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How do the Public's Environmental Attitudes affect Recreation Demand for National Forests and Grassland in the Southwest?

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by

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DISSERTATION

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ABSTRACT

This dissertation studies the relationship between environmental attitudes and National Forest management in the Southwest, specifically the effect that attitudes have on changes to recreation fees. Although there is research on the effect of environmental attitudes on willingness-to-pay for environmental goods (e.g., Spash 2000; Spash 2006; Ojea and Loureiro 2007), little work has been done on analyzing the effect that environmental attitudes have on changes to recreation fees. I help address this gap by investigating the effects that public land values, a measure of environmental attitudes, have on changes to recreation fees at National Forests using primary data from a general population survey of households in the Southwestern region of the United States. In the face of reduced budget appropriations, recreation fees represent a vital source of additional funding that helps cover the short-fall in financial resources. For public land agencies, the ability to fund maintenance of ecosystem service benefits through recreation fees is an important aspect of management plans. Of critical significance for this dissertation is the acknowledgement by public land agencies of the importance of

environmental values and attitudes in shaping socially acceptable policies that affect ecosystem services.

I begin by using canonical correlation analysis, a multivariate analysis method that makes no *a priori* assumptions on the direction of causality, to identify and describe environmental attitudinal groups in the sample. Results show that agencies must realize that environmental values and attitudes often contradict the conventional wisdom of a clear demarcation within segments of the population, e.g., not all women have pro-environmental attitudes, or Hispanics hold weaker environmental attitudes relative to other groups. I then measure the effect that environmental attitudes have on accepting an increase in recreation fees and a new fee to support public lands. The effect of the environmental attitudes is to moderate the support, or rejection, to changes in recreation fees, impacting how resource management may be funded. Finally, I estimate the impact on recreation demand from changes in recreation fees using a corner solution travel cost model. Four changes in recreation fees are analyzed, including dropping all fees due to not renewing the current fee legislation, which is set to expire in 2014, and switching to a flat fee at recreation sites that are currently charging a fee. As would be expected, higher recreation fees will reduce recreation demand to National Forests, but what is unexpected is the negligible effect on demand from switching to a flat fee. Introducing fees on eligible sites not currently charging is likely to have a slightly negative effect on recreation to National Forests in the Southwest. The planning process must seek public input and an analysis of environmental attitudes to ensure regional and local plans reflect the concerns of public and important stakeholder groups. Policymakers must consider conservation efforts in the short-run and limited resource development over the long-run.

In terms of public input, planners should involve stakeholder groups in the process, as they play an important role in signaling how strongly people feel about the environment and the likely direction of support for policy based on their underlying environmental values and attitudes.

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Chapter 1 – Introduction

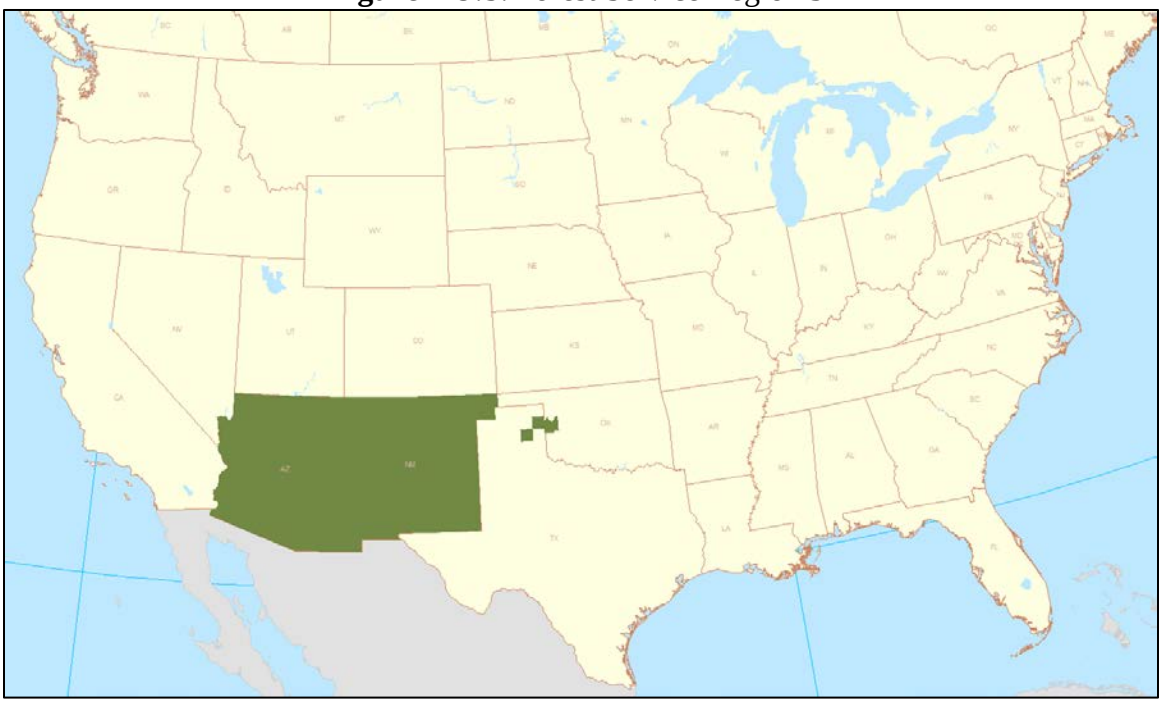
1.1 Introduction

Ecosystem services are the benefits provided by nature to sustain and fulfil human life (Boyd and Banzhaf 2007; Chee 2004). In the context of environmental analysis, environmental attitudes help researchers and policymakers evaluate how favorably individuals view the demand for ecosystem services (Milfont and Duckitt 2010, 80). For example, environmental attitudes can inform researchers on the value attached to clean air, biodiversity, and the spiritual values attached to the natural environment (McFarlane and Boxall 2000; Brown and Reed 2000; de Groot et al. 2002), as well as economic values, such as existence and option values (Bengston 1994; Tarrant et al. 2003; Dietz et al. 2005). Despite some research in economics that has looked at the effect of environmental attitudes on policies related to environmental goods, like the protection of endangered species (Ojea and Loureiro 2007; Aldrich et al. 2007) or of wetlands (Spash 2000), it is difficult to find research that studies the relationship between environmental attitudes and recreation fees.

In this dissertation I help address this gap by analyzing the effects that environmental attitudes have on changes to recreation fees at National Forests using primary data from a general population survey of households in the Southwestern region of the United States (see Figure 1). This region is of interest given a recent review of forest management plans, that is, the guidance documents on land management and development (Federal Register 2012), and the diversity in the population. Of significance in developing long-term policies is the expected growth of Hispanics in the coming years (Ortman and Guarneri 2009). Such shifts in the demographic characteristics in the population will result in a change of the general environmental attitudes of the Region and will impact

the development of socially acceptable resource management plans (Cordell et al. 2002; Johnson et al. 2004).

Figure 1 U.S. Forest Service Region 3



This dissertation also contributes to a growing economic literature that uses environmental attitudes as an integral part of policy analysis (e.g. Ojea and Loureiro 2007; Spash et al. 2009; Spash 2006), as well as to the upcoming discussion on extending the legislation that allows federal agencies to charge recreation fees on public lands. Specifically, this dissertation answers the following research questions:

(i) What are the characteristics of the people who are willing to pay more for recreation and how do environmental attitudes affect the acceptability to pay more for recreation?

