route if a pictograph that was not defaced was on the alternative route. The second stated preference question asked respondents if they would still switch their trip if the pictograph was vandalized. The authors' model uses information from the previous choices to help account for state dependence and correlation between the different types of data.

Normally, revealed preference methods are associated only with use value, which is defined as the value obtained from the use, but not necessarily consumption, of a particular good. The link between revealed preference techniques and use value stems from the assumption of weak complementarity that is generally employed in these models. The weak complementarity assumption implies that an individual's consumption of a public good (often an environmental good) is linked to an associated private good – the individual will receive no utility from the public good unless they are consuming some positive amount of the private good (Herriges, Kling and Phaneuf 2003). In the case of environmental goods related to recreation, travel cost models are often employed which link the demand for recreation (cost paid for travel) to the environmental good in question. While these methods can only measure use values, it is worth noting that this use may be non-consumptive (for example viewing wildlife or scenic landscapes). Furthermore, the definition of use values employed by a researcher may have a significant effect on the estimation of those values. For example, some researchers argue that it is not necessary to be in close proximity to a resource in order to experience use values, and activities such as observing photographs of animals or scenic views in magazines also constitutes use (Freeman 1993).

In contrast, stated preference methods can measure both use and nonuse values, or the total value of the resource to the individual. Non-use values have been described as values placed on environmental goods that are independent of an individual's current use of the good (Freeman 1993). Non-use values include things such as existence value, bequest value and option value. Freeman (1993) describes "pure existence" value as what would be lost if the resource did not exist, while others describe existence value as encompassing any value placed on a resource beyond use value. Bequest value comes from maintaining the quality of a resource for future generations, and option value is related to the value that comes from having the option of using the resource in the future. Again, there is some disagreement in the terminology and definition of different non-use values which may influence the estimates obtained by different researchers.

Many of the combined techniques, while often providing better estimates than using a single method, are still only able to provide estimates for use value. However, more cutting edge techniques have attempted to provide estimates that are able to supply consistent estimates of use, non-use and total values. Niklitschek and León (1996) develop a model that attempts to isolate use and non-use values with a sample of users and non-users. In their model, weak complementarity does not hold, and the non-users in their sample have a recreational use of zero and thus the entire value estimate is non-use. However, Eom and Larson (2006) note that their chosen preference function excludes non-use values. Eom and Larson (2006) develop a model based in utility theory that is able to estimate use, non-use and total value for a change in environmental quality. They use TC and CV data and develop a theoretically consistent model by beginning with a Marshallian demand function for recreation and then deriving the quasi-expenditure function. Their model allows for the identification of use parameters from both the TC and CV data and non-use parameters from the contingent valuation data only. They estimate one model which provides both use and non-use values, and a second that assumes weak complementarity, imposing the restriction that non-use values are equal to zero.

This paper attempts to use these more recent techniques to develop estimates of use and non-use values for ranchland open space and water quality. The model combines revealed and stated preference information collected from a sample of summer tourists to Chaffee County, Colorado. Building on the methodology of Eom and Larson (2006), a model is developed that allows for the calculation of use and non-use values for a single-site recreation demand model, by incorporating not only TC and CV data, but also contingent behavior (CB) data. The addition of CB data introduces variation in environmental quality into the recreation demand function, which would not be possible in a single site model using only TC data. The theoretical model applied in this paper is used to produce estimates of the change in welfare, or equivalent variation, experienced by the visitors to Chaffee County for a specified decrease in environmental quality. While many previous empirical studies address changes in welfare in terms of improvements in environmental quality, this study measures the willingness to pay to avoid a change in environmental quality. This type of analysis could provide useful information for many communities that are experiencing threats that may result in declining environmental quality. Such information may help in community planning to avoid the potential impacts of declining environmental quality.

In this paper, the joint model described above is used to assess the change in welfare for summer tourists to Chaffee County, Colorado due to changes in natural resource quality. Due to increasing development pressures and the historic importance of agricultural activities in Chaffee County, the potential loss of farm and ranchlands has become an important issue of concern in the county. In addition to the concerns about the loss of agricultural open space, additional questions arise about how increased development could affect water quality in the county. These issues are important not only to the residents of Chaffee County but also to tourists that visit the county. Decreases in the amount of ranchland open space could have significant effects on features that draw many visitors to the county. In addition, since water-based recreation is an important summer tourist activity, declining water quality could further impact the visitor population. These effects on the tourist population could have serious implications for the regional economy as well, since the tourism industry is a major driver for the local economy. A recent export base analysis of Chaffee County indicates that the tourism industry makes up 29 percent of basic employment and 19 percent of basic income (Colorado State Demography Office 2005). Basic economic activity is related to the production of goods and services sold outside of the local economy and is considered to be important for local economic growth.

The next section presents the theoretical model that has been developed to measure the welfare change of tourists to Chaffee County resulting from changes in natural resource quality. This is followed by a description of the survey data collected and a presentation of the empirical model and results. The final section concludes.

THEORETICAL MODEL

The analysis presented in this paper estimates the change in welfare experienced by visitors to Chaffee County, Colorado based on potential changes in natural resource quality in the area. In this analysis we are concerned with two natural resources: ranchland open space and water quality. We included three scenarios in our survey: the first two scenarios assess the impact of a decrease in the quality of each resource alone, and the third scenario assesses the effect of a decrease in the quality of both resources simultaneously. In this section, a generic model is described for the first two scenarios (that applies to changes in open space or water quality). Some of the important differences for the third model are presented at the end of the section.

The basis of our theoretical model is an individual utility maximization function, subject to a budget constraint, as shown in Equation 3.1.

$$\max_{x,z} u = u(X(EQ);Z,EQ) \quad s.t. \sum_i p_i \cdot x_i + Z = M \tag{3.1}$$

Where u is the individual's utility, X is equal to the number of trips taken by the individual (which is influenced by the environmental quality at the site), Z is consumption of all other goods, and EQ is the environmental quality level (here measured as the amount of ranchland open space or water quality level). This utility maximization function is subject to a budget constraint with annual household income (M) equal to the sum of individual trip price (p_i) multiplied by the individual quantity of trips (x_i) annually plus the cost of all other goods consumed (Z) (assuming a unit price).

The relevant first order necessary conditions for the constrained maximization problem are shown in Equation 3.2 for X and Z.

$$\begin{aligned} &\frac{\partial u(\cdot)}{\partial X} \cdot \frac{\partial X}{\partial EQ} - \lambda P = 0 \\ &\frac{\partial u(\cdot)}{\partial Z} - \lambda = 0 \end{aligned} \tag{3.2}$$

Where λ is the marginal value of income. The first condition in Equation 3.2 states that the marginal value of visitation to the site is equal to the price paid for travel to the site. The marginal value of visitation is also affected by the environmental quality of the site. Assuming that environmental quality is a good ($\partial X / \partial EQ > 0$), it would be expected that an increase in environmental quality would increase the marginal utility of visitation. The second condition in Equation 3.2 says that the marginal value of all other goods is equal to one (since we assumed a unit price).

As shown in Eom and Larson (2006), the solution to the constrained maximization problem shown in Equation 3.1 results in the following Marshallian demand function for trips, assuming a semi-log functional form.

$$x(P, EQ, M) = e^{(\alpha + \beta P + \gamma EQ + \delta M)} \tag{3.3}$$

In this equation P is equal to the price of travel or travel cost, α is a constant, β is the coefficient for travel cost, γ is the coefficient for environmental quality and δ is the coefficient for income. Travel cost (P) is calculated as the direct costs of traveling to the site plus the opportunity costs of time. We calculate the direct travel costs as the round-trip distance from the respondent's home to the site (using the respondent's zip code) multiplied by the current government mileage reimbursement of \$0.505 per mile (GSA 2008), and divided by the number of people traveling in the group as reported by the respondent. We measure the opportunity cost of time as one-third of the wage rate (calculated as the respondent's reported income divided by 2000 working hours) multiplied by the travel time (round-trip distance divided by a speed of 40 miles per hour[9]). The opportunity cost of time for housewives (or househusbands), unemployed persons and retirees are assumed to be zero.

Using our semi-log demand function as shown in Equation 3.3, we are able to obtain the following quasi-expenditure function, following Eom and Larson (2006):

[9] Although the speed of 40 mph is slower than the speed limit on many roads in Colorado, it was chosen in this context due to the mountainous terrain on much of the drive to Chaffee County which may necessitate driving at a slower speed. The assumptions about driving speed and the cost per mile of travel may affect the travel cost estimates.

$$\tilde{E}(p, EQ, u) = -\frac{1}{\delta}\ln\left(-\frac{\delta}{\beta}e^{\alpha+\beta P+\gamma EQ} - \delta e^{\delta\psi EQ}u\right) \tag{3.4}$$

The second term in Equation 3.4 is a constant of integration that generally depends on environmental quality. It is possible to set this term equal to the utility index, which implies weak complementarity and no non-use value. We instead follow the approach of Eom and Larson (2006) by setting the constant of integration equal to $e^{\delta\psi EQ}u$ which allows for the estimation of non-use value. The parameter ψ is a function of individual characteristics (described more fully in the data section below), which, if equal to zero, indicates the absence of non-use value.

One of the focal areas of this research is to estimate the change in welfare for a given change in environmental quality. In this case, since we are concerned with an individual's willingness to pay to *avoid a decrease* in environmental quality, the appropriate welfare measure is equivalent variation. To calculate changes in welfare, we also follow a similar approach to Eom and Larson (2006), but apply their theoretical model to measure equivalent variation. We can represent this welfare measure as the total value of (or willingness to pay for) avoiding a decrease in environmental quality. This function measures the total value of the change in welfare as the difference between the quasi-expenditure function with the initial environmental quality level and the quasi-expenditure with the lower level of environmental quality, as shown in Equation 3.5.

$$TV(EQ_1, EQ_0) = \tilde{E}(P_0, EQ_1, u_1) - \tilde{E}(P_0, EQ_0, u_1) \tag{3.5}$$

Where EQ_1 is the new, lower level of environmental quality, EQ_0 is the initial level of water quality, and utility and prices are held constant at their initial levels. Using the form of the quasi-expenditure function that is consistent with the semi-log demand function shown in Equation 3.3, we arrive at the following empirical function for total value.

$$TV(EQ_1, EQ_0) = \frac{1}{\delta} \ln\left[-\frac{\delta}{\beta} x^0 + \left(1 + \frac{\delta}{\beta} x^1\right) e^{\delta\psi(EQ_0 - EQ_1)} \right] \tag{3.6}$$

Where x^0 and x^1 are the demand functions as shown in Equation 3.3, for higher (EQ_0) and lower (EQ_1) levels of environmental quality, respectively.

It should be noted that although the general procedure followed to obtain the total value function shown in Equation 3.5 is the same for all three scenarios being considered, the empirical function obtained for the third scenario that includes changes in both quality variables at the same time differs slightly. First, the form of the quasi-expenditure function for the scenario that includes both open space and water quality is as shown in Equation 3.7.

$$\tilde{E}(p, OS, WQ, u) = -\frac{1}{\delta} \ln\left(-\frac{\delta}{\beta} e^{\alpha + \beta p + \gamma_1 OS + \gamma_2 WQ} - \delta e^{\delta\psi OS WQ} u \right) \tag{3.7}$$

Similar to the description above, the total value function is then calculated as shown in Equation 3.8.

$$TV(EQ_1, EQ_0) = \tilde{E}(P_0, OS_1, WQ_1, u_1) - \tilde{E}(P_0, OS_0, WQ_0, u_1) \tag{3.8}$$

Which results in the following function when substituting the appropriate quasi-expenditure functions into Equation 3.9.

$$TV(EQ_1, EQ_0) = -\frac{1}{\delta}\ln\Big(-\frac{\delta}{\beta}e^{\alpha+\beta p+\gamma_1 OS_0+\gamma_2 WQ_0+\delta M} + \left(1+\frac{\delta}{\beta}e^{\alpha+\beta p+\gamma_1 OS_1+\gamma_2 WQ_1+\delta M}\right)e^{\delta\psi(OS_0 WQ_0 - OS_1 WQ_1)}\Big) \tag{3.9}$$

DATA

This analysis utilizes data from a survey of tourists to Chaffee County, Colorado during the summer of 2007. Visitors were contacted in person at various locations throughout the county on alternating weekends from June through September. Potential respondents were initially screened to rule out residents of the county and individuals under the age of 18. The survey was conducted as a combination in-person contact and mail/Internet format. Individuals were approached during their trip by survey enumerators and asked if they would be willing to participate in the survey. If they agreed, they were given either a paper mail-back survey with a pre-paid envelope or a card explaining how to access and complete an identical version of the survey via the Internet. To ensure random assignment of survey type, enumerators alternated the type of survey that was offered to individual respondents.

A brief pre-test of the survey was conducted prior to survey distribution in order to ensure that questions were clear to potential respondents. Extensive focus group testing was not conducted prior to the survey due to budget constraints. Since respondents were initially contacted on-site, respondent addresses and/or e-mail addresses were requested during the survey distribution. Although an attempt was made to obtain contact information from all respondents, some did not comply with the request. Additional follow-up postcards were sent to all respondents for which address information was obtained. In addition, an e-mail with an electronic link to the on-line survey was sent to those internet survey respondents that provided an e-mail address.

A total of 902 surveys were distributed, including 446 mail-back surveys and 456 Internet survey cards. Forty-nine percent of the paper surveys were returned, while the Internet response rate was somewhat lower at 35 percent. Overall, 377 surveys were returned for a total response rate of 42 percent. When on-site refusals are included, the overall response rate falls to 36 percent.

Information collected on the survey included relevant information about the respondent's trip (including activities undertaken, the importance of various attributes to their decision to visit Chaffee County, and trip details such as expenditures and travel time), as well as demographic information. Several questions were also included that asked respondents how their behavior might change with a decrease in quality and how much they would be willing to pay to avoid a decrease in environmental quality under different hypothetical scenarios.

The WTP questions focus specifically on ranchland open space and water quality in Chaffee County. Respondents were asked to consider three different scenarios: A) a decrease in amount of ranchland open space, B) a decrease in the level of water quality, and C) a decrease in both ranchland open space and water quality. Each scenario included experimental variation for the level of quality change, with a random assignment of a decline of 25 percent, 50 percent or 75 percent from current ranchland open space area and a decline in water quality from the current swimmable level to a fishable or boatable level of water quality. The variable for open space is measured as the percentage of original open space remaining, while the variable for water quality is coded as 3 for swimmable, 2 for boatable, and 1 for fishable. These codes are a measure of the number of recreational activities allowed for a given water quality level. While a more precise numerical measure of water quality may be preferable for modeling purposes, the measure of recreational uses (swimmable, fishable, boatable) was chosen for use in the survey to ensure that all survey respondents were able to understand what was meant for each water quality level. Figures 3.1 and 3.2 show the graphical depiction of the variation in quality as shown on the survey instrument for each environmental quality variable.