(ii) How will recreation demand be impacted if the *Federal Lands Recreation Enhancement Act* is not extended or, if extended, fees are increased to compensate for a potential reduction in traditional sources of funding?

A recent shift by the United States Department of Agriculture's Forest Service (USFS) towards enhancing ecosystem services, has meant that policy analysis must reflect, as much as possible, public preferences. As a result, forest managers and policymakers must have a greater understanding of how the public values the environment as a whole (Federal Register 2012; Ruhl 2010). From this new perspective, National Forests are no longer managed just for the benefit of humans only, under a commercial or *multiple-use* model (Rolston and Coufal 1991); instead, forest managers must now also consider the impact of policy on the natural environment, under a *stewardship of ecosystem services* model (Kennedy and Koch 2004; Steel et al. 1994). This represents a notable departure from the traditional model of forest management that will change how policy impacts are measured (Kennedy and Koch 2004; Ruhl 2010; Fisher et al. 2009). Prior to this shift in focus, analysis of forest management policies were often limited to impacts based on the (utilitarian) resource management model, which only considered the effects on humans.

Economic analysis, be it cost benefit analysis to protect an endangered species or alternative methods to control forest fires, has been restricted to maximizing the utility of current and future generations based on the optimal use of resources, with limited consideration on how environmental attitudes would affect welfare (Spash 2000). Empirical analysis usually considers easily quantifiable opportunity costs, such as travel costs, and harder to quantify option and endowment values. Krutilla (1967), however, argued for recognizing a wider range of tastes, of which environmental attitudes represent a means of expressing them towards nature and the environment (Milfont and Duckitt 2010). The last couple of years has seen growing interest in economics of using

environmental attitudes to help describe the heterogeneity in opinion towards environmental policy and, most importantly, the willingness to engage in trade-offs for the protection of environmental goods and services (e.g., Clark et al. 2003; Spash 2006; Ojea and Loureiro 2009; Dietz et al. 2005). The primary implication of this research has been to challenge the magnitude of welfare estimates and corresponding policy recommendations (Kotchen and Reiling 2000; Spash 1997; Cooper et al. 2004; Spash 2006; Chee 2004).

Milfont and Duckitt (2006; 2010) have found environmental attitudes to be multi-dimensional, and results in this dissertation are consistent with these findings, showing them to be broad and distinct across a sample of households in the Southwest. This is important considering that ecosystem services are also defined across multiple dimensions, from the tangible benefits humans derive from the environment to abstract concepts such as spirituality, aesthetics, and biodiversity (Manning et al. 1999; de Groot et al. 2002; Ruhl 2010; Fisher et al. 2009). As a result of a shift towards a more holistic approach of forest management, and the need to consider the multiple dimensions of environmental attitudes and values associated with public lands, I first identify the multiplicity of environmental attitudes in the sample based on their relationship with demographic characteristics. I then measure the degree of acceptability to higher recreation fees and new fees to support public lands. A primary determinant of such acceptability is environmental values, which are introduced into the model in summary form based on a set of statements used in the initial identification of environmental attitudes in the region. Finally, I estimate the impact on recreation demand from changes in recreation fees.

1.2 Current state of research

The focus of this research is on recreation, one of the benefits from ecosystem services (Boyd and Banzhaf 2007; Fisher and Kerry Turner 2008; Fisher et al. 2009). With the changes in the scope of natural resource management, as outlined in the recent Forest Service planning rule emphasizing the stewardship of ecosystem services in developing management plans (Federal Register 2012), understanding environmental attitudes is an important aspect in developing and validating natural resource management plans. One key to finding balance between the stewardship of ecosystem services model and the multiple uses model is an improved understanding of the full range and complexity of attitudes of the general public, resource users, and other stakeholders (Minteer and Manning 1999). In developing management policies under the framework of the new planning rule, knowledge of attitudes is helpful in predicting behavior towards the environment (Manning et al. 1999) and measuring support for issues that will impact the environment (Brown and Reed 2000). Therefore, I use three related themes in the environmental and ecological literature: 1) environmental attitudes; 2) recreation fees on public lands; and 3) recreation fees and environmental attitudes.

Environmental attitudes are a collection of beliefs and behavioral intentions towards environmental activities and issues (Milfont and Duckitt 2006). The majority of the research on *environmental attitudes* is found in the environmental psychology literature, where the discussion has been focused on the types of questions, or statements, that are used to describe the underlying environmental attitudes in the data (for example, see Stern et al. 1995; Stern 2000; Dunlap 2008; Dietz et al. 2005). Additional work has been conducted in the economics literature, primarily by ecological economists due to the

unorthodox methods and theory involved in explaining the inclusion of environmental attitudes in economic research (Spash and Ryan 2012).

The second theme involves *recreation fees in public lands*, specifically the current recreation fee legislation. Considerable work has been done in the leisure literature on the recreation fee demonstration program, an antecedent legislation to the current system (Vincent 2010). In fact, it is because of the findings from this research that the current legislation was enacted in 2004. There is also a strand of literature that has been analyzing fees on public lands and the different outcomes in terms of acceptability given the magnitude of new fees and the length of time in which fees have or have not been charged (Rollins and Trotter 1999). Both elements of the recreation fee literature are discussed below.

The final theme links both *recreation fees and environmental attitudes*. There are additional ecosystem service benefits that are derived from outdoor recreation (Fisher et al. 2009). There is also an implicit connection between the types of outdoor activities individuals engage in and the extent to which they would support certain policies (Vogt and Williams 1999). This has important implications for policymakers moving forward, especially as the types of recreation activities change over time due to changes in demographic characteristics (Schroeder and Louviere 1999; Johnson et al. 2004) and the influence of national forests near urban centers (Chavez and Olson 2008; Stanis et al. 2008; Chavez and Olson 2009). However, most research has been limited to asking about general attitudes regarding the fee itself (Rosenberger et al. 2012) or about the ethical beliefs of individuals with respect to the environment and society (Spash et al. 2009).

1.2.1 Environmental attitudes and Forest Values

In the context of this investigation, forest values are defined as an "*enduring conception of the good related to forest and forest ecosystems*" (Bengston and Xu 1995). Most importantly for this analysis, underlying values are assumed to influence attitudes (McFarlane and Boxall 1996; Tarrant et al. 2003). Therefore, values represent an ideal measure of attitudes, especially as they relate to resource management planning (Brown and Reed 2000) and a sustainable relationship towards the environment (Dietz et al. 2005). Another important aspect for this analysis is that forest values are influenced by the social setting in which they are formed, leading to differences across demographic groups (Clement and Cheng 2011; Fischer 2010). Thus, some of the variation in values is rooted in social interactions (Dietz et al. 2005), which means that there is a degree of similarity within demographic groups in a particular location but not across other locations (Johnson et al. 2004).

Not only is identifying and characterizing values important in determining environmental attitudes, but it is also helpful in defining how future policy must be shaped as the country undergoes shifts in its demographic characteristics (Jackson 1986; McFarlane and Boxall 2000; Cordell et al. 2002; Bengston and Xu 1995). Under these conditions, measuring values is ideal in evaluating attitudes as they are regarded as an enduring concept (Bengston and Xu 1995) – what changes are the overall attitudes in the population and not the underlying values of each group. An additional benefit to identifying values is in reducing conflicts with stakeholder groups (Tarrant et al. 2003). Values, therefore, help policymakers identify which policies are important and what direction future policies should undertake (Steel et al. 1994).