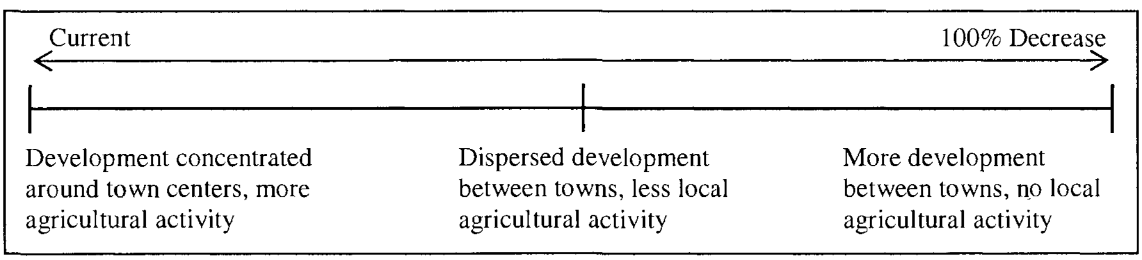

Figure 3.1. Diagram of Variation in Ranchland Open Space

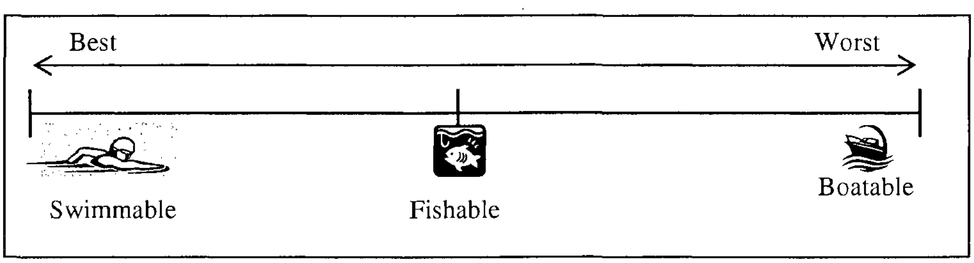

Figure 3.2. Diagram of Variation in Water Quality

For each scenario, the respondent was first asked how their behavior would change if the scenario were to occur. This contingent behavior question was worded as follows (this example is for Scenario A): "Suppose that this scenario became a reality in Chaffee County. Would this change in land use (with no change in water quality) cause you to make fewer (or more) ***trips*** to Chaffee County during the year?". Each contingent behavior question was followed by a question asking for the respondent's maximum willingness to pay to ensure that the scenario did not occur (i.e. their willingness to pay to avoid the decrease in quality). The WTP questions were then phrased as follows: "If you answered fewer or no change in part a, what is the maximum increase in your total costs per person per trip you would be willing to pay to ensure that Scenario ___ did not occur?" These questions were framed in a payment card format giving the respondent a choice of 12 values ranging from $0 to $500 ($0, $5, $10, $25, $50, $75, $100, $150, $200, $300, $400, $500). Since we are concerned with the WTP to avoid a particular scenario, we would expect a greater WTP for lower levels of quality or a negative relationship between the two variables. In other words, a respondent would be expected to pay more to avoid a scenario with lower quality level than they would to avoid a scenario with a higher quality level. Demand for trips would be expected to fall with lower quality levels, indicating an expected positive relationship between environmental quality and demand for trips.

Information on demographic and other attitude variables was also collected from each respondent. The parameter ψ as shown in Equation 3.4 is a measure of non-use value and incorporates various individual-specific characteristics that may affect the respondent's WTP. Since ψ appears in the WTP function but not in the demand function, we must use parameters other than those in the demand function for its estimation. Here it is estimated as a function of individual-specific characteristics. In our model, we choose a simple linear functional form for the non-use value equation as shown in Equation 3.10.[10]

$$\psi = \psi_0 + \psi_1 * Ranches + \psi_2 * Rivers + \psi_3 * Education + \psi_4 * Age + \psi_5 * Gender \quad (3.10)$$

In Equation 3.10, *Ranches* and *Rivers* are variables that measure the importance of ranchlands and water resources in the respondent's decision to visit Chaffee County. These variables are measured on a five-point Lickert scale, with 1 indicating irrelevant and 5 being very important. It is expected that individuals that place a greater importance on rivers and ranchlands would be willing to pay a larger amount to avoid a decrease in the amount of ranchland open space or water quality. The remaining variables are demographic characteristics of the individual including *Education* (categorized as junior high, high school, 2 year college, 4 year college, and graduate or professional degree), *Age* (in number of years) and *Gender* (a dummy variable equal to one if male and 0 if female)[11]. Although the anticipated sign for demographic variables is somewhat more ambiguous, we would expect education level to be positively related to WTP, age to be positively related to WTP and gender to be negatively related to WTP.

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[10] Although Eom and Larson (2006) use a squared term $(\Sigma_k \psi_k D_k)^2$ for ψ in order to impose the restriction that non-use value be non-negative our model would not converge with a squared sum term.

[11] There are a number of possible variables that could be included in the non-use parameter equation, we focused on several demographic variables that are frequently used in contingent valuation research (age, gender and education) and the attitude variables about the two specific resources under consideration in this study.

Table 3.1. Variable Descriptions and Descriptive Statistics

Variable	Description	Units	Mean	Standard Deviation
Income	Annual household income	$	98,969	66,402
Education	Level of education (0=junior high; 1=high school; 2=2 year college; 3=4 year college; 4=graduate or professional school)		2.88	1.07
Age	Age of respondent	years	51	13
Gender	Dummy variable =1 if male, =0 if female		0.52	0.50
Ranches	Importance of ranches to the decision to visit Chaffee County	Lickert scale (1=unimportant; 5=very important)	3.53	1.06
Water	Importance of water resources to the decision to visit Chaffee County	Lickert scale (1=unimportant; 5=very important)	4.47	0.74
Travel Cost	The roundtrip costs of travel to the site per person (including opportunity costs of time)	$	536	737
Trips	Number of trips to Chaffee County in the past year	Number of trips	6.16	24.09
WTP Scenario A	Willingness to pay to avoid a decrease in open space	$	57	75
WTP Scenario B	Willingness to pay to avoid a decrease in water quality	$	59	81
WTP Scenario C	Willingness to pay to avoid a decrease in open space and water quality	$	69	94

Table 3.1 shows the variable names, descriptions, units, mean values and standard deviations for the variables included in the model. Average roundtrip travel costs were approximately $536, including the opportunity costs of time. The average respondent reported taking six trips to Chaffee County in the past year. Scenario C had the highest

average willingness to pay (WTP) value, followed by Scenario B and Scenario A. The mean WTP value for Scenario A (change in open space only) was \$57, \$59 for Scenario B (change in water quality only), and \$69 for Scenario C (change in open space and water quality).

ECONOMETRIC MODEL

The econometric model follows the approach used by Eom and Larson (2006) but adjusts their model to be used with payment card data. Willingness to pay data collected using a payment card format indicates that an individual is willing to pay as much (or more) than the given value that they choose from the payment card (t_{li}), but not as much as the next highest value (t_{ui}) included in the payment card. As shown in Cameron and Huppert (1989) the probability that an individual chooses a given bid amount can be represented as:

$$P(t_{li}) = P(t_{li} \leq WTP < t_{ui}) \tag{3.11}$$

Using this probability function for payment card data, we can write the general likelihood function for joint decisions as follows:

$$\ell = \prod P(x, WTP_i \subseteq (t_{li}, t_{ui})) \tag{3.12}$$

Where x is trip demand and the second term reflects the probability that the individuals true willingness to pay (WTP) falls within the payment card interval.

We can then write the specific empirical likelihood function as the product of the marginal distribution of trips ($\phi(x)$) and the probability that an individual chooses the bid value t_i given that x trips are taken.

$$\ell = \prod \phi(x)\, P\big(((\log t_{ui} - TV)/\sigma) < t_i < ((\log t_{li} - TV)/\sigma)\,\big|\,x\big) \tag{3.13}$$

The corresponding log likelihood function can be written as:

$$\log \ell = -\frac{n}{2}\log\left(2\pi\sigma_\eta^{\,2}\right) - \frac{1}{2}\sum_{i=1}^{n}\left[\frac{\ln x - (\alpha + \beta P + \gamma EQ + \delta M)}{\sigma_\eta}\right]^2$$
$$+\sum_{i=1}^{n}\log\left[\Phi\left(\frac{((\log t_{ui} - TV)/\sigma_\varepsilon) - \rho(\eta/\sigma_\eta)}{(1-\rho^2)^{1/2}}\right) - \Phi\left(\frac{((\log t_{li} - TV)/\sigma_\varepsilon) - \rho(\eta/\sigma_\eta)}{(1-\rho^2)^{1/2}}\right)\right] \tag{3.14}$$

Where σ_ε and σ_η are scale parameters and ρ is a correlation parameter. $\Phi(\cdot)$ represents the standard normal cumulative distribution function.

We estimate three different econometric models based on the two measures of environmental quality that we are considering in the survey[12]. The first model incorporates the data for Scenario A, which only considers the change in the amount of ranchlands in the county, the second model incorporates the data for Scenario B, which only considers a change in water quality, and the third model uses data from Scenario C, which includes changes in both ranchland open space and water quality, as described in the previous section. The results are presented in the following section.

[12] We chose to estimate three separate models instead of combining all three scenarios in one data set in order to avoid potential problems that might arise from multiple error terms and cross-correlation.

RESULTS

This section presents the results from two model estimations. The first estimates include travel cost and contingent valuation data as in Eom and Larson (2006). However, we show that the lack of variation in the environmental quality variable in our single-site travel cost data makes it impossible for us to isolate use and non-use values. The next section presents the results of a model that attempts to rectify this problem by adding contingent behavior data to the travel cost portion of the model to allow for variation in the environmental quality variables.

RP-SP Model Results

The first set of models is estimated by combining revealed and stated preference data. An estimate of the joint model was undertaken for each of the three scenarios described above. Table 3.2 shows the model results for actual demand and WTP functions. The individual parameter estimates presented for each model consist of coefficients for the demand function including travel cost, income, environmental quality and standard errors, as well as non-use parameters estimated in the ψ function as shown in Equation 3.10. The demographic and preference variables estimated in the non-use function include *Ranches*, *Water*, *Education*, *Age* and *Gender*.

In general, coefficient estimates across the three models conformed to our expectations. The travel cost parameter was negative and statistically significant at the 1 percent level in all models, indicating that individuals that travel costs had a negative effect on the demand for visitation as well as the respondent's WTP to ensure that environmental quality did not decline. Income has a positive effect on visitation demand and WTP, although the coefficients for income tend to be less significant than travel cost. The income parameter was significant at the 10 percent level for Models 2 and 3, but was not significant for Model 1. Environmental quality was found to be negative and statistically significant in Model 1 and Model 2. This indicates a negative relationship with WTP but no relationship with demand for visitation, since the environmental quality variable in the demand equation does not change. In Model 1, the negative sign on open space indicates that with a smaller decline in the level of open space (and thus a larger percentage of open space in Scenario A), the WTP to avoid the decrease in open space is lower. The results for Model 2 can be interpreted in a similar manner; with a smaller decline in water quality (and thus a higher level of water quality in Scenario B), the WTP to avoid a decrease in water quality is lower. In Model 3, when individuals were asked to consider a scenario in which open space and water quality both declined, the coefficients for both environmental quality variables were negative. The coefficient for open space was statistically significant at the 1 percent level, while the coefficient for water quality was only significant at the 15 percent level.

Several different demographic and attitude variables were included in the non-use value term. Different specifications were used across the three models due to difficulty of convergence with more complex specifications for some of the models. In Model 1, demographic variables included in the model were age and gender. *Age* was positively related to WTP and *Gender* was negatively related to WTP, although neither variable was found to be statistically significant.

Table 3.2. Joint Model Estimates for All Scenarios

Parameters	Model 1 (Scenario A)	Model 2 (Scenario B)	Model 3 (Scenario C)
Intercept (α)	2.5597***	2.293***	2.0732***
	(0.2197)	(0.2797)	(0.2922)
Travel Cost (β)	-0.0337***	-0.0379***	-0.0406***
	(0.0091)	(0.0096)	(0.0089)
Income (δ)	0.0001	0.0009*	0.001*
	(0.0006)	(0.0007)	(0.0008)
Open Space (γ_1)	-0.0161***		-0.0087***
	(0.0018)		(0.0021)
Water Quality (γ_2)		-0.0047***	-0.0093
		(0.0008)	(0.0085)
Standard Error for Demand Function (σ_η)	1	1	1
Standard Error for WTP Function (σ_ε)	61.2172***	65.9094***	79.4041***
	(2.9666)	(3.2059)	(3.8019)
Correlation Parameter (ρ)	-0.1177**	-0.0797	-0.0572
	(0.0685)	(0.0838)	(0.0702)
Non-Use Parameters			
Intercept (ψ_0)	1.1967**	0.2862*	-0.003
	(0.6507)	(0.193)	(0.0217)
Ranches (ψ_1)	-0.0091		-0.0019
	(0.1773)		(0.0029)
Water (ψ_2)	0.3929***	0.1459***	0.0122***
	(0.1546)	(0.0385)	(0.0041)
Education (ψ_3)			0.0038**
			(0.0024)
Age (ψ_4)	0.0059		0.0001
	(0.0072)		(0.0002)
Gender (ψ_5)	-0.1864		-0.006
	(0.1524)		(0.0053)
Mean log-likelihood	-229.218	-225.57	-227.633
N	246	242	244

Note: Standard errors are in parentheses.

Other attitude variables included *Ranches* and *Water*, which measure the importance of ranchlands and water resources in the respondent's decision to visit Chaffee County (with a higher value indicating greater importance). The *Ranches* variable was not significant, while the *Water* variable was positive and significant at the 1 percent level, indicating that individuals that placed a higher importance on water resources had a larger WTP to avoid a decline in the amount of ranchland open space. In Model 2, the *Water* variable was also positively related to WTP and significant at the 1 percent level, indicating that individuals with a higher WTP to avoid a decline in water quality placed a greater importance on water resources in their decision to visit Chaffee County. Model 3 included *Education*, *Age* and *Gender* as non-use parameters, of which only education was significant. *Education* was found to be positively related to WTP, indicating that individuals with more years of education had a higher WTP to avoid a decline in the amount of ranchland open space and water quality. In Model 3, as in Model 1, *Ranches* is not significant, while *Water* is positive and significant at the 1 percent level. This indicates that respondents that placed a higher importance on water resources had a higher WTP to avoid declining ranchland open space and water quality.

The econometric results presented in the previous section can be used to calculate use, non-use and total value of ranchland open space and water quality. Table 3.3 shows the results for each of the three scenarios. These results show a negative use value and positive non-use and total values for all three scenarios. The unexpected negative result for use value comes from the fact that we do not have variation in the environmental quality variables in the revealed preference part of our survey. This is an important difference from the analysis conducted by Eom and Larson (2006). In their analysis, they have information from respondents on six different sites and assign a "typical site" to each respondent which is defined as the most frequently visited site. They note that the model is set up in this way because they would not be able to identify the quality parameters in a system using all six sites since there would be no variation in the quality variable across respondents. Because we are implementing a single site model, we have the inherent problem of no variation in the revealed preference part of our data set. Based on this lack of variation in our data, while we were able to implement the Eom and Larson (2006) model, we lose the ability of the model to be able to determine which part of the total value is use value and which part is non-use value. This leads to the results shown in Table 3.3, with essentially all value being assigned to non-use value[13].

Table 3.3. Use, Non-Use and Total Value Calculations for RP-SP Models

		Use Value ($)	Non-Use Value ($)	Total Value ($)
Scenario A[14]				
75% of open space maintained		-6.40	78.13	71.73
50% of open space maintained		-15.93	156.25	140.32
25% of open space maintained		-30.15	234.38	204.23
Scenario B				
F		-6.24	93.87	87.63
B		-15.78	187.74	171.96
Scenario C				
75%	F	-3.48	86.65	83.18
75%	B	-4.82	129.98	125.16
50%	F	-6.27	115.54	109.27
50%	B	-7.76	144.42	136.66
25%	F	-9.69	144.42	134.73
25%	B	-11.40	158.86	147.46

F = water quality is at the fishable level, B = water quality is at the boatable level.

[13] In this case, while our calculations did result in negative values, these result from taking the log of a number very close to 1. If calculated with slightly less precision, our calculations would produce use values of zero.

[14] Open space variables can also be viewed as the percentage of open space converted under a given scenario. For example, 75 percent of open space maintained is equal to avoiding a loss of 25 percent of the current level of open space.

In order to deal with the lack of variation in the revealed preference data that exists in a single-site model, we propose an extension of the Eom and Larson (2006) model that incorporates additional stated preference data on projected number of trips. In this model we combine travel cost and contingent behavior data for the travel cost portion of the joint model and use the same contingent valuation as in the previous estimation. This way, we are able to incorporate variation in terms of the environmental quality variable in the travel cost part of the joint model, to allow us to arrive at estimates of use, non-use and total value. Although Eom and Larson (2006) only used TC and CV data for their estimation, Whitehead (2005) has previously attempted a model that included willingness to pay information along with revealed and stated behavior data. While Whitehead (2005) does provide estimates for use and non-use, these are not obtained from a unified model such as the one proposed by Eom and Larson (2006). The results of these additional estimations are presented in the next section.

RP-SP-SP Model Results

For each scenario in the RP-SP-SP model, we include two observations (one travel cost and one contingent behavior) and three pieces of information (travel cost, contingent behavior and contingent valuation) per respondent. The first observation includes the revealed preference data for the travel cost portion of the model along with the individual's response to the contingent valuation question. The second observation includes stated preference data from the contingent behavior question for the travel cost part of the model and the respondent's answer to the contingent valuation question for that scenario. The two observations for each respondent are combined in a data set for each of the three scenarios, and the same joint models are estimated as in the previous section.

Table 3.4 shows the results of the three RP-SP-SP joint model estimations. Model 4 is the joint estimation of Scenario A, which includes a decrease in the level of ranchland open space only. In this model, the coefficient for travel cost is negative, as expected, and is statistically significant at the one percent level. Income is positive and significant at the 10 percent level. The coefficient for environmental quality (ranchland open space) is positive in this model and statistically significant at the 1 percent level. This is different from the result obtained in the previous estimation since in this case the environmental quality coefficient would be expected to have a negative relationship with willingness to pay to avoid a decrease in quality as in the previous results but would be expected to have a positive relationship with the demand for trips to the site (higher quality would increase demand for trips). Overall, these two effects result in a positive coefficient for environmental quality for Scenario A. The non-use parameters *Water* and *Age* were both found to be statistically significant at the five percent level and positively related to non-use value, indicating that older respondents and those that placed a higher level of importance on water resources had higher non-use values. The variables *Ranches*, *Education* and *Gender* were also included in the non-use component but were not found to be statistically significant.

Table 3.4. RP-SP-SP Joint Model Estimates for All Scenarios

Parameters	Model 4 (Scenario A)	Model 5 (Scenario B)	Model 6 (Scenario C)
Intercept (α)	-3.686***	-5.7767***	-13.1592***
	(0.135)	(0.1448)	(0.1472)
Travel Cost (β)	-0.0252***	-0.1378***	-0.0151***
	(0.0016)	(0.0174)	(0.0016)
Income (δ)	0.0008*	-0.0002	0.0025***
	(0.0006)	(0.0007)	(0.0006)
Open Space (γ_1)	0.0458***		0.0955***
	(0.0014)		(0.0025)
Water Quality (γ_2)		0.2029***	0.1292***
		(0.0054)	(0.0086)
Standard Error for Demand Function (σ_η)	1	1	1
Standard Error for WTP Function (σ_ε)	81.8117***	83.8336***	99.1171***
	(2.6962)	(2.8324)	(3.3255)
Correlation Parameter (ρ)	-0.0063	-0.028***	-0.0186***
	(0.0097)	(0.0062)	(0.0068)
Non-Use Parameters			
Intercept (ψ_0)	-1.8278***	-4.2411**	-0.0677***
	(0.7482)	(2.1292)	(0.0255)
Ranches (ψ_1)	-0.1078	-0.1808	-0.0016
	(0.1194)	(0.2005)	(0.0037)
Water (ψ_2)	0.2686**	1.1322***	0.01**
	(0.1498)	(0.4827)	(0.005)
Education (ψ_3)	0.0815	0.3247*	0.0053**
	(0.0976)	(0.2286)	(0.0033)
Age (ψ_4)	0.0165**	0.0573***	0.0003
	(0.0086)	(0.0243)	(0.0003)
Gender (ψ_5)	-0.123	-1.0016*	-0.0036
	(0.2167)	(0.6611)	(0.0069)
Mean log-likelihood	-492.044	-478.538	-478.212
N	520	498	492

Note: Standard errors are in parentheses.

Model 5 estimates the joint model for a decline in water quality only. Again, travel cost is negative and statistically significant at the one percent level. Income is not statistically significant in Model 5. The water quality variable has a positive coefficient and is significant at the one percent level. The non-use parameters *Water*, *Education*, *Age* and *Gender* were all statistically significant in this model at the ten percent level or higher, while *Ranches* was not significant. The coefficient on *Water* is positive, indicating that respondents with a higher preference for water-related attributes have a higher non-use value. The coefficients on *Education* and *Age* are both positive as well, indicating that respondents that are older and those with more education are likely to have higher non-use values for water quality. The coefficient for *Gender* is negative, indicating that men tend to have lower non-use values than women.

Model 6 shows the results for Scenario C which includes a decline in both ranchland open space and water quality. In this model, the parameters for travel cost, income, and both environmental quality variables are all significant at the one percent level. The coefficient for travel cost is negative, as expected. The income parameter in this case is positive, which is what would be expected both in terms of demand for trips and willingness to pay to avoid a decrease in quality. Both environmental quality parameters are positive, as in the two previous models. In terms of the non-use parameters in this model, only *Water* and *Education* are statistically significant. Both of these variables are positively related to non-use value and are statistically significant at the five percent level.

Table 3.5 shows the results for use, non-use and total values (all values are estimated per trip) for the combined RP-SP-SP model. The RP-SP-SP model results give positive use and non-use values for all three scenarios. In terms of total values, we see that Scenario A has the lowest value of the three scenarios, with the largest value for maintaining 25 percent of the current level of open space (avoiding the loss of 75 percent of current open space). Scenario B, which has only a decrease in water quality, has the next highest total values. Scenario C, which incorporates both a decrease in ranchland open space and water quality, has much larger total values than the other two scenarios that only examine changes in one resource.

Table 3.5. Use, Non-Use and Total Value Calculations (per trip) for RP-SP-SP Models

		Use Value ($)	Non-Use Value ($)	Total Value ($)
Scenario A[15]				
75% of open space maintained		18.39	0.08	18.47
50% of open space maintained		24.19	0.16	24.35
25% of open space maintained		26.03	0.24	26.27
Scenario B				
F		4.04	18.35	22.39
B		4.06	36.70	40.76
Scenario C				
75%	F	18.36	360.08	378.43
75%	B	12.24	540.11	552.35
50%	F	14.46	480.10	494.56
50%	B	10.81	600.13	610.94
25%	F	10.83	600.13	610.96
25%	B	9.35	660.14	669.49

F = water quality is at the fishable level, B = water quality is at the boatable level.

Scenarios B and C (change in water quality only and change in water quality and open space) give non-use values that are larger than the use values. Scenario A (change in open space only) results in use values that are larger than the non-use values. Initially, these results seem somewhat counterintuitive to what one might expect. Since ranchland

[15] Open space variables can also be viewed as the percentage of open space converted under a given scenario. For example, 75 percent of open space maintained is equal to avoiding a loss of 25 percent of the current level of open space.

open space is not directly used by many visitors to Chaffee County (i.e. by visiting a working ranch), one might initially expect this resource to provide non-use values that are larger than use values. However, in this case, it is likely that the "use value" being obtained by the visitors comes from viewing the ranchland open space during their visit and not from directly recreating on the ranchlands. This is similar to the case when visitors to a National Park or other public land obtain use value from viewing the wildlife even though no direct use is involved. In terms of non-use values for ranchland open space, these results would seem to indicate that the intrinsic values that the survey respondents have for ranchlands would be expected to be relatively small.

Although water quality may be more likely to have a direct use by some visitors, such direct use values might only be expected from those individuals that participate in water-based recreation activities. In the case of our sample, smaller use values for water quality are not that surprising since only around 20 percent of our sample participated in rafting or kayaking during their trip[16]. On the other hand, 62 percent of respondents reported driving for pleasure and 55 percent reported sightseeing and photography as activities they participated in during their trip, which would be much more likely to result in use values for ranchland open space. Furthermore, it is likely that even if individuals do not participate in water-based recreation, they still might have significant intrinsic values for water quality, and thus might have a larger willingness to pay to avoid a decrease in water quality.

[16] Although rafting and kayaking are prominent activities in Chaffee County, our sample was meant to include a broad variety of tourists and therefore we did not have an over-representation of these individuals in our sample.

DISCUSSION

As shown in the models above, while Eom and Larson's (2006) model is useful in providing estimates of use and non-use value for environmental quality variables, the model is limited in terms of providing these values for a single-site model. Since a single-site model does not have variation in environmental quality in its revealed preference travel cost data, their model will produce estimates of only non-use value when estimated with single-site data. In our RP-SP-SP model, we combine additional stated preference data with the travel cost data in order to provide estimates of both use and non-use value for a single-site model. This new formulation of the model allows us to distinguish use and non-use values in a case where information on actual behavior under different levels of environmental quality is limited.

Although the necessity of distinguishing use and non-use values has been questioned (Freeman 1993), some benefits of separating these values have been noted. Eom and Larson (2006) observe that estimating use and non-use values is important in developing a utility-theoretic model since it is necessary to determine which parameters enter into each part of the equation. In addition, the estimation of use and non-use values can provide useful information for policymakers. Additional information on the relative magnitude of use and non-use values can be helpful in determining what policies might be the most useful in extracting untapped consumer surplus from resource users. Taxes on goods related to use may be more appropriate for environmental goods with primarily use value, while voluntary donations could also be beneficial for goods with primarily non-use values.

In our analysis, the results show that visitors to Chaffee County would experience a decline in welfare with a decline in the amount of ranchland open space and/or water quality in the county. The calculated equivalent variation measures as shown in Table 3.5 show that visitors to the county would be willing to pay between $18 and $26 to avoid a decrease in the level of ranchland open space, and between $22 and $41 to avoid a decrease in the level of water quality. If the amount of ranchland open space and water quality were to decline simultaneously, however, the equivalent variation values are much higher, with values ranging from $378 and $669. These results show that if a change in land use (from agricultural to more urban uses) were to also lead to a decrease in water quality, the potential loss in welfare (and associated willingness to pay) would be substantially larger than if the associated water quality implications were not considered. The implications of these results are important for policy, particularly in an area such as Chaffee County where water resources are an important part of recreational activities undertaken by area visitors. Since the implications of land uses on water resources are often not considered by developers, policies that provide incentives for landowners to consider the associated effects of land use change on water quality could help address the potential declines in natural resource quality.

The relative magnitude of use and non-use values as shown in Table 3.5 can also have important implications for local policymakers. Since use value comprises the majority of total value for open space alone, policies that try to extract the additional willingness to pay through a lodging tax may be appropriate. However, considering the potential water quality implications and the non-use value associated with that resource, other types of policies could be considered as well.

CONCLUSIONS

This paper applies a joint stated and revealed preference model to estimate individual willingness to pay to avoid a decrease in ranchland open space and water quality. We follow the model developed by Eom and Larson (2006) to estimate both use and non-use values for these resources. Our initial results show that estimating the model as proposed by Eom and Larson (2006) does not allow us to separate the total value into use and non-use components since our data is for a single site travel cost model. Since we were only estimating the model for one site, we did not have variation in environmental quality for the travel cost portion of the model. In order to address this issue, we develop an alternative model that utilizes travel cost, contingent behavior, and contingent valuation data. By combining the travel cost and contingent behavior data in the travel cost portion of the model, we are able to introduce variation in environmental quality in the recreation demand function and thus estimate use and non-use values. Similar models could be applied in other situations where data from multiple sites is not available.

Our RP-SP-SP model shows total values that are largest for a scenario that includes decreases in both ranchland open space and water quality, followed by a scenario that includes water quality only and a scenario that includes ranchland open space only. Total values obtained for ranchland open space are made up of primarily use values, indicating that visitors to Chaffee County place a positive value on observing ranchland open space during their visit but have relatively low intrinsic value for ranchlands more generally. Visitors have a smaller use value and larger non-use value for water quality, indicating that respondents place a greater intrinsic value on water quality and thus may have greater option, existence or bequest values for water quality.

These results indicate that visitors do value ranchland open space and water quality in Chaffee County. While the values for ranchland open space are smaller than those for water quality, if increased development results in decreased water quality, the overall willingness to pay of tourists to avoid loss of ranchland open space will be much larger. Further research should be conducted on the relationship between more urban development and water quality to fully consider the policy implications of these results.

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CHAPTER FOUR

Regional Economic Impact of Decreased Open Space and Water Quality: An Application to Chaffee County, Colorado

INTRODUCTION

Rural economies have long been found to benefit from the presence of natural resources. Traditionally, natural resources have been important terms of extraction (such as forestry and mining) and agriculture. More recently, however, the emphasis in many rural communities has begun shifting away from these traditional areas to service and retail industries. Natural resources are still important to rural economies, however, for the aesthetic and recreational opportunities that they provide to tourists, as well as the amenities and quality of life benefits that they provide to residents.

Natural resources in many rural areas provide amenities and contribute to residents' quality of life. Some research suggests that a large part of recent rural population growth stems from natural resource-based amenities located in these areas, and that growth rates are positively related to the level of natural resource amenities. McGranahan (1999) found that high amenity rural counties tended to have much greater population growth than those counties with low levels of amenities. Thus, one would expect that rural residents are placing a positive value on natural amenities and may experience a decrease in the utility they receive from these resources if their quality was to decline.

Natural resources also provide benefits to non-residents in terms of tourism and outdoor recreation (Kim et al. 2005). Tourism is an important economic driver in many rural areas in the United States, particularly those areas with high levels of natural amenities or outdoor recreation benefits (English et al. 2000). Due to the importance of tourism to many rural economies, significant changes in environmental amenities could affect the tourism industry and the regional economy.

Open space is one natural resource that provides amenities that are valued in many rural areas. In many communities, farm and ranchland (which is often privately owned) provides a large portion of the open space amenities to residents and tourists. In recent years, farm and ranchland area has been threatened in many areas as pressure increases to develop these lands for more urban uses. Between 1992 and 2001, an average of 2.2 million acres of farmland in the United States was converted to urban uses per year (Nickerson and Hellerstein 2007). This decrease has led to an increased emphasis on the policy analysis of farm and ranchland open space. Changing land uses can also lead to decreasing water quality, which can also affect the tourism industry in many rural areas.

Potential changes in the quality or quantity of natural resource amenities available can affect the local economy (particularly in terms of tourism) and the quality of life of local residents. Declining quality of local natural resources may lead to changes in future visitation from tourists, which can lead to broader regional economic impacts. Some previous studies have assessed the regional economic impacts of changing visitation due to decreased natural resource quality or the regional economic impacts of different policy options for maintaining natural resource quality (Orens and Seidl 2009, Seidl, Ellingson and Mucklow 2009). This type of information helps policymakers to see what effects declining resource quality and alternative policy options for protecting natural resources might have on the local economy.