A pertinent consideration is that values are latent concepts (Brown and Reed 2000) and are traditionally identified using psychometric scales, such as the New Ecological Paradigm (Dunlap et al. 2000) or the General Awareness of Consequences (Stern et al. 1995). The New Ecological Paradigm (NEP) is a widely used and cited scale that measure environmental belief based on the degree to which people view the world ecologically (Dunlap 2008; Hawcroft and Milfont 2010). On the other hand, the General Awareness of Consequences (GAC), developed by Stern et al. (1995), measures environmental concern. To determine which scale to use, the researcher must first define the extent of the underlying environmental issue and the scope of the area of study. If the researcher is interested in a specific environmental good or service, then GAC is ideal. For example, Ojea and Loureiro (2007) use GAC to measure environmental attitudes towards preserving an endangered species in Spain; Spash (2006) uses GAC to help measure the value of a proposed wetlands preservation project in England. The NEP, on the other hand, is an ideal scale to define general environmental attitudes over a wider area, or a for a policy question that has a broader.

The scale used in this investigation was specifically developed for the National Survey on Recreation and the Environment (NSRE) and is based on the NEP (see Shields et al. 2002). Unlike the NEP, and consistent with empirical findings on the multi-dimensionality of environmental values (Hawcroft and Milfont 2010), the scale developed for the NSRE assumes two dimensions of *public land values*: individual and management. [1] The use of the NEP-inspired scaled developed for the NSRE is especially

[1] It is understood that values are in fact multidimensional and that they influence attitudes (Tarrant et al. 2003). However, researchers do not test the dimensionality of the scale

useful in the context of this analysis, as it helps define the view people place on the environment, which in turn will inform attitudes that then influence behavior towards the environment (Fraj and Martinez 2007).

As mentioned earlier, forest values are an enduring concept of the good related to forests, while attitudes are how the environment is viewed favorably or unfavorably. This in turn affects the perception of the importance of ecosystem services on public lands (Kotchen and Reiling 2000; de Groot et al. 2002). As a matter of suitability in this study, the NSRE statements are used to measure values, which in turn define environmental attitudes towards the National Forests in the Southwest.

1.2.2 Recreation fees

Financial resources are necessary to maintain and protect ecosystem services, and most importantly for this investigation, recreational services on public lands. One source of funding is recreation fees, currently authorized under the Federal Lands Recreation Enhancement Act (REA), enacted under Title VIII of Division J of P.L. 108-447 of the *FY 2005 Consolidated Appropriations Act*. In order to "*enhance the visitor experience and reduce maintenance backlogs,*" the REA allows public land management agencies from the Department of Interior (Bureau of Reclamation, Bureau of Land Management, Fish and Wildlife Service, and National Park Service) and the Department of Agriculture (Forest Service) to charge recreation fees in order to (Vincent 2010).

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and characterize values from the NEP using one dimension (Hawcroft and Milfont 2010). This is done despite research that has found the dimensionality is influenced by the number of items in the scale and sample-specific attributes (Dunlap 2008; Hawcroft and Milfont 2010).

Public land managers are also tasked with enhancing the visitor experience by offering improved facilities, such as developed campsites, permanent toilet facilities, developed parking areas, etc. (Vincent 2010). In order to allocate financial resources where they are needed the most, policymakers should have an understanding of the preferences and values towards the environment to achieve a consensus with the public on their implementation (Park et al. 2010). It is also understood that, for many people, recreation on public lands provides a way of relieving stress and gathering with family (Chavez 2001; Chavez and Olson 2008; Burns et al. 2008).

A discussion of recreations fees on federal public lands is not new (Bengston and Fan 2001), nor is the authorization to charge recreation fees. What has changed is how public land agencies manage the funds collected from fees. Since the *Land and Water Conservation Fund Act* was enacted in 1964, public land agencies have collected user fees to support maintenance and alleviate insufficient appropriation in the Federal budget (Martin 1999). However, this particular legislation did not allow the agencies to use the revenues at their discretion and required them to deposit the revenues into the General Fund of the Treasury (Vincent 2010; Bowker et al. 1999). As a result, there was little incentive to maintain facilities and amenities, or to provide a reasonable level of service to the public.

In 1996, Congress passed the *Recreation Fee Demonstration Program* (RFDP), a significant departure in how fee revenue is managed. This 3-year pilot program sought, among other things, to address the backlog of maintenance programs throughout the public land system (Bengston and Fan 2001). It allowed agencies to charge fees at any recreation site that provided a minimum level of facilities (Vincent 2010). As an added

benefit for public land agencies, revenues were spent at their discretion instead of being sent into the General Fund, allowing them to engage in significant long-term investment projects (USDOI and USDA 2012). In part because research had revealed public support for fees as long as the funds were spent on-site, reduced crowding, generated ecological benefits, and promoted better stewardship of resources (Bengston and Fan 2001; Bowker et al. 1999; Vaske et al. 1999), the program was made permanent in 2005 under REA.

Early on, the RFDP faced considerable criticism (Bengston and Fan 2001) and many researchers noted the difficulty of introducing a fee to areas that had traditionally not charged any recreation fees (McFarlane and Boxall 1996; Vaske et al. 1999; Martin 1999). Some argued that fees were discriminatory towards lower income households, minorities, local (and frequent) users, and that fees amounted to double taxation (Martin 1999; Bengston and Fan 2001). For many users, fees seemed inconsistent, especially in the face of subsidies to extractive industries (Vogt and Williams 1999). Considerable research was conducted to determine the acceptability of proposed fees under the RFDP using simple measures of attitude towards fees (Rollins and Trotter 1999). Public land agencies also expended considerable effort to engender social trust with respect to the fee policy, a critical component in reducing conflict and encouraging acceptability of recreation fees (Bengston and Fan 2001; Park et al. 2010). One important aspect of support for recreation fees was information on how and where funds are used, especially as means of addressing shortfalls in on-site improvements (Park et al. 2010; Chung et al. 2011). Indeed, when people were asked why they would support the program, most agreed with it as long as funds were used to support the recreation site and to improve

environmental services (Kyle et al. 2003; Burns and Graefe 2006; Park et al. 2010; Chung et al. 2011).

The problem that public land agencies face is the sunset provision in the legislation of December, 2014. Agencies would once again be under the *Land and Water Conservation Fund Act*, limiting how and where recreation fees are collected. The incentives to improve local visitor experiences, engage in long-term planning, fund conservation and preservation programs, and deal with maintenance needs would be eliminated, as funds would once again go to the General Fund of the Treasury (Vincent 2010). In the context of the upcoming discussion on extending the legislation, policymakers must take special care to address the needs of different user groups (Jackson 1987), environmental organizations (Bowker et al. 1999), and frequent visitors (Reynisdottir et al. 2008; Park et al. 2010).

Although there will certainly be a considerable debate on extending the REA for another 10 year period, there are still many other needs that have to be met by public land agencies. With changes to the planning rule placing greater emphasis on the stewardship of ecosystem services, rather than solely on the traditional commodity-driven model of multiple-uses, the need for financial resources that can address conservation and preservation efforts become so much greater (McLean and Johnson 1997). The current environment at the Federal level would make it difficult for these agencies to seek an increase in budget allocations, making recreation fees an attractive alternative to meet the emphasis on ecosystem services (Martin 1999; Vaske et al. 1999; Reynisdottir et al. 2008).