This paper addresses the issue of loss of open space in the context of Chaffee County, Colorado. Chaffee County is a rural county in central Colorado with a summer tourism industry (including whitewater rafting and kayaking) that is important to the local economy and a substantial ranchland acreage that is under pressure from development interests. The importance of both ranchlands and water resource recreation in the county allows for an interesting opportunity to address the interactions between land use and water quality. We use survey data from visitors to the county to see how changes in visitation due to declining natural resource quality might affect the regional economy.

We develop a more comprehensive analysis than has been used in the past by assessing not only the regional economic impacts of decreased tourism due to declining levels of ranchland open space and water quality but also the regional economic impact of various policy options available for maintaining current levels of ranchland open space and water quality. This comprehensive analysis provides information that can help local community leaders assess the costs and benefits of different policy options and determine the best option for preserving natural resource quality.

The next section provides a literature review of previous studies that have used regional economic analysis to address issues of changing environmental quality. The following section describes our study area in Chaffee County, Colorado and provides an overview of the non-market valuation survey used to assess changes in tourist behavior. We then discuss the methodology used to estimate the economic impact of various policy options and the results of six different policy scenarios. The final section concludes.

LITERATURE REVIEW

Regional economic impact analyses are often conducted to determine the effect of various public policies on regional economies. Input-output (I-O) models are one tool that show linkages between different sectors in the economy and allow researchers to assess the impact of particular shocks on different sectors of the regional economy (Blair 1995). These models are able to assess the direct, indirect, and induced effects that occur in the economy due to a public policy or other shock to a particular sector of the economy. Direct effects are measured as the "first round" effects that occur based on changes in production in the industry that is directly affected. Indirect effects occur based on the interactions between different industries and result from different industries purchasing or providing inputs to each other. This type of interaction causes impacts in one sector to be felt in all related sectors in the regional economy. Induced effects are those effects that occur through linkages between the affected sector and households in the model. These impacts occur from labor linkages between households and other economic sectors as well as other effects due to additional changes in household spending based on changes in wages.

One of the most common software packages developed for I-O modeling is the IMpact Analysis for PLANning model or IMPLAN. IMPLAN is an I-O modeling package developed by the U.S. Forest Service and maintained by the Minnesota IMPLAN Group. IMPLAN uses data from the Bureau of Economic Analysis and the Bureau of Labor Statistics and defines industry groupings using SIC or NAICS codes to allow users to forecast or predict regional economic impacts for specific industries. It should be noted that IMPLAN estimates static effects, meaning that the model does not allow for adjustments that might be made in related industries over time or re-employment of displaced workers to other economic sectors.

I-O analysis is used in the regional economics literature for a wide range of applications and has been used in several cases to assess the impact of different environmental or natural resource management programs. However, to date, there have been only a few published studies that link non-market valuation to regional economic analysis. This type of analysis can provide policy-relevant information that can help communities to determine appropriate policies to reach environmental economic goals. This section provides a review of some studies that have used IMPLAN to address natural resource policy issues and/or combine non-market valuation results with I-O modeling.

Unsworth and Paterson (1999) use benefit transfer with I-O modeling to assess the regional economic effects of a proposed National Wildlife Refuge in south-central Wisconsin. In order to determine the economic impact of a proposed wildlife refuge, the authors utilize results from other relevant studies that estimate values for fishing and hunting that are similar to those that would be available in the refuge. Using IMPLAN, they estimate the losses in regional output, employment and income that would occur based on the land taken out of agricultural production. They use both the estimates of recreational value and agricultural production losses in the I-O model to derive estimates of the net economic impacts of the creation of the refuge.

Loomis and Caughlan (2004) combine information from a non-market valuation survey of visitors to Grand Teton National Park in order to provide information about different wildlife management options. In their study, they asked visitors to the park about several different management options for wildlife in the park and how their visitation might change under the different management scenarios. They were able to use contingent behavior information obtained from the survey in a regional economic analysis along with IMPLAN software to see how changes in visitation due to changes in wildlife management would affect the local economy. In their analysis, they assess the direct, indirect and induced effects of changing visitation. Through this analysis, they were able to provide information to park managers about the anticipated change in jobs and change in income for each option.

Kido and Seidl (2008) conduct a similar analysis of a butterfly preserve in Mexico. In their analysis, they collected information on travel cost and contingent behavior for different entrance fees for the park. They used this information along with an economic base analysis in order to determine the economic impact of different policy decisions on the gateway communities surrounding the park. Their analysis considers the relevant policy options that are available to each of the different stakeholder groups under consideration.

Seidl, Ellingson and Mucklow (2009) have applied I-O analysis to assess different policies for ranchland open space protection. In their study, the authors used I-O analysis to estimate the impacts of different policy options for protection of ranchlands in Routt County, CO. They mention several different policy options available to the local government to protect ranchland open space which can include various types of regulation, incentives, and disincentives. In the analysis, they consider four policy options including a sales tax, a mill levy, a lodging tax, and agricultural zoning. The three tax options are methods of funding a public policy and would likely be linked to a policy that required significant government payments such as the purchase of conservation easements or payments for ecosystem services.

In order to estimate the benefits of ranchland open space protection for different stakeholder groups, the authors used WTP data from surveys of residents and tourists to determine the consumer surplus they receive from ranchland open space protection. The authors used IMPLAN to estimate the total impact of each of the three tax policies to the local economy. The scenarios are implemented as shocks in the sector where the tax is applied. The lodging tax results in a shock to the hotel and motel sector, the mill levy is implemented through a shock to the owner occupied dwellings sector, and the sales tax results in a shock in six different retail industrial groups. In addition, each scenario also examines an injection into the cattle and ranching sector from the tax revenue being used for payment to farmers for conservation easements or other similar public policies. Through the IMPLAN analysis, the authors are able to describe the employment and output impacts for different sectors in the economy. The results showed that the sales tax generated the most revenue and jobs for the county, while a lodging tax generated the least.

Orens and Seidl (2009) undertake a similar analysis related to the relationship between ranchland open space and winter tourism in Colorado. In this analysis, the authors use travel cost and contingent behavior data to determine the effect of decreased levels of open space on winter tourism in Gunnison County, Colorado. They use data on the expected change in visitation due to a decrease in the amount of ranchland open space in the county in an I-O analysis to determine the regional economic implications of a change in the level of open space. Their results show that a decrease in ranchland open space in Gunnison County could result in a loss of $14.5 million and 350 jobs per year.

Our study uses similar techniques combining regional economic analysis and non-market valuation to assess different policy scenarios related to the protection of privately-owned ranchland open space and water quality in Chaffee County, Colorado. The analysis provides a more comprehensive assessment of the different policy options available by addressing several potential policies to raise funds to maintain current levels of open space and other scenarios that assess the regional economic impact of potential reduction in tourist visitation due to decreased environmental quality (decreased open space and/or water quality). The second set of scenarios combine regional analysis and non-market valuation data from a survey of tourists to Chaffee County during the summer of 2007.

STUDY AREA AND SURVEY DATA

Study Area

Chaffee County is located in Colorado's central mountains, and is home to the headwaters of the Arkansas River and 15 of Colorado's 54 "fourteeners" (14,000 foot peaks). The mountain location and unique geographic features of Chaffee County make the area a prime location for tourism and outdoor recreation, particularly whitewater rafting, kayaking, fishing, off-road vehicle (jeep and ATV) recreation, and hiking. Chaffee County hosts numerous visitors per year, primarily due to its vast outdoor recreation opportunities.

A large portion of the county's total land area is managed by federal, state and local government agencies including the United States Forest Service (USFS), the Bureau of Land Management (BLM), the State Land Board and the State Divisions of Wildlife and Corrections. Approximately 79 percent of the county's total land area is federal land, while another three percent is administered by the state of Colorado. The federally-owned land includes 455,804 acres in the San Isabel National Forest, managed by the USFS, and another 53,866 acres managed by the BLM. Approximately 120,000 acres of land in Chaffee County are privately owned (excluding the municipalities of Salida, Buena Vista, and Poncha Springs). Farmland and ranchland makes up 71,188 acres of privately owned land in Chaffee County, with 26,257 acres in cropland and 8,818 acres in irrigated land (National Agricultural Statistics Service 2006).

Ranching and farming have historically been important land uses in the county, with agricultural uses making up about 13 percent of total land use, and around 71 percent of private land use. Agricultural lands not only provide stimulus for the regional economy but also contribute to the local atmosphere and culture through the management of valley floor wildlife habitat and open space. Water quantity and quality are also important issues for residents and tourists since many of the outdoor recreational opportunities are centered on the region's widely known water resources.

In recent years, the local population has been increasing, with an overall increase of 33 percent between 1990 and 2005 to reach an estimated resident population of 16,879 (United States Bureau of the Census, 2007). This increase in population and increased interest in tourism in the area are likely to lead to future pressures to convert low density private lands (largely farmland and ranchlands) to higher density residential and tourism uses.

Visitor Survey

In order to obtain information on changes in intended behavior of visitors to Chaffee County based on changes in ranchland open space and water quality, a survey of adult tourists to the county was conducted during the summer of 2007. Individuals were contacted in-person at several locations around the county on seven alternating weekends throughout the summer. The survey method was a combination mail-back and Internet survey. Visitors were contacted in person and asked to take part in the survey. If they agreed to participate, they were provided with a survey packet that could be returned by mail (which included a cover letter, the questionnaire and a self-addressed stamped envelope) or a card describing the project and explaining how to fill out the survey on-line. The survey type was alternated among intercepted individuals to ensure that the same number of each type was distributed, and that the survey type received was random among the survey respondents.

Paper surveys were distributed to 446 individuals and Internet survey cards were distributed to 456 individuals, for a total of 902 surveys distributed. A total of 219 paper surveys were returned for a response rate of 49 percent. The response rate for the Internet surveys was somewhat lower, with 158 surveys filled out for a response rate of 35 percent. Overall, 377 surveys were returned for a total response rate of 42 percent. When on-site refusals are included, the overall response rate falls to 36 percent.

Information collected on the survey included questions related to various aspects of the respondent's visit to the area as well as relevant demographic information. Individuals were asked to report the importance of various natural and human attributes to their decision to visit Chaffee County and to list the activities they participated in during their trip. Information on spending patterns was also collected, including costs by category for the entire trip and expenditures by category while the respondent was in Chaffee County.

The survey also collected additional information on observed and contingent behavior. Respondents were asked to report the number of trips and total number of days that they had spent in Chaffee County in the past year. Contingent behavior information was collected to determine how the respondent would alter their behavior given a change in the quality of ranchland open space and/or water quality. Each respondent was asked to consider three scenarios: A) a decrease in amount of ranchland open space, B) a decrease in the level of water quality, and C) a decrease in both ranchland open space and water quality. Respondents were asked if they would take more trips, fewer trips or the same number of trips if the scenario described were to occur. If they stated that they would take more or fewer trips, they were asked to state the change in number of trips. For each scenario, experimental variation was included for the level of quality change. Respondents were randomly assigned a decline of 25 percent, 50 percent or 75 percent from current ranchland open space area. Change in water quality was specified as a decline from the current swimmable level to a fishable or boatable level of water quality[17].

ECONOMIC IMPACT METHODOLOGY

This paper follows a similar approach to the Seidl, Ellingson and Mucklow (2009) study mentioned above, but also incorporates the estimated impact on the local economy if land use changes from agriculture to urban uses occurred, as well as estimates of potential effects from associated changes in water quality. In this analysis, IMPLAN software is used to assess the economic impacts of different policy options in Chaffee County. Although the regional purchase coefficients (the percentage of local demand that is met through local production) are sometimes criticized as being one of the weakest parts of input-output models (Lazarus, Platas and Morse 2002), we chose to use those specified in IMPLAN rather than develop our own estimates due to lack of time and budget to develop survey-based estimates.

The options considered in the policy analysis stem from an initial policy decision of whether to protect or not protect ranchland open space (See Figure 4.1). In the first policy option where a decision to protect ranchland open space is made (the top row in Figure 4.1); four different scenarios are considered, following those developed by Seidl, Ellingson and Mucklow (2009). The first three scenarios involve different types of taxes that would be used to raise funds for conservation easement purchases to keep private land in agriculture and ranching uses. The three types of taxes include a sales tax (Scenario ST), a mill levy (Scenario ML) and a lodging tax (Scenario LT), each of which

[17] A water body is described as fishable if the water quality is sufficient for trout and other game fish to survive but not safe for swimming, and boatable if the water is safe for boating and sailing but <u>not</u> for swimming or fishing.

will have very different ramifications for the diverse stakeholder groups being considered. The fourth scenario under this policy option is agricultural zoning (Scenario AZ), which does not necessitate additional taxes but does have impacts on agricultural land owners and other local residents.

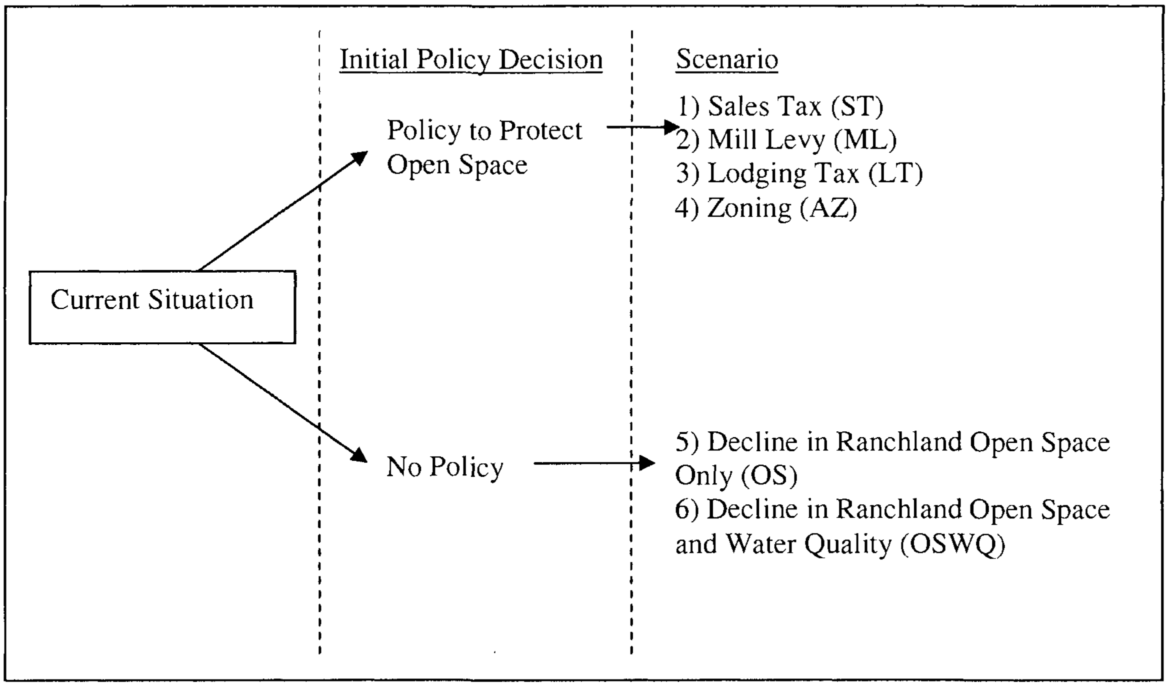

Figure 4.1. Schematic of Economic Impact Scenarios

A second policy option, labeled No Policy in 4.1, will also be considered. In this option, no funding is allocated to the protection of ranchland open space, resulting in additional urban land uses. Two scenarios are considered under this option. These two scenarios are considered because the relationship between land use and water quality is unclear and will likely depend on the type of management processes that are used with each potential land use. In this case, with an increase in urbanization, we could either expect a decrease in water quality due to increased runoff from pavement and other urban pollution, or an increase in water quality due to proper urban land management and a decrease in agricultural water pollution. Since the relationship between land use and water quality is not clear, we will look at three different possibilities – a positive relationship between the presence of ranchland open space and water quality, no relationship between ranchland open space and water quality, and a negative relationship between ranchland open space and water quality. Operationally, this will result in two possible situations, one in which there is an impact only on ranchland open space, and another in which there is an impact on ranchland open space and water quality (the situation where there is no relationship between land use and water quality is expected to yield the same results as the case where there is a positive relationship in this particular area since water quality in the area is currently good)[18]. Scenario OS assesses the regional economic impacts if there is only a decline in ranchland open space (incorporating the positive relationship between ranchland open space and water quality), while Scenario OSWQ considers the option where a decline in ranchland open space also leads to a decrease in water quality (incorporating a negative relationship between ranchland open space and water quality). These scenarios will specifically address the local economic impact due to the change in behavior of tourists to the area. Based on the CBM information obtained from the tourist survey, we can estimate the resulting shocks to the local economy based on change in visitation due to changes in land use and water quality. It should be emphasized here that these are estimates of regional economic impacts, i.e., the ripple effects of the change in visitation throughout the regional economy and not estimates of the value of open space and water quality to visitors to Chaffee County.