Fees help fund maintenance, volunteer programs, conservation, signage and other improvements that enhance the visitor experience. An important query for planners is where to devote resources, as not all funds have to be spent at the site where they were collected (Vincent 2010). The public's preferences for facilities, amenities, and ecosystem services on public lands extend to all aspects of natural resource management and are often contradictory (Clement and Cheng 2011). Such preferences towards the environment are informed by past experiences (McCarville and Crompton 1987), external factors (Ajzen 1991; Dietzet al. 2005), participation in outdoor activities (Teisl and O'Brien 2003), and existence and use values (Cooper et al. 2004). Therefore, public land agencies require as much information and analysis on the needs and attitudes from the public and stakeholder groups. Each stakeholder group feels they are entitled to special consideration, given their revealed preferences towards public lands and wilderness based on membership and/or use (McFarlane and Boxall 1996; Teisl and O'Brien 2003). The idea is to define a set of policies that are acceptable to the majority of groups, ensuring a consensus and reducing any possible conflicts. As discussed in the previous sub-section, environmental attitudes form an important component of such planning effort.

1.2.3 Environmental attitudes and recreation fees

In addressing environmental attitudes when developing resource management plans, policymakers are better able to build a *social trust* with the public, minimizing conflict and ensuring in the acceptability of natural resource policy (Bengston and Fan 2001; Park et al. 2010; Rosenberger et al. 2012). Underlying values are helpful in characterizing future behavior with respect to the environment (Bengston and Xu 1995; Jackson 1986; Cordell et al. 2003), and pro-environmental attitudes have been found to have a greater

positive effect on willingness-to-pay (WTP) than socio-economic characteristics (Aldrich et al. 2007; Spash et al. 2009; Chung et al. 2011; Rosenberger et al. 2012). Therefore, there is a clear need to control for environmental attitudes in an economic analysis of natural resource policy in general, and forest management in particular.

The environmental psychology literature has devoted considerable research on measuring environmental attitudes, and there is growing interest in the economics of recreation (e.g., Spash 1997; Spash 2006; Ojea and Loureiro 2007; Ojea and Loureiro 2009; Spash et al. 2009; Milfont and Duckitt 2010). Traditional economic analysis is predicated on the idea of trade-offs for environmental goods and services. However, Spash (1997) identified segments in the population with rights-based beliefs (or lexicographic preferences) that tend to disagree with the idea of trade-offs relative to the environment. Lexicographic preference structures violate several assumptions of neoclassical utility maximization, such as continuity, with individuals who are unwilling to engage in trade-offs for the environment, or to even consider compensation under strong lexicographic preferences (Spash 2000). There is also evidence that the utilitarian ethic of altruism has as important a role in defining pro-environmental attitudes as do rights-based preferences (Ojea and Loureiro 2007). Nevertheless, this evidence might be misinterpreted, as Spash also found instances of individuals with rights-based beliefs that were willing to engage in trade-offs for environmental goods and services, but at the expense of their entire income (Spash 2000). Values are helpful in determining attitudes, which in turn are helpful in defining the attitudes individuals will use to make choices and trade-offs regarding the environment (Dietz et al. 2005). Thus, by not controlling for values, researchers have implicitly been assuming a utilitarian behavior with respect to

trade-offs for the environment. In terms of welfare analysis for environmental changes, zero bids are interpreted as a protest to a hypothetical scenario, as opposed to an ethical reaction based on the belief system (Spash et al. 2009).

Inclusion of environmental attitudes in economic analysis is likely to lead to higher estimates of mean willingness to pay (WTP) for environmental goods (Kotchen and Reiling 2000; Ojea and Loureiro 2007). The use in economic analysis of attitudes towards the environment also serve as a test of plausibility in valuing public goods and the environment (Spash 2000; Kotchen and Reiling 2000), making them that much more important in WTP analysis (Cordell et al. 2003). With a clear understanding of the available substitutes (Ojea and Loureiro 2009), environmental attitudes are also helpful in quantifying non-use values that are affected by underlying beliefs and attitudes towards the environment (Kotchen and Reiling 2000; Spash 2006).

Despite this evidence, some researchers have restricted their evaluation of attitudes on a single question of the acceptability of a recreation fee (Rollins and Trotter 1999; Rosenberger et al. 2012). Such question is based on the Theory of Planned Behavior discussed in Ajzen (1991), where attitudes towards a recreation fee is based on the sum total of beliefs about them. This measure implicitly assumes a utilitarian ethic that characterizes the choice based on work and leisure and does not extend it to the underlying values about the environment. It may well be that, based on a choice between work and leisure; the individual may not be willing to accept higher fees. However, their concern for the environment, and a strong conservation ethic, may lead them to find such policies acceptable. This apparent contradiction is not explicitly captured in a question dealing solely with the acceptability of fees. The question is simply limited to the policy

itself and no additional information may be derived from it, unless other information is elicited. Certainly, questions about the fairness in the change in policy should be included, but values towards the environment are more useful in the context of policies that affect ecosystem services (Bengston 1994; Minteer and Manning 1999; Fisher and Turner 2008). Further, by helping define attitudes, intentions to pay can also be determined (Meyerhoff 2006).

1.2.4 Discussion

Underlying environmental attitudes may be from a utilitarian value system. However, there are segments in the public whose values system is rights-based, in which trade-offs that sacrifice some aspect of nature are not likely to occur. If we consider recreation on public lands a benefit derived from the ecosystem services provided by nature (Boyd and Banzhaf 2007; Fisher et al. 2009), identifying and controlling for environmental attitudes in policy discussions will lead to a more conservative approach towards at least one important aspect of public land management: recreation fees. Some respondents appreciate nature for its own sake and are said to hold biocentric attitudes (Stenmark 2008). These same individuals are likely engaged in appreciative or motorized activities. Each activity implies a different approach towards natural resource management, but the underlying attitudes towards the environment may be the same (Jackson 1986; Jackson 1987; Nord et al. 1998). The question is how individuals derive benefits from the environment and how to use values to identify environmental attitudes may be helpful in guiding natural resource policy.

The results in this dissertation show that environmental attitudes play an offsetting role in questions related to recreation fees on public lands. Individual values towards the

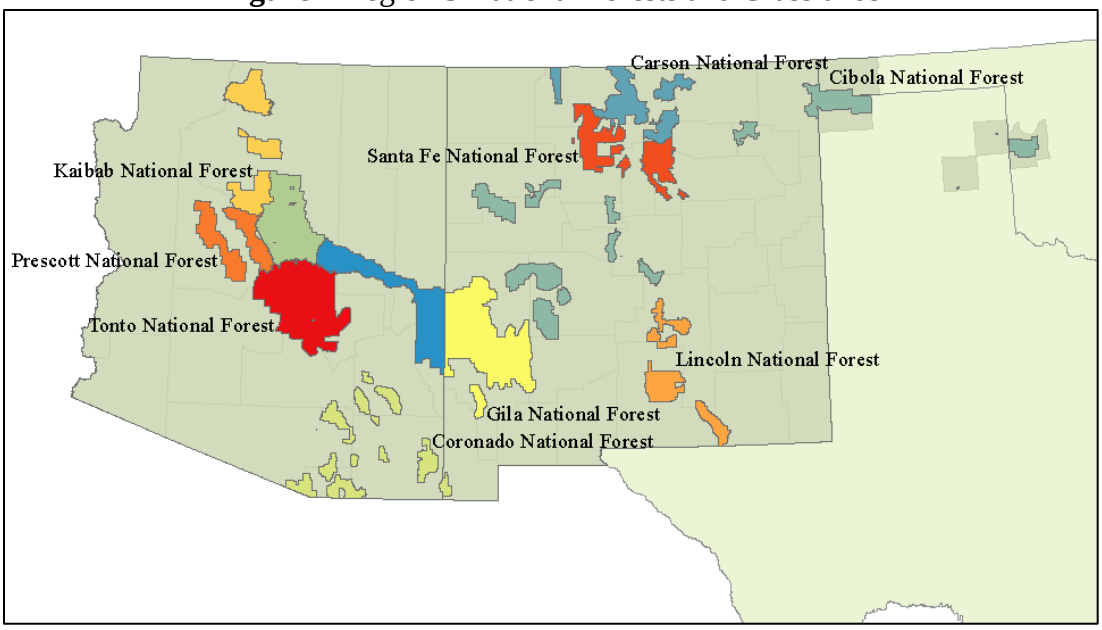
environment lead to support for such policies, while at the same time values towards a conservationist approach of public land management lead to a rejection of higher fees. For policymakers, these results imply the need to engage the public in any discussion regarding public land management. Findings also indicate that even among certain demographic groups, such as women or Hispanics, there is a plurality of values associated with the environment, so policy should not assume homogeneity in their attitudes. Instead, policy should be developed in a way that ensures a level of flexibility in the general goals, implementing plans that develop natural resource in a manner consistent with the stewardship of ecosystems services directive. The main result from this investigation is that resource plans need to be based on a middle ground by clearly identifying the benefits to both humans and the environment.

1.3 Structure of Research

The remaining dissertation is structured as follows. In Chapter 2, I discuss the data set that is used throughout the dissertation. This is primary data gathered over a period of five months, in 2007, by the Department of Economics of the University of New Mexico on behalf of the Forest Service. It is part of a broader research agenda seeking public input on the management of National Forests and Grasslands in the Southwestern region of the Forest Service, comprised of National Forests in Arizona and New Mexico, and National Grasslands in three western counties in Oklahoma and two western counties in Texas (see Figure 2). Chapter 2 also presents the result of an exploratory factor analysis on a set of *public land values* statements. The ability to summarize the statements and apply them to the analysis is important in discussing the effect of environmental attitudes

on management policy. These statements also represent an integral part of this investigation and are used in two of three analytical chapters.

Figure 2 Region 3 National Forests and Grasslands



In Chapter 3, the *public land value* statements are matched with the demographic characteristics of the sample, which is used to identify and describe the latent attitudinal groups. In order to identify and discuss the nuances of opinion in the sample, I use canonical correlation analysis. This multivariate method allows two sets of data to be analyzed simultaneously. The method identifies latent groups by generating weights similar to coefficients in regression analysis for each set of variables in the data set. These weights are estimated such that each latent relationship represents the highest level of correlation between the sets of variables. The total number of latent relationships is limited by the number of variables in the smallest dataset.

In Chapter 4, I use an ordinal logit regression model to measure the determinants of acceptability of two statements dealing with fees that are measured with a 5-point Likert-scale: (a) an increase of $5 in recreation fees, and (b) an introduction of a fee to support

public lands. There has been considerable research on willingness-to-pay for recreation on public lands; however, my interest is in measuring the likelihood of higher fees to support recreation and public lands. This chapter contributes to a growing literature that has begun to include measures of environmental attitudes in analysis of willingness-to-pay for environmental goods. Findings suggest that environmental attitudes have a moderating effect on agreement to changes in fees on public lands.

In Chapter 5, I explore the effect of changes to fees on recreation demand using four policy scenarios: (i) dropping all recreation fees as a result of not renewing the fee legislation; (ii) a five dollar increase to current recreation fees, (iii) charging a flat five dollar fee at sites currently charging a fee; and (iv) introducing a five dollar fee to eligible sites that are currently not charging a recreation fee. The first policy scenario is consistent with not renewing the current fee legislation, which is set to expire in December 2014. The second policy scenario would occur if the legislation is renewed and the Forest Service requires additional financial resources to make up any short-falls in budget allocations. The third policy scenario, charging a flat fee, represents an interesting opportunity to analyze the effects of charging the same price regardless of additional services or amenities on site. This type of pricing policy has also been found to be effective in reducing recreation demand for fishing in the Gulf of Mexico (Kim et al. 2007), addressing an earlier concern with congestion and crowding when the *Recreation Fee Demonstration Program* was being implemented (Bowker et al. 1999). The final policy is linked to the second, in that recreation sites must meet a minimum of on-site facilities in order to be able to charge a fee. However, not all eligible sites are currently

charging a recreation fee, which represent a potential source of additional funds for the Forest Service.

The empirical model for the analysis in Chapter 5 is a corner solution travel cost model. I use this model for two reasons: (i) the considerable number of recreation sites with zero demand, which lead to corner solutions, and, (ii) the extent and disaggregated nature of National Forests in the Southwest that requires a model that does not assume all recreation sites are substitutes of each other (see Figure 2). Under this model, the decision to visit a National Forest for recreation purposes is comprised of two decisions, *participation* and *choice of a recreation site*. Both components are linked by the expected utility from the choice that is made, given the available alternatives. As part of the analysis I separate the sample by the type of site they visit, resulting in two recreational activity sub-samples: Active and Day. Overall, Day recreationists visited fee-charging sites more often and are, therefore, more impacted by changes in the current fee structure. On the other hand, Active recreationists appear to be marginally affected by a policy that would charge a flat fee.

Chapter 2 – Data used in this investigation

2.1 Introduction

The data used in this dissertation comes primarily from the survey "*Managing National Forests and Grasslands in the Southwest: What do you think?*" administered by the University of New Mexico on behalf of the Southwestern regional office (Region 3) of the Forest Service (the survey questionnaire appears in Appendix E). Data was gathered over a five month period in 2007, from June to October. The population of interest is households in Arizona, New Mexico, three western counties in Oklahoma, and two western counties in Texas (see Figure 1 in Chapter 1).