[18] We will not consider the situation with only a decrease in water quality here since we are only estimating the impact of potential land use changes on water quality.

The first step in the analysis involves the estimation of the costs of the three tax options discussed for the resident and tourist populations. The costs of the sales tax can be estimated by determining the total tax increase by multiplying a certain percentage increase in tax by the total amount of sales revenue in the appropriate economic categories in IMPLAN. The lodging tax revenue is determined in a similar way, by multiplying the percentage increase in tax by the total revenue in the hotel and motel sector. The third tax, a mill levy, is a type of property tax for which one dollar tax is assessed for each one thousand dollars of assessed property value. To estimate the tax revenue for a one mill increase, the total assessed value of residential land would be divided by 1000. These costs can then be compared to the willingness to pay of the different groups from the survey data collected to determine if the total WTP is large enough to justify each of the three policy options.

In addition, the local economic impact of the three tax policies is estimated by imposing a shock in the appropriate sector in IMPLAN to represent the tax. This is implemented through a shock in the hotel and motel sector for the lodging tax, a shock in owner-occupied dwellings for the mill levy, and a shock in appropriate retail sectors for the sales tax. In addition to the tax shock, an injection into the agriculture sector is employed to simulate the impact of payments to farmers for maintaining their land in agriculture. Each scenario simulates the overall impacts of the tax and distribution of tax revenues to determine how the policies will impact different sectors of the economy.

For Scenarios OS and OSWQ, the resulting impact in the tourism sectors of the economy is estimated based on the expected percentage decrease in tourist visitation elicited from the CBM questions on the visitor survey. We will calculate the resulting percentage decrease in visitation for the two scenarios and apply these as shocks to the hotel/motel, recreation, food and drinking places and gasoline station sectors in IMPLAN. The IMPLAN analysis will show the resulting impacts throughout the regional economy as a result of the decreased tourism revenues.

RESULTS

In each of the policy scenarios considered in which a tax is implemented, the tax rate is based on a $500,000 shock in the regional economy. We normalized the policies implemented in each scenario in order to effectively compare the results across scenarios. The increase in tax revenue of $500,000 was chosen in order to maintain reasonable policy changes for each of the scenarios. In order to put this increase of tax revenue into perspective in terms of the amount of funding that would be required to preserve the agricultural open space in Chaffee County, we can first note that the value of agricultural land in the county has been assessed at $4.5 million (State of Colorado, Department of Local Affairs 2008). Recent survey results show that conservation easements in Colorado were generally valued at 51 percent of the total appraised land value, and landowners generally received compensation on 65 percent of the easement value (Hoag et al. 2002). If we apply these averages to the total value of agricultural land in Chaffee County, we can estimate that a $500,000 payment would be able to purchase conservation easements on approximately one-third of the agricultural land in the county.

The policy scenarios considered use I-O analysis to forecast the effects of each of the different policy scenarios. In order to project these impacts, multipliers are calculated based on output and employment data. Two types of multipliers that are frequently used in I-O analysis are Type I multipliers, which include direct and indirect effects and Type II multipliers, which include direct, indirect and induced effects. The multipliers are calculated as a ratio of total effects (direct and indirect for Type I, and direct, indirect and induced for Type II) to the direct change due to a change in final demand. These multipliers can be calculated for output, employment and income. In this analysis, we use Type II multipliers in order to account for the induced as well as direct and indirect effects due to the policy change. Higher multipliers indicate a larger effect of the direct impact on the local economy, for example, an output multiplier of 1.5 would indicate that $500,000 would be lost in indirect and induced sales for a direct impact of $1 million.

In Scenario ST, we consider an increase in sales tax revenue of $500,000, which is implemented through a 0.45 percent increase in the sales tax in Chaffee County. This policy would extract willingness to pay from both residents and tourists, with the funding being used for conservation easement payments to agricultural land owners. This would help the ranchers by providing additional funding that would allow them to maintain their ranches. Currently, the sales tax in Chaffee County is 6.9 percent. This is made up of a county-wide tax of 2.0 percent, a city tax (implemented in Buena Vista, Salida and Poncha Springs) of 2.0 percent, and a statewide tax of 2.9 percent implemented by the state of Colorado (State of Colorado, Department of Revenue 2008).

Using IMPLAN data from 2004, Table 4.1 shows the total output for several relevant retail industries from which the additional sales tax would be collected and the estimated revenue from the additional sales tax for each industry. Since a large number of specific retail industries are included in the IMPLAN data, we considered those that have the highest level of total output and that seem most relevant to the tourist and resident populations. Table 4.1 shows the additional sales tax revenues that would be obtained from the 0.45 percent sales tax increase, which would total around $500,000. Over half of this increase in revenues would come from food service and drinking places and other amusement and recreation industries. Although it is not possible to tell from these data what percentage of revenues from each industry come from tourists or residents, one would expect that a large portion of revenues from the two largest industries may come from visitors to Chaffee County.

Table 4.1. Chaffee County Industry Output and Additional Sales Tax Estimation

NAICS Code	Industry	Total Output (2004)	Estimated Additional Sales Tax Revenue
481	Food services and drinking places	$ 38,500,000	$ 173,580
478	Other amusement- gambling- and recreation industries	$ 24,400,000	$ 110,009
410	General merchandise stores	$ 13,300,000	$ 59,964
407	Gasoline stations	$ 10,200,000	$ 45,987
405	Food and beverage stores	$ 10,100,000	$ 45,537
404	Building material and garden supply stores	$ 8,200,000	$ 36,970
479	Hotels and motels- including casino hotels	$ 6,200,000	$ 27,953
Additional Sales Tax Revenue			$ 500,000

To see the regional impacts of the increase in sales tax and the injection of the sales tax revenues into the cattle and ranching sector through payments to ranchers, IMPLAN is used to analyze the impact of the shocks to all sectors simultaneously. In this case, we assume that demand in each of the industries will decrease due to the increase in sales tax. We show estimates of the effect on employment and income in Chaffee County since these measures give a better idea of the how the local residents will be affected than output effects. Table 4.2 shows the top ten affected sectors in terms of employment for

Scenario ST. The direct effects show a large positive impact on the cattle ranching and farming due to the injection of sales tax revenue in that sector. Other negative direct effects occur in several retail industries, with the largest effects occurring in food and drinking places, recreation industries, and general merchandise stores. Indirect effects occur primarily in the cattle ranching and farming sector, with a gain of 2.1 jobs. Other positive effects occur in the all other crop farming and agriculture and forestry support activities sectors. Negative indirect effects occur in the food and drinking places industry. Induced effects have a negative impact in some retail industries including food and drinking places, general merchandise stores and food and beverage stores. The direct, indirect, and induced effects result in a net gain of 1.3 jobs in Chaffee County due to a 0.45 percent increase in county sales tax.

Table 4.2. Employment Impacts for Scenario ST (in Number of Jobs)

NAICS Code	Industry	Direct	Indirect	Induced	Total
11	Cattle ranching and farming	8.7	2.1	0	10.8
481	Food services and drinking places	-4.3	-0.1	-0.1	-4.5
478	Other amusement- gambling- and recreation industries	-2.3	0	0	-2.3
410	General merchandise stores	-1.1	0	0	-1.2
10	All other crop farming	0	0.8	0	0.8
405	Food and beverage stores	-0.7	0	0	-0.7
479	Hotels and motels- including casino hotels	-0.6	0	0	-0.7
407	Gasoline stations	-0.6	0	0	-0.6
404	Building material and garden supply stores	-0.4	0	0	-0.5
18	Agriculture and forestry support activities	0	0.4	0	0.4
Net Employment Impacts		-1.3	3.4	-0.8	1.3

The income impacts from Scenario ST for the 10 most affected industries are shown in Table 4.3. Direct effects are primarily negative. Negative effects occur in the food services and drinking places, other amusement and recreation, general merchandise, food and beverage, gasoline stations, building materials and garden supply, and hotel and motel sectors, while positive direct effects occur in the cattle ranching sector. Net indirect effects are positive, with an increase in output of $33,693 across all industries. Positive indirect effects occur in the cattle ranching and farming, all other crop farming, and agriculture and forestry support activities. Negative indirect effects are felt in several retail sectors including food and drinking places, general merchandise stores, food and beverage stores, gas stations, building and garden stores and hotels and motels. Induced effects related to Scenario ST are primarily negative, with the largest effects being felt in the food and drinking places, food and beverage stores, general merchandise stores, building and garden stores, and recreation industries. Overall, Scenario ST results in a small negative net income impact of $135,605.

From the results in Table 4.3, it is clear that the indirect and induced effects are much larger for the agricultural sectors than for the retail sectors affected in Scenario ST. The all other crop farming sector has an indirect effect of $19,365, agriculture and forestry support activities has an indirect effect of $7,500, and cattle ranching and farming has an indirect effect of $5,265 compared to negative indirect effects in the hundreds or less for the retail sectors. These results are reflected in the labor income multipliers. The multiplier for the cattle ranching sector is quite high at 4.55, compared to 1.32 to 1.39 for the retail sectors included in the analysis. A labor multiplier of 4.55 indicates that if the tax results in a direct increase in income of one dollar in the cattle ranching sector, 3.55 dollars of induced and indirect income would be generated. The subsequent decrease in the retail sectors, however, would only result in a decrease in income of $0.32 to $0.39 per dollar of decreased income in the retail sector.

Table 4.3. Income Impacts for Scenario ST (in Dollars)

NAICS Code	Industry	Direct	Indirect	Induced	Total
481	Food services and drinking places	-51,257	-710	-1,580	-53,546
478	Other amusement- gambling- and recreation industries	-37,555	0	-346	-37,901
11	Cattle ranching and farming	21,800	5,265	-1	27,065
410	General merchandise stores	-24,549	-269	-632	-25,450
405	Food and beverage stores	-20,170	-243	-799	-21,212
10	All other crop farming	0	19,365	-3	19,361
407	Gasoline stations	-14,326	-92	-231	-14,649
404	Building material and garden supply stores	-13,977	-166	-429	-14,573
479	Hotels and motels- including casino hotels	-9,891	-83	-231	-10,205
18	Agriculture and forestry support activities	0	7,500	-9	7,491
Net Income Impacts		**-149,924**	**33,693**	**-19,374**	**-135,605**

Scenario ML estimates the impact of the addition of a 2.13 mill levy in Chaffee County. This would result in additional revenues of $500,000 that would go from property owners to ranchers in the county to pay for conservation easements or other incentive based policies to encourage the existing extensive rural lands management regime. The total taxable assessed value of land in Chaffee County for the year 2007 was $328,870,480 (State of Colorado, Department of Local Affairs 2008). Table 4.4 shows the value of the taxable assessed value for different classes of land in Chaffee County in the year 2007. In this scenario, we will consider an increase in taxes for residential, commercial and industrial land classes[19]. A 2.13 mill levy increase would result in the collection of an additional $319,838 in tax revenue from the residential sector, $165,274 from the commercial sector, and $14,887 from the industrial sector. In IMPLAN, these shocks are applied to the following sectors: owner-occupied dwellings (NAICS 509), commercial and institutional buildings (NAICS 38), and manufacturing and industrial buildings (NAICS 37). This scenario applies these increases in tax as a negative shock to the above-mentioned sectors and an injection into the cattle farming and ranching sector.

Table 4.4. Chaffee County Total Taxable Assessed Value for 2007, by Land Class

Class	Value	Percentage of Total
Residential	$ 150,415,080	46%
Commercial	$ 77,725,990	24%
Industrial	$ 7,001,350	2%
Vacant	$ 71,212,050	22%
Agricultural	$ 4,506,480	1%
Natural Resources	$ 3,959,630	1%
Prod. Mines	$ 0	0%
Oil and Gas	$ 0	0%
State Assessed	$ 14,049,900	4%
Total	**$ 328,870,480**	**100%**

Source: State of Colorado, Department of Local Affairs (2008).

Table 4.5 shows the results for Scenario ML in terms of employment impacts. Direct effects primarily occur in the cattle ranching and farming sector, with an increase of 8.7 jobs. Small negative direct effects occur in the commercial and institutional and manufacturing and industrial building sectors. Very small positive indirect effects occur in several different sectors, for a net gain of 3.7 jobs. The induced effects resulted in

[19] Although the Vacant land class is makes up a relatively large portion of the total assessed value, we do not consider it in this case since it is unlikely to have large regional economic impacts.

essentially no change in employment. Overall, Scenario ML results in an increase of 10.1 jobs in Chaffee County. Most of this increase comes from the cattle ranching and farming sector, with a few slight gains in other agriculture related sectors.

Table 4.5. Employment Impacts for Scenario ML (in Number of Jobs)

NAICS Code	Industry	Direct	Indirect	Induced	Total
11	Cattle ranching and farming	8.7	2.1	0	10.8
38	Commercial and institutional buildings	-2	0	0	-2
10	All other crop farming	0	0.8	0	0.8
18	Agriculture and forestry support activities	0	0.4	0	0.4
449	Veterinary services	0	0.3	0	0.3
37	Manufacturing and industrial buildings	-0.2	0	0	-0.2
431	Real estate	0	0.2	0	0.2
390	Wholesale trade	0	0.1	0	0.1
439	Architectural and engineering services	0	-0.1	0	-0.1
Net Employment Impacts		**6.5**	**3.7**	**-0.2**	**10.1**

In terms of income impacts, net direct effects are negative, with negative effects occurring in the commercial and industrial building sectors and positive effects occurring in the cattle ranching sector. Indirect effects have a positive impact overall, with an increase of $43,764 (Table 4.6). The largest positive indirect effects occur primarily in the cattle ranching, all other crop farming sectors, agriculture and forestry support services and veterinary services sectors. Induced effects result in a small negative income effect of $4,064. Overall, Scenario ML results in a small negative net income effect of $28,443.