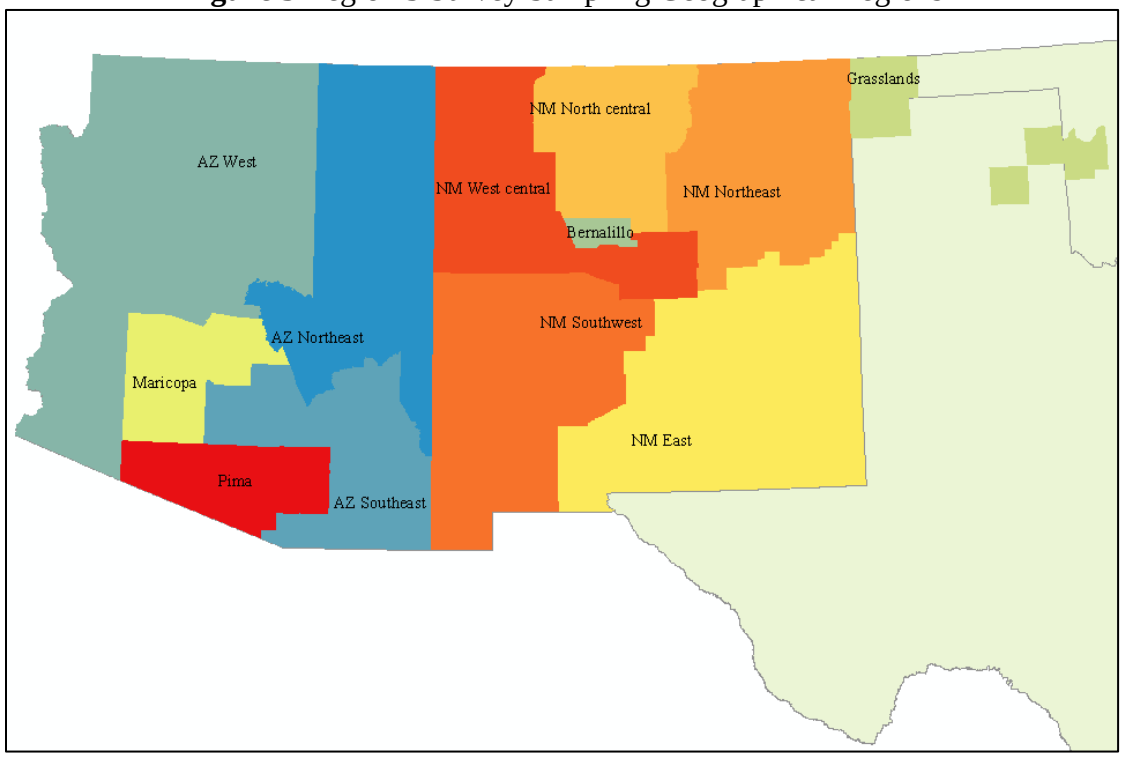
The purpose of the survey is to support the regional planning process by informing policymakers on the publics' values towards natural resource management policies, such as access and local economic development, visitation patterns, fire management, and knowledge of local forestry issues. It is based on an earlier Forest Service national survey, the 2000 National Survey on Recreation and the Environment (NSRE), and achieve a larger sample for the region: 7,628 observations compared to the 176 in the national sample [see Shields et al. (2002) for a description of the NSRE and Haefele et al. (2005) for a description of the regional sample of the NSRE].

2.2 Sampling methodology

Two goals were followed in determining the number of households that were contacted for the survey. First, a minimum sample size of 384 observations for statistical validity based on a sampling error of 5%; second, purposeful oversampling of rural areas. Given these goals, a two-stage stratification sampling plan was implemented. In the first stage, the area of study (Arizona, New Mexico, western part of Oklahoma and Texas) was divided into the 12 geographic regions. Two important restrictions were imposed at

this stage: 1) each region must contain at least one National Forest or Grassland, and, 2) each region must be comprised of least one county and all counties within the region must be adjacent to the others (see Figure 3 below). Three of the geographical regions are comprised of the counties that contain the main urban centers of Phoenix, AZ (Maricopa County), Tucson, AZ (Pima County), and Albuquerque, NM (Bernalillo County). One region is comprised of the three counties in Oklahoma and two counties in Texas where National Grasslands are located.

Figure 3 Region 3 Survey Sampling Geographical Regions



In the second stage, a random sample of households from each geographical region was calculated to achieve the minimum sample size required for valid statistical analysis. County level samples were determined by dividing the number of households in the county by the total number of households in the geographical region, and as mentioned, with purposeful oversampling of rural counties. An initial target sample of 39,200

households was set, with a minimum sample size for each geographical region of 384 observations (McCollum et al. 2008, 25–26). The sample was further divided into two survey response modes using a random 50/50 split: (a) mail-in only, and, (b) mail/ internet. In the second mode, respondents were given the option to mailing the survey questionnaire or completing it via internet.

A database of geocoded addresses for 39,200 households was purchased in 2006 from Survey Sampling International, a commercial survey vendor. Due to delays in approving the survey instrument by the Office of the Management and Budget (OMB), this database was submitted to a national database cleaning service in 2007 to verify and remove any invalid addresses, leading to a reduced sample of 37,804 households. Sampling began on June 6-7, 2007, and the majority responses were received by October, 2007, with a small number of surveys arriving through the end of 2007 (McCollum et al. 2008, 31).

Following Dillman's total design method (Dillman 1978), sampled households received up to five contacts regardless of response mode and were given the option of completing the survey in Spanish. In the first contact, respondents received an introductory letter informing them that they had been randomly selected to participate in the survey. The second contact involved mailing a survey packet that included the introductory letter, a Regional map of National Forests and Grasslands, a Q&A sheet in English and Spanish, the survey questionnaire, a Spanish language request postcard, and a return envelope with postage paid. The letter sent for the second mode (mail/ internet) included details on completing the survey online. The third contact was a postcard reminding the respondents to submit the survey. For the second mode, a letter was sent instead of a postcard for the third mailing. The fourth contact sent the same survey

packet as the second contact. At this point, both response modes were allowed to submit the survey online, with the packet for the first mode (mail) including information on completing it online. The fifth and final contact involved a reminder letter and a self-addressed envelope to submit a completed questionnaire, with postage paid.

The effects on the response rate from following Dillman's total design method are discussed in the following section. Overall, the sampling strategy achieved the goal of 384 responses for statistical validity for all regions except the Grasslands grouping, which received only 358 responses (McCollum et al. 2008, pg. 38).

2.3 Sample size and response rate

The mailings by response mode and the response rates are presented in Table 2.1 below. There are two columns under *Survey Questionnaires*; the first is the number of surveys sent under the reduced sample, and, the second is the updated number of surveys after dropping undeliverable bad addresses and deceased. Under *Type*, there is a row labeled WCO, which corresponds to questionnaires returned with written comments only. That is, the respondent did not answer any questions and opted instead to submit a comment and/or complaint about the survey. These were entered into the system to remove them from the database and avoid any future mailings.

A total of 7,628 responses were received, resulting in a response rate of 21.54% (RR1). This response rate includes 35 questionnaires that were returned with written comments only. The response rate (RR2) without these 35 narrows a bit. RR3, the

response rate using the original sample as the denominator, is much lower (20.18%) and is a more conservative estimate compared to the first (RR1).[2]

Table 2.1 Survey Response Rate

	Survey Questionnaires		Returned Surveys		Response Rate (%)		
Mode	Original	Updated	Type	Responses	RR1	RR2	RR3
A (Mail)	18,997	17,763	Usable	4,005		22.55	21.08
			WCO [a]	22			
			Total	*4,027*	*22.67*		
B (Mail and Internet)	18,807	17,651	Usable	3,579		20.28	19.03
			WCO [a]	12			
			Total	*3,591*	*20.34*		
No id			Usable	9			
			WCO [a]	1			
			Total	*10*			
Total	***37,804***	***35,414***		***7,628***	***21.54***	***21.44***	***20.18***

[a] Indicates responses consisting only of a Written Comment Only.