Table 4.6. Income Impacts for Scenario ML (in Dollars)

NAICS Code	Industry	Direct	Indirect	Induced	Total
38	Commercial and institutional buildings	-81,412	0	0	-81,412
11	Cattle ranching and farming	21,800	5,265	0	27,065
10	All other crop farming	0	19,348	-1	19,347
37	Manufacturing and industrial buildings	-8,532	0	0	-8,532
18	Agriculture and forestry support activities	0	7,507	-2	7,505
449	Veterinary services	0	4,917	-12	4,905
431	Real estate	0	4,144	-178	3,967
390	Wholesale trade	0	3,270	-204	3,066
439	Architectural and engineering services	0	-2,884	-18	-2,902
19	Oil and gas extraction	0	1,891	-56	1,835
Net Income Impacts		**-68,143**	**43,764**	**-4,064**	**-28,443**

Compared to Scenario ST, the income effects for Scenario ML are much smaller. As with the previous scenario, the indirect income effects for cattle ranching and agricultural sectors are much larger than those for the sectors that are negatively affected by the mill levy. Only the architectural and engineering services sector shows negative indirect effects. Induced effects in this scenario are quite small for all sectors. Again, the indirect effects are much larger for the cattle ranching sector than for the sectors that are negatively affected by the mill levy. The labor income multiplier is 1.23 for manufacturing and industrial buildings, 1.31 for commercial and institutional buildings and 0 for owner-occupied dwellings since an increase in output in that sector would not affect income. These multipliers indicate that a one dollar decrease in income in the building sectors would result in a loss of only $0.23 to $0.31 in indirect and induced income effects.

Scenario LT considers the effect of an increase in the lodging tax in Chaffee County. Chaffee County currently has a lodging tax of 1.9 percent. We consider an increase in the lodging tax of 8.1 percent, for a total lodging tax of 10 percent. It should be noted that a lodging tax this high would likely be infeasible since there is a two percent limit on lodging taxes in Colorado for units of government that do not have home rule designation (Seidl, Sullins and Cline 2006). Most counties in Colorado that institute a lodging tax have a tax of 1.9 or 2 percent, while some municipalities charge an additional lodging tax above the county tax (Seidl, Sullins and Cline 2006). Thus, the 10 percent lodging tax considered here is just for illustrative purposes to make each of the scenarios comparable.

The current level of output in the hotel and motel industry is $6,182,000, so an 8.1 percent increase in the lodging tax would lead to an additional $500,000 in lodging tax revenue, in order to make this scenario comparable to Scenarios ST and ML. In IMPLAN, this scenario is implemented through a negative shock in the hotel and motel sector, and a positive shock in the cattle farming and ranching sector due to the payments to that sector in the form of conservation easements. In this case we assume that tourists will decrease their spending on lodging due to the tax increase. Alternatively, one could assume that an increase in lodging tax might cause visitors to decrease their other expenditures on the trip and their lodging expenditures would remain the same.

Table 4.7 shows the employment impacts for the most affected sectors in Scenario LT. The direct effects result in a decrease of 11.6 jobs in the hotel and motel sector and an increase of 8.7 jobs in the cattle ranching and farming sector. Indirect effects occur primarily in the cattle ranching and farming, all other crop farming and agriculture and forestry support activities sectors. Overall, an eight percent increase in the lodging tax would result in essentially no net change in the number of jobs in Chaffee County.

Table 4.7. Employment Impacts for Scenario LT (in Number of Jobs)

NAICS Code	Industry	Direct	Indirect	Induced	Total
479	Hotels and motels- including casino hotels	-11.6	0	0	-11.6
11	Cattle ranching and farming	8.7	2.1	0	10.8
10	All other crop farming	0	0.8	0	0.8
18	Agriculture and forestry support activities	0	0.4	0	0.4
449	Veterinary services	0	0.3	0	0.3
481	Food services and drinking places	0	0	-0.1	-0.2
390	Wholesale trade	0	0.1	0	0.1
413	Newspaper publishers	0	0	0	-0.1
431	Real estate	0	0.1	0	0.1
456	Travel arrangement and reservation services	0	-0.1	0	-0.1
Net Employment Impacts		**-2.9**	**3.4**	**-0.8**	**-0.3**

The income effects for Scenario LT are shown in Table 4.8. The direct income effects result in an overall decrease of $155,129, which comes from a decrease in the hotel and motel sector and a small increase in the cattle ranching sector. Indirect effects have an overall positive net impact of $31,098. The positive indirect effects come primarily from the all other crop farming, agriculture and forestry support services, and cattle ranching and farming sectors. Negative indirect effects occur in the travel arrangement and reservation and food and drinking places sectors, with a small additional decrease in the hotel and motel industry. Induced effects have an overall negative impact of $20,674. These come primarily from physician and dentist offices, food services and drinking places, and wholesale trade sectors. Overall, the net economic impacts of an eight percent increase in the lodging tax would result in a negative income effect of $144,706.

Table 4.8. Income Impacts for Scenario LT (in Dollars)

NAICS Code	Industry	Direct	Indirect	Induced	Total
479	Hotels and motels- including casino hotels	-176,930	-63	-246	-177,239
11	Cattle ranching and farming	21,800	5,265	-1	27,065
10	All other crop farming	0	19,384	-4	19,381
18	Agriculture and forestry support activities	0	7,508	-10	7,498
449	Veterinary services	0	4,917	-59	4,859
456	Travel arrangement and reservation services	0	-2,874	-24	-2,898
465	Offices of physicians- dentists- and other health	0	0	-2,707	-2,707
431	Real estate	0	3,577	-904	2,673
390	Wholesale trade	0	3,413	-1,037	2,376
481	Food services and drinking places	0	-549	-1,686	-2,235
Net Income Impacts		**-155,129**	**31,098**	**-20,674**	**-144,706**

The overall income effects of Scenario LT are slightly larger than Scenario ST and much larger than Scenario ML. As with the previous two scenarios, the indirect effects are much larger in the agricultural sectors than in the travel related sectors, although the travel arrangements and reservation services does have a negative indirect income effect of $2,874. Induced effects in this scenario are larger in the physician and dentist offices, food services and drinking places and wholesale trade sectors. The labor income multiplier for the hotel and motel sector is 1.38, indicating that a decrease of one dollar in income in this sector would lead to a loss of $0.38 in indirect and induced income effects. This is significantly less than the labor income multiplier for the cattle ranching sector, thus the indirect and induced effects for sectors related to the cattle ranching sector are much larger, as was the case in the previous two scenarios.

No IMPLAN analysis is conducted for Scenario AZ. Since this scenario only includes agricultural zoning, there are no direct effects (such as the collection and redistribution of additional taxes) that occur in any sector that can be implemented through IMPLAN. Costs or benefits in this case are in terms of opportunity cost to land owners due to restricted land development opportunity. It is possible that agricultural zoning might result in additional effects on the regional economy, but these effects would be difficult to quantify and implement in an I-O modeling framework.

Scenarios OS and OSWQ incorporate information from the survey of visitors to Chaffee County to estimate the regional economic impacts of changing visitation due to decreasing quality of local natural resources. These scenarios only estimate the impact of the change in visitation and do not consider other economic impacts that could occur in the agricultural and related sectors due to taking land out of ranching. In addition, we are only considering the regional economic impacts due to the decrease in visitation and do not consider the decrease in visitor's consumer surplus that would also occur.

Scenario OS considers the economic impact of a decline in the amount of ranchland open space in terms of changing tourism revenues. In this case, we use expenditure and contingent behavior data collected from the visitor survey in order to estimate these impacts. Table 4.9 shows the average expenditures made by tourists while visiting Chaffee County. Tourists spent an average of $796 per group per trip, $386 per person per trip and $111 per person per trip day. Per trip expenditures (both group and individual) were largest for lodging, followed by food and drink and travel expenses.

Table 4.9. Tourist Expenditures in Chaffee County

Expenditure Category	Per Group Per Trip *(Mean Value)*	Per Person Per Trip *(Mean Value)*	Per Person Per Trip Day *(Mean Value)*
Travel expenses	$165.64	$79.99	$30.15
Lodging	$182.68	$86.27	$19.13
Food and Drink	$163.67	$83.58	$28.39
Outdoor recreation fees	$63.35	$25.68	$7.92
Other retail purchases/gifts	$131.72	$64.72	$17.03
Other	$88.64	$45.74	$8.00
Total (of mean values)	$795.70	$385.98	$110.62

Using the information on reported changes in visitation from the survey and estimates of total summer visitation, we can project the approximate aggregate economic impact for the county due to changing visitation. Although direct published estimates of total summer visitation in Chaffee County are not available, we can arrive at an estimate of the total number of summer visitors based on the total amount of travel spending in Chaffee County. A recent report of the economic impact of tourism in Colorado reports that travel spending in Chaffee County in 2005 totaled $45.1 million (Dean Runyon Associates 2006). Dividing this number by our average estimated expenditures per person per trip of $385.95, we can estimate the total annual visitation in Chaffee County of 116,855 individuals. Based on previous research that indicates 86 percent of Chaffee County tourists visit during the summer months (Leisure Trends Group 2006), we can estimate summer visitation of 100,495.

In order to project the regional economic impacts of the decrease in visitation associated with a decrease in open space, we first need to estimate the expected direct economic impacts that would occur due to the change in visitation. Following Loomis and Caughlan (2004), we calculate the impacts by type of visitor including 1) visitors who came to Chaffee County as their sole destination or as the primary purpose of their visit (primary trip purpose), 2) visitors for which visiting Chaffee County was one of many equally important reasons for their trip (equal trip purpose), and 3) those visitors for which the stop in Chaffee County was an incidental or spur of the moment trip (incidental trip purpose). Based on the percentage of each type of visitor in our sample, we can calculate the change in visitation for each type of visitor for each level of change in ranchland open space. We then use the average number of days spent in Chaffee County for each type of visitor and the percentage change in visitation for each level of change in ranchland open space to estimate the change in number of days spent in the county[20]. With only changes in the amount of ranchland open space, 16 percent of respondents stated that they would visit less often with a 25 percent decrease in ranchlands, 17 percent would come less often with a 50 percent decrease, and 28 percent would come less often with a 75 percent decrease. We use average expenditures per person per day for each visitor type along with the change in number of days to obtain the average change in expenditures for each visitor type. Multiplying the change in expenditure values by the change in number of visitors, we are able to obtain an estimate of the aggregate economic impact from the decrease in visitation (Table 4.10). The direct economic impact is a loss of $6.2 million for a 25 percent decrease in the amount of ranchland open space, around $6 million for a 50 percent decrease, and $11 million for a 75 percent decrease, for an average decrease of $7.7 million.

[20] We apply the entire average number of days for equal importance and incidental visitors since all visitors were asked about the number of days spent *in Chaffee County*.

Table 4.10. Direct Economic Impact from Change in Visitation

	Primary trip purpose (75% of total visitors)	Equal trip purpose (17% of total visitors)	Incidental trip purpose (8% of total visitors)	**Total Direct Effect**
25% Decrease				
Average decrease in visitation (days)	5.37	4.49	1.23	
Economic Impact	-$4,641,443	-$1,382,825	-$212,808	**-$6,237,076**
50% Decrease				
Average decrease in visitation (days)	4.83	4.04	1.10	
Economic Impact	-$4,435,972	-$1,321,609	-$203,387	**-$5,960,968**
75% Decrease				
Average decrease in visitation (days)	5.48	4.58	1.25	
Economic Impact	-$8,289,594	-$2,469,719	-$380,073	**-$11,139,386**
Average				
Average decrease in visitation (days)	5.29	4.43	1.21	
Economic Impact	-$5,720,420	-$1,704,285	-$262,278	**-$7,686,982**

In order to implement these impacts in IMPLAN, the aggregate effects are divided among different industries using the percentage of each expenditure category from the survey data. These industry-specific impacts are then applied to the appropriate industry in IMPLAN. Travel expenses are applied to NAICS code 407 – Gasoline stations, lodging expenses are applied to NAICS code 479 – Hotels and motels, food and drink expenses are applied to NAICS code 481 – Food services and drinking places, outdoor recreation fees are applied to NAICS code 478 – Other amusement and recreation industries, and other retail purchases and other are applied to NAICS code 410 – General merchandise stores. The specific impacts applied to each NAICS category are shown in Table 4.11.

Table 4.11. Impacts Applied to Each NAICS Category, Scenario OS

Impacts for IMPLAN Model			*Decrease in Ranchland Open Space*			
	NAICS Code	**Industry**	**25%**	**50%**	**75%**	**Average**
				(million dollars)		
Travel expenses	407	Gasoline stations	-$1.7	-$1.62	-$3.04	-$2.1
Lodging	479	Hotels and motels-including casino hotels	-$1.08	-$1.03	-$1.93	-$1.33
Food and Drink	481	Food services and drinking places	-$1.6	-$1.53	-$2.86	-$1.97
Outdoor recreation fees	478	Other amusement-gambling- and recreation industries	-$0.45	-$0.43	-$0.8	-$0.55
Other Combined	410	General merchandise stores	-$1.41	-$1.35	-$2.52	-$1.74

Table 4.12. Employment Impacts for Scenario OS (in Number of Jobs)

Level of Change	Direct	Indirect	Induced	Total
25% Decrease	-121.5	-12.6	-16.5	-150.6
50% Decrease	-116.1	-12.1	-15.7	-143.9
75% Decrease	-217.1	-22.5	-29.4	-269.0
Average	-149.8	-15.6	-20.3	-185.6

Table 4.12 shows the net employment impacts for each level of decrease in the amount of ranchland open space and an average across all three levels. On average, direct effects lead to a loss of 149.8 jobs, with indirect effects leading to a loss of another 15.6 jobs and induced effects leading to a loss of 20.3 jobs, for a total impact of 185.6 jobs lost. The top 5 industries affected in terms of jobs lost are food services and drinking places, general merchandise stores, hotels and motels, gasoline stations, and recreation industries.

Table 4.13 shows the income impacts for Scenario OS for each level of decrease in ranchland open space and an average across all three levels. On average, a decrease in ranchland open space would lead to a total decrease in income of around $3.58 million. Most of this total is made up of direct effects at $2.61 million, with indirect effects resulting in a loss of $0.46 million and induced effects resulting in a loss of $0.51 million. These income impacts are felt most strongly in the general merchandise stores sector, followed by gasoline stations, food services and drinking places, hotels and motels and recreation sectors.

Table 4.13. Income Impacts for Scenario OS (in Million Dollars)

Level of Change	Direct	Indirect	Induced	Total
25% Decrease	-2.11	-0.37	-0.41	-2.90
50% Decrease	-2.02	-0.36	-0.40	-2.77
75% Decrease	-3.78	-0.67	-0.74	-5.18
Average	-2.61	-0.46	-0.51	-3.58

Scenario OSWQ is implemented in a similar way to Scenario OS but introduces changes in water quality as well as changes in ranchland open space. This would occur in the situation where a conversion of ranchlands to more developed urban uses results in a decrease in water quality as well. This scenario introduces the same variation in the level of ranchland open space that were considered in Scenario OS (decreases of 25, 50 and 75 percent) and also includes two levels of variation in water quality (a decrease from swimmable quality to either fishable or boatable). We use the percentage of visitors that report a change in their behavior (Table 4.14) to calculate the economic impact for each level of change in open space and water quality by type of visitor as discussed for Scenario OS. The total economic impact as applied to each NAICS sector is shown in Table 4.15. On average, the largest effects occur in the gasoline, food and drinking places, and general merchandise stores sectors.

Table 4.14. Change in Visitation, Scenario OSWQ

Decrease in Ranchland Open Space	Change in Water Quality	Percentage of respondents that would visit less often
25%	Fishable	58.8
25%	Boatable	45.6
50%	Fishable	47.2
50%	Boatable	50.9
75%	Fishable	50.0
75%	Boatable	66.7

Table 4.15. Impacts Applied to Each NAICS Category, Scenario OSWQ (in Millions)

NAICS Code	Industry	25% F	25% B	50% F	50% B	75% F	75% B	Average
407	Gasoline stations	- $6.20	- $5.17	- $5.20	- $5.87	- $5.89	- $8.17	- $6.05
479	Hotels and motels- including casino hotels	- $3.94	- $3.28	- $3.30	- $3.73	- $3.74	- $5.19	- $3.84
481	Food services and drinking places	- $5.84	- $4.87	- $4.89	- $5.53	- $5.55	- $7.69	- $5.70
478	Other amusement- gambling- & recreation industries	- $1.63	- $1.36	- $1.36	- $1.54	- $1.55	- $2.15	- $1.59
410	General merchandise stores	- $5.15	- $4.29	- $4.31	- $4.87	- $4.89	- $6.78	- $5.02

The employment impacts estimated for Scenario OSWQ are shown in Table 4.16. Overall, looking at the average employment impact for a decrease in ranchland open space and water quality, we see a loss of approximately 536 jobs. The majority of this job loss comes from direct impacts, with a loss of 433 jobs, followed by a loss of 59 jobs from induced impacts and a loss of 45 jobs from indirect impacts. Across the levels of change for open space and water quality, greater decreases in the number of jobs lost occur for larger decreases in open space and water quality. The only deviation from this pattern comes from the 25 percent decrease/Fishable combination, which showed a larger than expected percentage of individuals that stated they would change their behavior.

Table 4.16. Employment Impacts for Scenario OSWQ (in Number of Jobs)

Level of Change *Open Space/Water Quality*	**Direct**	**Indirect**	**Induced**	**Total**
25% / Fishable	-443.5	-46.1	-60.1	-549.7
25% / Boatable	-369.8	-38.4	-50.1	-458.3
50% / Fishable	-371.4	-38.6	-50.3	-460.3
50% / Boatable	-419.8	-43.6	-56.8	-520.2
75% / Fishable	-421.1	-43.7	-57	-521.9
75% / Boatable	-584.2	-60.7	-79.1	-724
Average	**-432.6**	**-44.9**	**-58.6**	**-536.1**

Table 4.17. Income Impacts for Scenario OSWQ (in Million Dollars)

Level of Change	**Direct**	**Indirect**	**Induced**	**Total**
25% Fishable	-7.72	-1.36	-1.51	-10.59
25% Boatable	-6.43	-1.14	-1.26	-8.83
50% Fishable	-6.46	-1.14	-1.27	-8.87
50% Boatable	-7.30	-1.29	-1.43	-10.02
75% Fishable	-7.33	-1.29	-1.44	-10.06
75% Boatable	-10.16	-1.79	-1.99	-13.95
Average	**-7.53**	**-1.33**	**-1.48**	**-10.33**

In terms of income impacts, Scenario OSWQ shows an average total loss in income of approximately $10.33 million (Table 4.17). This impact is around $6.75 million larger than Scenario OS, which included decreases in ranchland open space only. Scenario OSWQ shows an average loss of $7.53 million in direct impacts, $1.33 million in induced impacts, and $1.48 million in indirect impacts. In general, a larger decrease in ranchland open space and water quality leads to larger income effects. Again, the only deviation from the expected pattern is the case of the 25 percent/Fishable combination, which led to an unexpectedly high impact.

DISCUSSION

We can use these results to show the net effect of implementing a policy to protect ranchland open space. Table 4.18 shows the net effect of each of the three policy scenarios and the losses offset[21] from each of the no policy scenarios (the amount that would have been lost in terms of visitation if agricultural land had been developed)[22]. This gives us an idea of the total effect of each of the policies both in terms of the effect of the policy and the effect of maintaining open space. The net effect of each scenario is very similar across all three policy scenarios. Scenario ML has a slightly larger effect both in terms of jobs and income when considering the losses that would be offset for ranchland open space alone and ranchland open space and water quality. However, considering the small differences in employment and income effects across the three scenarios, it may also be important to consider the distributional implications of each scenario and the feasibility of implementing each scenario.

Table 4.18. Net Effect of Taxes and Offsetting Losses

	Scenario ST		**Scenario ML**		**Scenario LT**	
	OS	OSWQ	OS	OSWQ	OS	OSWQ
Employment Effects (*jobs*)	186.9	537.4	195.7	546.2	185.3	535.8
Income Effects (*million $*)	3.44	10.19	3.55	10.30	3.43	10.19

[21] Using the average values for Scenario OS and Scenario OSWQ.
[22] Although the agricultural zoning (AZ) scenario could be assumed to have 100 percent of the offsetting losses, we do not include the scenario here since we did not conduct a detailed analysis of the regional impacts of that scenario.

One important aspect of this analysis beyond the quantification of the regional economic impacts is the consideration of who gains and loses in each scenario, where there is additional willingness to pay that is not currently being captured in the market, and the political acceptability of the different policy alternatives. Under Scenario ST, an increase in sales tax, the additional tax burden would fall on both residents and tourists. Both groups would have to pay sales tax on items purchased in the county, although since residents would be expected to make more purchases in the county, their tax incidence would be expected to be higher. The additional tax in Scenario ML would be paid by landowners in Chaffee County. This distribution of costs under this policy is uneven compared to Scenario ST since only residents would be paying the additional tax. The increase in lodging tax under Scenario LT would be borne solely by visitors to Chaffee County. Both residents and tourists would be expected to gain under all three of the policy scenarios compared to the no action scenarios due to the maintenance of current open space and water quality. Scenario ST distributes the costs most evenly of the three scenarios considered since both groups (residents and tourists) share the incidence of the tax, compared to Scenarios ML and LT in which the tax burden falls on one group only.

Both visitors and residents exhibit a willingness to pay for the maintenance of ranchland open space and water quality above their current expenditures. The survey of visitors to Chaffee County indicated that tourists are willing to pay an average of $56 per person per trip to avoid a decline in ranchland open space and $59 to avoid a decrease in water quality. A similar survey of residents of Chaffee County indicates an annual average willingness to pay of $153 for ranchland open space and $114 for water quality (Cline and Seidl 2008). Aggregating these values over the relevant populations would result in an aggregate annual WTP for ranchland open space of $5.6 million for visitors and $1.6 million for residents. The aggregate WTP for water quality is $14.4 million for visitors and $1.2 million for residents annually. These figures indicate that significant potential exists for providing funding to maintain ranchland open space and water quality from both stakeholder groups.

One final aspect to be considered with regard the policies discussed here is the acceptability of the alternatives to the different stakeholder populations. Several questions were asked on both the resident and tourist surveys to obtain information about respondent attitudes about property ownership. As shown in Table 4.19, both residents and tourists appear to recognize the public benefits that may exist due to private land management. Most individuals felt that there should be some restrictions on what can be done with private land and that neighbors should consider each other's property values in their land management decisions. This would seem to indicate that a significant portion of both residents and tourists may be willing to support measures that preserve the current privately-owned open space if they value the open space provided by ranchlands.

Residents were also specifically asked about their attitudes about the cost management of rural development (Table 4.20). When considering additional rural development, residents felt that developers and landowners should shoulder the costs instead of rural residents. The respondents also opposed paying for development with increased taxes. These results seem to indicate a lack of support by residents of additional development in the county, perhaps also indicating some support for the maintenance of lower intensity development in the county. However, the lack of support for additional taxes may also lead to concerns about taxes being used to preserve open space.

Table 4.19. Property Management Attitudes of Residents and Tourists

	I should be able to do anything I want to with my land		My neighbors should be able to do anything they want to with their land		My property values depend in part on my neighbor's property management		Neighbors need to consider each other's property values when managing their property	
	Residents	Tourists	Residents	Tourists	Residents	Tourists	Residents	Tourists
Strongly Agree	15.06	9.17	13.71	8.02	49.44	42.57	51.43	44.13
Agree	25.32	22.92	24.35	22.35	44.96	52.00	39.01	47.28
Neutral	10.74	17.48	10.32	15.76	3.2	2.57	6.21	5.44
Disagree	35.42	34.67	35.97	34.67	1.44	1.71	2.07	2.01
Strongly Disagree	12.82	14.9	14.84	18.34	0.48	0.57	0.96	0.57
Not Sure	0.64	0.86	0.81	0.86	0.48	0.57	0.32	0.57

Table 4.20. Resident Attitudes on Cost Management of Rural Residential Development

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Not Sure
Developers pay an impact fee to cover additional costs	72.76	20.19	3.85	0.48	1.60	1.12
Landowners pay a transaction fee to cover additional costs	21.48	33.28	21.64	13.77	6.23	3.61
Rural residents living further from town pay increased taxes/fees to cover county costs	9.30	19.41	20.88	28.87	17.78	3.75
Increased sales taxes	5.37	17.24	18.86	31.22	24.55	2.76
Increased property taxes	2.94	13.70	19.58	29.20	31.97	2.61

CONCLUSIONS

This paper used input-output analysis and non-market valuation research to complete a more comprehensive analysis of regional economic impacts of different policy options for dealing with changes in natural resources than had been used in previous research. In addition, the inclusion of both ranchland open space and water quality allows us to provide further insights for rural communities where land and water resources are both important for the local economy and quality of life of residents. We considered four different policy options to maintain the current level of ranchland open space, and two options that consider the situation if no policy to maintain ranchland open space was implemented. The policy options considered for maintaining the current level of ranchland open space all estimate the regional economic impacts of an increase in tax revenues of $500,000. The policy options for maintaining the current amount of ranchlands are expected to have little overall effect on the regional economy, with slight negative income effects and very small positive or no employment effects. The largest positive regional impact in terms of employment and income effects comes from Scenario ML, the mill levy. Scenario ML is expected to result in an increase of 10.1 jobs and a loss of only $28,443 in income. Scenario ST would result in an increase of 1 job and a loss of $135,605 in income, while Scenario LT has no change in employment and a decrease of $144,706 in income.

If no policy to maintain ranchland open space is implemented, however, the negative regional economic impacts are expected to be much larger. If there is no relationship (or a positive relationship) between the area of ranchland open space and water quality in the Arkansas River, the local economic impact is estimated to be a loss of 185.6 jobs and a decrease in income of $3.6 million compared to the current situation in the county. If the conversion of ranchland to urban uses results in decreasing water quality, the effects are expected to be even larger. With a decrease in both ranchland open space and water quality, the regional economy is expected to lose 536.1 jobs and $10.3 million in income. It should be noted that these impacts are regional economic impacts based on changing visitation due to decreased natural resource quality. These values are independent of estimates of the value of the open space and water quality resources to local residents and tourists to Chaffee County. As noted in the previous section, both residents and visitors exhibit a positive willingness to pay for the protection of these natural resources. Using simple aggregation of the average WTP values from our resident and visitor surveys, we found an aggregate annual WTP for ranchland open space of $5.6 million for visitors and $1.6 million for residents and an annual WTP for water quality of $14.4 million for visitors and $1.2 million for residents annually.

Overall, the results of this analysis indicate that losses to the regional economy from the conversion of ranchlands could potentially be much larger than the effects of implementing a policy to maintain these areas. Although the collection of the various forms of taxes in Scenarios ST, ML and LT would have a negative impact on the resident (Scenarios ST and ML) and tourist (Scenarios ML and LT) populations, the overall impacts on the regional economy are expected to be positive. Before deciding which policy options are the most appropriate, policy makers would also need to consider the political feasibility of implementing each of the different types of policies mentioned here.

Although the residents of Chaffee County recognize that private lands can have public benefits, they also raised some concern about an increase in property and sales taxes, at least in terms of funding additional rural development. If this reluctance is due to the increase in taxes in general, some additional measures might be required to ensure the passing of a local referendum to raise funds through an increase in property or sales tax. An education campaign that provides the public information about the benefits of maintaining ranchlands and the potential impacts on water quality could help make an increase in taxes more palatable for residents.

One weakness of the current approach is the simplistic approach used to estimate the impact of different relationships between land use and water quality. An improvement that could be implemented in future research is to explicitly model the relationship between land uses and water quality and incorporate these into the non-market valuation study to obtain more specific estimates of changes in both resources simultaneously. Another potential limitation is that the on-site contact approach that was used in this study does not include individuals that are currently not visiting the county. It would be expected that if non-users were included in the sample, more individuals would be likely to prefer more urban environments than in the sample of current visitors only. This would likely result in a smaller net negative impact due to changing visitation than shown in our results above. Therefore, the estimates presented here should be viewed as an upper bound estimate of the potential negative impact of a shift from ranchland to more urban land uses.

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CHAPTER FIVE

Concluding Remarks

The loss of agricultural lands in the United States in recent years has caused significant concern in many rural areas. This concern has led to a number of studies related to the impact of this loss on rural residents. A smaller number of studies have addressed the impacts that this loss has had on tourists to rural areas. This work has addressed these effects on tourists and the associated impacts on Chaffee County, Colorado's regional economy.

In addition to the direct effects caused by the loss in agricultural productive values, communities can feel effects due to associated impacts from the non-market benefits of agriculture. While many studies have addressed the effects of loss of open space, this study begins to address the associated impacts related to potential changes in water quality as well. This work has shown that associated impacts from decreased water quality could make welfare losses significantly work for different stakeholder groups. Additional work should be undertaken to more fully understand these interactions and additional implications for other functions of agriculture.

This study has also attempted to deal with several empirical issues related to non-market valuation. First, we have addressed the issue of multi-day trips in travel cost and joint travel cost/contingent behavior models. While this issue has been ignored or avoided in many previous studies, our attempt to deal with this issue should be useful for future studies where the analysis of the broader tourism sector may be useful for policy purposes. The second paper employs an innovative joint revealed and stated preference model and employs an extension that can be useful with single site models with limited information about environmental quality. Finally, the third essay links the non-market valuation results to regional analysis, providing information that can be useful for policy purposes. Overall this dissertation has provided empirical extensions and policy lessons that will be useful for future research.

APPENDIX A – Survey Instrument

Your Visit to Chaffee County, Colorado
What Do You Think?

Colorado State University

Knowledge to Go Places

Dear Chaffee County Visitor and Survey Participant:

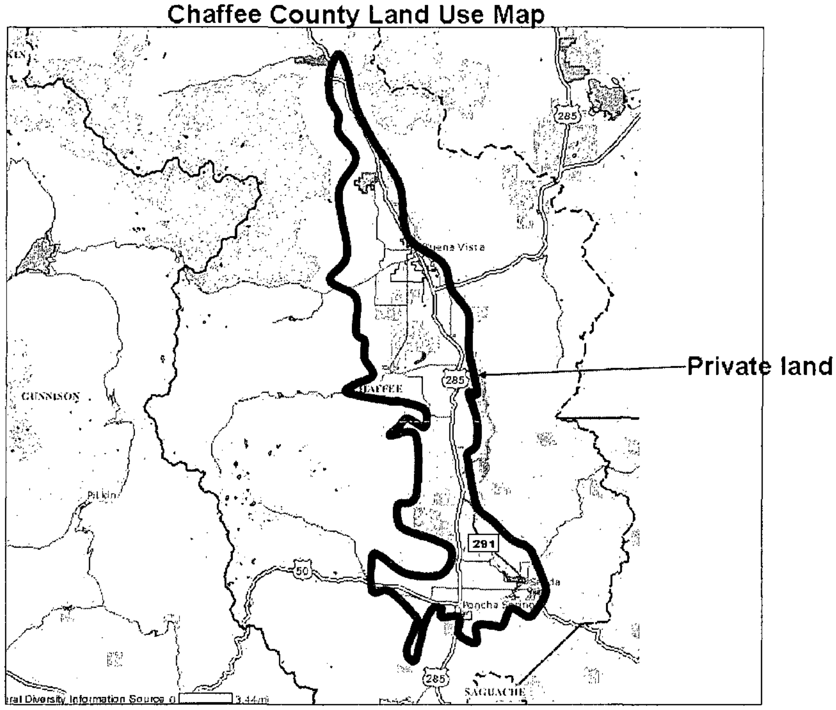
In collaboration with the Chaffee County Ranchlands Project, Colorado State University is conducting a survey of Chaffee County visitors to assist in future land use and natural resource planning and management efforts. Specifically, the purpose of this survey is to evaluate the contribution of local water quality and ranchlands to the quality of visitors' experiences in Chaffee County. We would deeply appreciate you taking 15 minutes to fill it out in its entirety. Incomplete responses are substantially less helpful to our analysis. Enclosed you will find the survey and a postage paid return envelope. Please complete the survey and drop it in the mail as soon as possible upon completion of this current trip to Chaffee County.