Regardless of how the response rate is being measured, it is on the low end observed in the literature, especially when compared to surveys that target resource-based issues. However, a 20% response rate is not unusual for mail surveys (Krosnick 1999) and is consistent with a decline in the response rate for general population surveys (Connelly et al. 2003; Deaton 1997). Possible reasons given by McCollum et al. (2008) include lack of saliency in the survey instrument, length of the questionnaire, and season (summer) in the year during which the survey was mailed. Of these reasons, McCollum et al. argue that saliency is likely the most important cause for the low response rate. The initial

[2] The response rates are calculated using the *Cooperating Rates*, household- and respondent-level response rates, of the American Association for Public Opinion Research (2011, 46). Specifically, $RR1 = \frac{C+P}{C+P+R}$ (COOP4), $RR2 = \frac{C}{C+P+R}$ (COOP3), $RR3 = \frac{C}{C+P+R+O}$ (COOP2). Where, C are completed questionnaires; P are partially completed questionnaires, including WCOs; R are refusals; and O are the additional questionnaires that would have been sent in the original mailing.

instrument included a choice experiment section on forest restoration that was removed by the OMB. The resulting questionnaire, therefore, lacked a critical component that might have attracted greater attention from the public.

2.4 Survey questionnaire structure

Pre-testing of the survey instrument indicated a 30 minute completion time. The survey is comprised of a total of 32 questions contained in five sections (see Appendix E for the survey questionnaire):

- Section 1: *Uses of National Forests and Grasslands*

  Respondents are asked about the types of outdoor recreation activities they participate in and prefer. They are also asked to identify the National Forest or Grassland they visit most often, the total number of trips taken to any National Forest or Grassland, and to identify the specific site they visit most often.

- Section 2: *Management of National Forests and Grasslands*

  Respondents are asked to rate two sets of statements using a 5-point Likert scale:

  i. 25 Public Land Value statements, measured from 1 "Strongly disagree," to 5 "Strongly agree."

  ii. 30 statements dealing with management objectives, measured from 1 "Not at all important," to 5 "Very important."

  Both sets of statements were adapted from the 2000 NSRE, slightly modified for the Southwestern region based on feedback from focus groups. All statements include a "Don't know" option.

- Section 3: *Relationships between People and Forest/Grassland managers*

  Respondents are asked how informed they are about issues that affect forest management. They are also asked to give their opinion regarding the role of public input and increasing public participation in managing National Forests and Grasslands.

- Section 4: *Wildland fire*

  This section has one question dealing with any personal experience with wildland fires.

- Section 5: *Background characteristics*

  Besides basic demographic characteristics, like household income, number of children, this section elicited information regarding membership to a natural resource group. If they had been given the chance to complete the survey online, but are submitting it via mail, to explain why they had chosen to do so. If the respondent had not been given the chance to complete the survey online, would they prefer such a response option?

2.5 Survey sections used in this analysis

For this dissertation, I use three sections: *Uses of National Forests and Grasslands* (Section 1), *Management of National Forests and Grasslands* (Section 2), and *Background characteristics* (Section 5). Many of the same demographic characteristics from Section 5 are used throughout the analysis, with differenced due to different samples and modeling approaches. Another common element is the 25 *public land value* statements from Section 2, used in Chapter 3 and Chapter 4. For Chapter 3, the statements are an integral part of the statistical model, but interpretation of the results is

facilitated by three summary measures described in the following section of this chapter. These same summary measures are used as part of the explanatory variables in the Chapter 4 statistical model, and one of the management objectives from Section 2 is used as an independent variable. The analysis in Chapter 5 uses three questions from Section 1: (i) total number of trips to a National Forest Grassland, (ii) the National Forest or Grassland they visited most often, and, (iii) the recreation site they visited most often.

As mentioned above, a total of 7,628 surveys were received, of which 780 had no responses for both sets of statements in Section 2 and are dropped from the analysis of Chapters 3 and 4. An additional 1,016 observations that had more five or more missing observations of *public land value* statements were also dropped, resulting in a usable sample of 5,832. For the remaining sample, missing values on are imputed by using the mean value of each geographical group. Missing income observations are similarly imputed, however, education attainment is imputed using multiple imputation methods, a simulation-based technique for missing data.[3]

2.6 Exploratory Factor Analysis of Public Land Value statements

2.6.1 Introduction

Factor analysis is a commonly used statistical method that uses joint variation in large number of variables to potentially isolate down to a small number of unobserved variables, referred to as factors (Afifi and Clark 2004). To facilitate the analysis and describe each factor, I use an orthogonal varimax rotation, which maximizes the squared loadings or percent of variance explained by each variable in the factor (Abdi 2003). The

[3] Multiple imputations use simulated values to replace the missing values in the data. This method is preferred over using the mean value for categorical and bivariate data, such as education and gender (StataCorp 2013).

benefit of this type rotation method is that it re-expresses the factor loadings so that each factor has a small set of variables with large loadings and a large number of variables with small loadings. Finally, I use the standard cut-off of 1.0 in the eigenvalue to retain all meaningful factors (Afifi and Clark 2004) and a cut-off value of 0.45 on factor loadings to identify the set of variables with the highest loading in each factor. This factor loading cut-off value was selected, in part, because four statements appeared with loadings less than 0.45 and in more than one factor. Further, at this cut-off the four dropped statements do not noticeably reduce the reliability score, Cronbach's alpha.

The *public land values* statements were adapted from the 2000 National Survey on Recreation and the Environment [NSRE] (McCollum et al. 2008) and designed to assess the publics' value of National Forests (Shields et al. 2002). The statements are also meant to describe environmental values and are divided into two distinct dimensions of socially responsible *public land values*: i) individual, and ii) management. Individual values define whether nature is valued for its own sake (*biocentric*) or due to some personal benefit (*anthropocentric*); management values define whether the management of natural resources should be passive (*conservationist*) or active (*development*). Values described in the second dimension, management, have greater social impact or are more influenced by social factors, than the first dimension. The corresponding statements are based on the New Ecological Paradigm scale, which measures five aspects of environmental attitudes, a collection of beliefs and behavioral intentions towards the

environment (Milfont and Duckitt 2006).[4] A common description of environmental attitudes is through the use of two dimensions – *Preservation* and *Utilization*. Under *Preservation*, the environment should be protected from human use and alteration, while *utilization* refers to managing resources to meet human needs (Milfont and Duckitt 2006). The environmental psychology literature argues that environmental attitudes are in fact multidimensional, as opposed to single- or two-dimensional (Bengston 1994; Steel et al. 1994; Cottrell 2003; Milfont and Duckitt 2006; Hawcroft and Milfont 2010). These scales are measure values towards the environment, which are assumed to influence attitudes. As such, they are an ideal measure of attitudes, especially with respect to resource management planning (Brown and Reed 2000).

In this section I present the results of an exploratory factor analysis that sought to confirm the two-dimensional assumption from the NSRE. To the best of my knowledge, this is the first empirical attempt to validate this assumption on these statements. I take advantage of a much larger regional sample than the NSRE, which due to the nature of the data generation process, telephone interviews, did not allow all statements to be presented to each respondent (Shields et al. 2002). The data generation process used in my dataset did present each respondent with the full set of statements, making the two-dimensional validation possible. Results show that there are in fact three dimensions, but as is shown below, the corresponding statements for each of the individual dimensions show that they explain separate individual environmental attitudes.

[4] Testing by Dunlap and others (2000) found four factors: one primary and three *subfactors*. Despite this evidence, most researchers interpret NEP results as a one-dimensional scale (Dunlap et al. 2000; Dunlap 2008).