You will not be put on any mailing lists or be solicited in other ways due to your participation in this research effort. If you have any questions please feel free to call me, Andy Seidl, at 970-491-7071. All individual responses will be kept strictly confidential and a final report of the results will be made public in early-2008. If you would like a copy of the results please contact me at your convenience.

We would like to ensure you that your participation is voluntary, there are no known risks or direct personal benefits to your participation in this survey. It is not possible to identify all potential risks in research procedures, but we have taken reasonable safeguards to minimize any known and potential, but unknown, risks. The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury. Any questions about your rights as a volunteer may be directed to Janell Meldrem, Human Research Administrator, at 970-491-1655.

Sincerely,
Andy Seidl, Ph.D., Associate Professor and Extension Specialist—Public Policy, Department of Agricultural and Resource Economics, Colorado State University

Chaffee County Land Use Map



I. Please tell us about your trip

1. Please rate the importance of the following natural and human attributes in your decision to visit Chaffee County, Colorado during the year. (Please check one box for each item.)

Importance for your visit to Chaffee County, Colorado

	Very Important	Important	Neither important nor unimportant	Unimportant	Irrelevant (Very unimportant)
Rivers, lakes & wetlands	□	□	□	□	□
Green pastures/irrigated lands	□	□	□	□	□
Abundant wildlife	□	□	□	□	□
Viewing alpine tundra/flowers	□	□	□	□	□
Mountain views	□	□	□	□	□
Viewing forested landscapes	□	□	□	□	□
Open vistas	□	□	□	□	□
Pastoral landscapes (fields, cattle & horses)	□	□	□	□	□
Valley views	□	□	□	□	□
Wildlife viewing	□	□	□	□	□
Friendly people	□	□	□	□	□
Solitude or lack of crowds	□	□	□	□	□
Rural lifestyle	□	□	□	□	□
Working ranches & farms	□	□	□	□	□
Historic buildings	□	□	□	□	□
Art museums/activities	□	□	□	□	□
Nightlife	□	□	□	□	□
High quality restaurants	□	□	□	□	□
High quality lodging	□	□	□	□	□
Affordable lodging	□	□	□	□	□
General affordability	□	□	□	□	□
Health care access	□	□	□	□	□
Other (specify):____________	□	□	□	□	□

2. a.) How many trips have you made to Chaffee County in the past year? _____ number of trips
   b.) How many days have you spent in Chaffee County in the past year? _____ days

3. What was the amount of time you spent in Chaffee County on *this most recent trip*?
   _____ # of hours **or** _____ # of days

4. What are the primary activities you participated in *during this most recent trip* to Chaffee County (Check all that apply).

- □ Horseback riding
- □ Hiking/walking
- □ Picnicking
- □ Visiting historic sites
- □ Bicycling/Mt. Biking
- □ Driving for pleasure
- □ Attending a rodeo
- □ Hot springs
- □ Fishing
- □ Sightseeing/photography
- □ Bird-watching
- □ Rafting/boating
- □ Kayaking
- □ Golf
- □ Attending a sporting event
- □ Art walk
- □ Wildlife viewing
- □ Backpacking
- □ Mountain/rock climbing
- □ Big game hunting
- □ Camping
- □ Ranch visit
- □ Alpine tundra/flower viewing
- □ Hot air ballooning

5. Are there activities that you would have liked to enjoy in Chaffee County, but were unable to? (Check one.) □ Yes □ No

If yes, please list activities

____

6. How many people were you traveling with on this trip? ____________number of people

7. Please record the approximate dollar amounts **you personally** spent to visit Chaffee County (for example, Buena Vista, Salida, Poncha Springs), Colorado on your most recent trip for:

Trip Expense	**Amount Spent in Chaffee County**	**Total Amount Spent**
Travel expenses (Gasoline, rental car, airline ticket)	$	$
Lodging (Hotel/motel, campground fees)	$	$
Food and drink (Restaurants, bars, grocery stores)	$	$
Outdoor recreation fees (Rafting companies, outfitters, park entrance, hunting/fishing license, guides, equipment rental; <u>not</u> equipment purchase)	$	$
Other retail purchases/gifts	$	$
Other: ______________________	$	$

8. a.) Did you provide ***expenditures*** for yourself or as part of a larger group or family in Question 7? (Check one) □ Myself □ Family/Group

b.) If Family/Group, how many people are included? _________people

9. As you know, some of the costs of travel (e.g., gasoline) have been increasing. If the travel cost of this most recent visit to Chaffee County had been **<u>$500</u>** higher, would you have made this visit? (Check one) □ Yes □ No

10. a.) Was this most recent visit from your home to Chaffee County (Check only one):

□ the sole destination (you came directly to Chaffee County and then back home)?
□ the primary purpose (but not the only purpose of your trip from home)?
□ one of many equally important reasons or destinations for your trip from home?
□ just an incidental or spur of the moment stop on a trip taken for other purposes or to other destinations?

b.) If you checked one of the last 2 items, did the trip from home to Chaffee County also involve visiting family or friends? (Check one) □ Yes □ No

11. What was the one-way travel time of your trip from home to Chaffee County?

_____ # of minutes **or** _____ # of hours.

12. What was the one-way travel distance from home to Chaffee County? ___ # of one way miles.

13. a.) If you could not go to Chaffee County, what alternative vacation site would you choose?

____

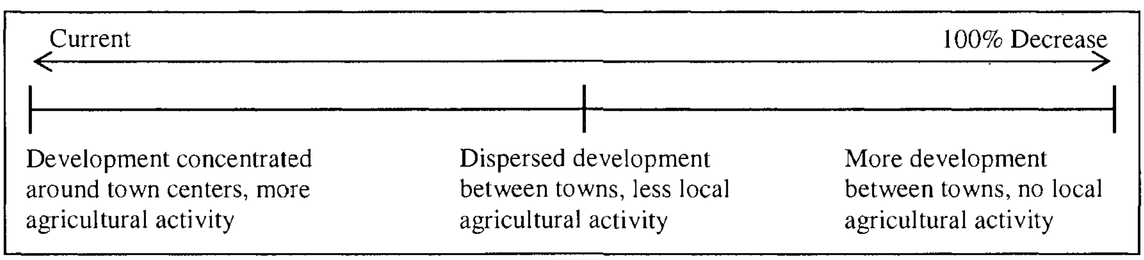
b.) What is the approximate distance from your home to this site? ______# of one way miles.

II. How would your visitation change with changes to land use or the natural environment? The previous questions have asked you about your visits to Chaffee County under current land use and environmental conditions. In the future, population growth and economic development could create changes in current local land uses and the local environment.

The next few questions ask you to consider some different scenarios that could affect land use and environmental conditions, specifically a) the amount of ***local working landscapes,*** the main current private land use in Chaffee County, and b) the ***water quality*** of the Arkansas River, the main water body in the county. Please read the text below & answer the questions that follow.

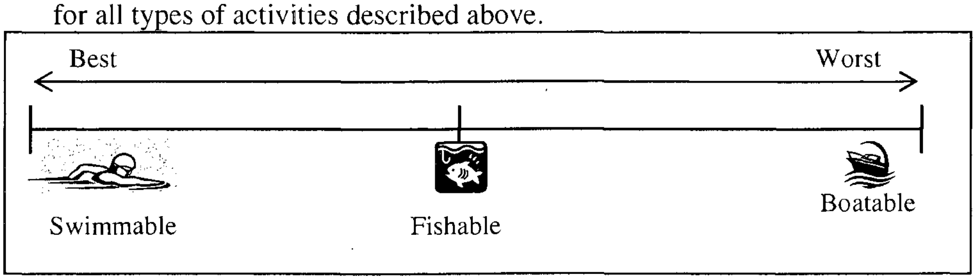
A. Local Working Landscapes

- About 80% of Chaffee County's land is publicly-owned and managed (by government agencies), while most of the remaining 20% is privately-owned (see Map). Most of these 120,000 privately-owned acres are made up of working landscapes (including farmland and ranchlands).
- ***Working landscapes*** are privately owned rural lands that include hay meadows and pastures, grazing areas for cattle and horses, corrals and ranch buildings, working ranch hands, and farm implements. Chaffee's working landscapes make up much of the county's lower lying hills, river corridors, & valleys.
- Local working landscapes decrease as the amount of rural residential and commercial development increases. Decreases in local working landscapes will likely result in more local housing (if more dispersed), retail establishments, & traffic, less local agricultural activity, wildlife habitat (for watching and hunting wildlife), & changes in the visual features of the landscape, among other things.



B. Water Quality

- Currently, the water quality of the upper Arkansas River is generally good. While the river is not of drinking water quality, it can be used for swimming (and other forms of water contact), fishing and boating activities.
- A water body is ***swimmable*** if the water is safe to swim in and ingest in small amounts. It is ***fishable*** if the water quality is sufficient for trout and other game fish to survive but not safe for swimming. It is ***boatable*** if the water is safe for boating and sailing but <u>not</u> for swimming or fishing.
- Water in most parts of upper Arkansas River is considered swimmable, which means it is safe for all types of activities described above.



C. What if conditions changed?

In the next questions, please evaluate the following three development scenarios:

	Development Scenario A: Affects local working landscapes but not water quality	Development Scenario B: Affects water quality but not local working landscapes	Development Scenario C: Affects both local working landscapes and water quality
Change in working landscapes	**25% Decrease (from 120,000 acres)**	**No Change**	**25% Decrease (from 120,000 acres)**
Change in Arkansas River Water Quality	**No Change**	**Decrease:** From Swimmable to only Fishable and Boatable	**Decrease:** From Swimmable to only Fishable and Boatable

1. Please consider **Scenario A**.

a.) Suppose that this scenario became a reality in Chaffee County. Would this change in land use (with no change in water quality) cause you to make fewer (or more) ***trips*** to Chaffee County during the year? (Check one, and fill in the appropriate blank)

Fewer trips per year	No change	More trips per year
□ How many fewer?______	□	□ How many more?______

b.) If you answered fewer or no change in part a, what is the ***maximum increase*** in your total costs per person per trip you would be willing to pay to ensure that **Scenario A** did not occur? (Please circle one.)

$0 $5 $10 $25 $50 $75 $100 $150 $200 $300 $400 $500

2. Please consider **Scenario B**.

a.) Would this change in water quality (but no change in land use) cause you to make fewer ***trips*** to Chaffee County during the year? (Check one, and fill in the appropriate blank)

Fewer trips per year	No change	More trips per year
□ How many fewer?______	□	□ How many more?______

b.) If you answered fewer or no change in part a, what is the ***maximum increase*** in your total costs per person per trip you would be willing to pay to ensure that **Scenario B** did not occur? (Please circle one.)

$0 $5 $10 $25 $50 $75 $100 $150 $200 $300 $400 $500

3. Please consider **Scenario C**.

a.) Suppose that this scenario became a reality in Chaffee County. How would these changes in land use and water quality combined affect the number of ***trips*** you make to Chaffee County during the year? (Check one, and fill in the appropriate blank)

Fewer trips per year	No change	More trips per year
□ How many fewer?______	□	□ How many more?______

b.) If you answered fewer or no change in part a, what is the ***maximum increase*** in your total costs per person per trip you would be willing to pay to ensure that **Scenario C** did not occur? (Please circle one.)

$0 $5 $10 $25 $50 $75 $100 $150 $200 $300 $400 $500

4. How do you view the relationship between working landscapes & water quality in Chaffee County? (Check one)

- ☐ The preservation of local working landscapes has a ***positive*** effect on local water quality.
- ☐ The preservation of local working landscapes has a ***negative*** effect on local water quality.
- ☐ The preservation of local working landscapes has ***no noticeable effect*** on local water quality.
- ☐ Not sure or no opinion.

III. Attitudes

The next two questions ask you to share your opinions on property ownership and environmental stewardship.

1. Property ownership involves rights (freedom, choices) and responsibilities (duties, limits). How do you feel about the following.....?

Category	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Not Sure
I should be able to do anything I want to with my land	☐	☐	☐	☐	☐	☐
My neighbors should be able to do anything they want to with their land	☐	☐	☐	☐	☐	☐
My property values depend in part on my neighbor's property management	☐	☐	☐	☐	☐	☐
Neighbors need to consider each other's property values when managing their property	☐	☐	☐	☐	☐	☐

2. Listed below are some statements about the relationship between humans and the environment. Please indicate your degree of agreement/disagreement with each one.

Category	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Not Sure
The balance of nature is very delicate and easily upset by human activities	☐	☐	☐	☐	☐	☐
Plants and animals have as much right as humans to exist	☐	☐	☐	☐	☐	☐
Modifying the environment for human use seldom causes serious problems	☐	☐	☐	☐	☐	☐
There are no limits for growth for nations like the United States	☐	☐	☐	☐	☐	☐
Humankind was created to rule over the rest of nature	☐	☐	☐	☐	☐	☐

IV. Please tell us something about yourself.
These last few questions will help us in evaluating how well our sample represents visitors. Your answers will be kept strictly confidential and will only be used in aggregate form for the analysis of this study. You will not be identified in any way.

1. Are you (Check one): ☐ Male ☐ Female

2. What is your age? ________ Years

3. Are you (Check one): ☐ Employed ☐ Retired ☐ Unemployed ☐ Work in home

4. What is your home zip code? __________________

5. How many people in your household were employed outside the home last year? ___People

6. How many of these people contribute to paying household expenses? _____ people

7. Do you own a computer? (Check one) ☐ Yes ☐ No

8. Do have ***home access*** to the internet? (Check one) ☐ Yes ☐ No

   If yes, what type of access do you have? (Check one)☐ Dial up ☐ Broadband or DSL

9. ***How often*** do you use the internet? (Check one)

☐ Never ☐ Seldom (once per month or less) ☐ Regularly (weekly) ☐ Frequently (daily or greater)

10. Are you a member of an environmental organization? ☐ Yes ☐ No

11. Education: (Check highest year completed)
☐ Jr. High ☐ High School ☐2 yr. College ☐4 yr. College ☐ Graduate or Professional Degree

12. How many people live in your household (including yourself)? _______ people

13. How many weeks of paid vacation do you receive each year? ________ weeks

14. Approximately what was your household income (before taxes) last year? (Check one)

☐ Less than $20,000	☐ $60,000 - $79,999	☐ $170,000 - $209,999
☐ $20,000 - $29,999	☐ $80,000 - $99,999	☐ $210,000 - $259,999
☐ $30,000 - $39,999	☐ $100,000 - $129,000	☐ $260,000 - $299,000
☐ $40,000 - $59,999	☐ $130,000 - $169,999	☐ Over $300,000

Thank you very much for completing this survey.

If there is anything else you would like to tell us, please write it in the space provided below.