In the following subsection I briefly describe each NSRE *public land value* dimension. I then present the results of the exploratory factor analysis and then conclude with a brief discussion of the results, including the consequences for this investigation and future work.

2.6.2 Individual and Management Public Land Values

Section 2 of the survey contains two sets of statement. The first set deals with the value people place on public lands in general and National Forests in particular; the second set deals with people's opinion regarding the management of National Forests and Grasslands in the Southwestern region. The primary interest in this dissertation is assessing the relationship between environmental attitudes and changes in recreation fees; therefore, I use the first set of statements, 25 in total. Based on the typology developed by Shields et al. (2002), the set of 25 statements can be divided into two dimensions: i) socially responsible individual values (SRIV), statements 1 through 17 in Table 2.2; and ii) socially responsible management values (SRVM), statements 18 through 25 in Table 2.3. All statements are scored using a 5-point Likert scale, from 1 'Strongly disagree' to 5 'Strongly agree'. Each statement also includes a 'Don't know' option that is treated as a missing value (McCollum et al. 2008).

2.6.2.1 Socially Responsible Individual Values

The individual value statements presented in Table 2.2 define individual values as either instrumental (anthropocentric) or intrinsic (biocentric). Although one might be tempted to think that people with anthropocentric values as being anti-environment, an implicit distinction drawn from the NEP, their underlying values are in fact conflicting

and multidimensional (Brown & Reed 2000; Clement & Cheng 2011; Manning et al. 1999; Steel et al. 1994).

Table 2.2 Socially Responsible Individual Values (n = 5832)

	Public Land Value Statements	M	SD
Factor 3 – Personal Conservation Behavior	1 People should be more concerned about how our public lands are used.	4.45	0.99
	2 Natural resources must be preserved even if people must do without some products.	3.91	1.26
	3 Consumers should be interested in the environmental consequences of the products they purchase.	4.22	1.05
	4 I would be willing to sign a petition for an environmental cause.	3.69	1.29
	6 If we could just get by with a little less there would be more left for future generations.	3.95	1.17
	7 Manufacturers should be encouraged to use recycled materials in their manufacturing and processing operations.	4.36	1.10
	8 Future generations should be as important as the current one in decisions about public lands.	4.29	1.12
Factor 1– Environmental Activism	10 People should urge their friends to limit their use of products made from scarce resources.	3.81	1.18
	11 I am glad there are national forests even if I never get to see them.	4.49	1.03
	12 People can think public lands are valuable even if they do not actually go there themselves.	4.48	1.00
	13 I am willing to stop buying products from companies that pollute the environment even though it might be inconvenient.	3.86	1.18
	14 I am willing to make personal sacrifices for the sake of slowing down pollution.	4.02	1.05
	15 Forests have a right to exist for their own sake, regardless of human concerns and uses.	4.03	1.27
	16 Wildlife, plants, and humans have equal rights to live and grow.	3.78	1.41
	17 Donating time or money to worthy causes is important to me. [b]	3.95	1.04
	5 The whole pollution issue has never upset me too much since I feel it is somewhat overrated. [a, b]	3.58	1.40
	9 I would be willing to pay five dollars more each time I use public lands for recreational purposes. [b]	3.35	1.39
	Socially Responsible Individual Values (SRIV) scale	*4.01*	*0.73*

[a] This item is reverse coded to ensure that higher values denote pro-environmental attitudes.

[b] Items are excluded from either factor due to low factor loading.

Individuals with anthropocentric values may support the preservation of nature as long as they derive some benefit from it, a pro-environmental stance according to the NEP. Benefits could be economic, use (recreation), or even existence. Individuals with biocentric values, on the other hand, receive some utility from the existence of nature alone, akin to a spiritual or faith-based benefit. At first glance, there is no apparent difference in these views; utility is derived from nature regardless of what environmental values are held. The difference comes from the trade-offs individuals are willing to make in order to preserve nature, and thus the types of policies they are likely to support.

Spash (2000) argues that willingness to engage in trade-off is an important distinction between the two apparently opposing views towards nature: anthropocentric (utilitarian) and biocentric (deontological). Utilitarian beliefs allows for trade-offs as long as the individual can afford it. Deontological beliefs relax the income constraint, and, to some extent, allow for trade-offs beyond what the individual can afford. This implies that measures of welfare that derive a monetary value of nature may be understated (Ojea and Loureiro 2007). In some cases, deontological belief holders would reject the idea of trade-offs completely. The individual value statements were written with a dichotomy of opinion in mind, such that agreement denotes biocentric values and disagreement anthropocentric values. As Table 2.2 shows, the mean value of the individual value statements implies that people tend to have biocentric individual values. That is, on average, respondents tend to agree with the majority of the statements. To maintain consistency with pro-environmental attitudes, statement 5, '*the whole pollution issue has never upset me too much since I feel it is somewhat overrated*,' is reverse coded. In this case, the mean value of 3.58 indicates that respondents in the region weakly disagree with

the statement, or that the pollution issue does upset them. There are three statements with relatively high mean values, statements 1, 11, and 12. Taken together, they indicate a value for public lands, regardless of use, and for the existence of National Forests. Respondents also tend to value future generations in terms of decisions regarding public lands, are environmentally concerned and are willing to make personal sacrifices.

2.6.2.2 Management values

Management values define whether individuals believe natural resources should be actively (development) or passively (conservation) managed. Both imply an action by the part of the natural resource manager (forester in this case); what differs is the scope of such action. For example, statement 18 says "*We should actively harvest more trees to meet the needs of a much larger human population.*" Clearly, development values imply actions which would seek to extract resources from the forest. Conservationist values also imply action by foresters, not to extract resources, but to preserve them.

One may think that biocentric attitudes imply conservationist values, but this is not necessarily the case. Individuals that hold anthropocentric attitudes also seek to have the resource preserved depending on the nature of the recreation activity they engage in (e.g., Dietz et al. 2005; Manning et al. 1999; Teisl and O'Brien 2003; Thapa and Graefe 2003). Similarly, individuals with biocentric attitudes might wish active management of resources. For example, statement 21 states "*The main reason for maintaining resources today is so that we can develop them in the future if we need to.*" If an individual holds conservationist values, then they would agree with the statement, which implies using the resource at some point in the future, contrary to the spirit of biocentric environmental

attitudes. Agreeing with the statement would inform the manager that action must be taken to preserve the resource today in order to use it at some point in the future.

Table 2.3 Socially Responsible Management Values (n = 5832)

	Public Land Value Statements [a]	M	SD
Factor 2 – Conservationist management values	18 We should actively harvest more trees to meet the needs of a much larger human population.	3.37	1.39
	19 The most important role for the public lands is providing jobs and income for local people.	3.43	1.34
	20 The decision to develop resources should be based mostly on economic grounds.	3.41	1.36
	21 The main reason for maintaining resources today is so we can develop them in the future if we need to.	2.91	1.36
	23 The primary use of forests should be for products that are useful to humans.	3.49	1.37
	24 The Federal government should subsidize the development and leasing of public lands to companies.	3.92	1.38
	25 The government has better places to spend money than devoting resources to a strong conservation program.	3.62	1.38
	22 I think public land managers are doing an adequate job of protecting natural resources from being overused. [b]	2.92	1.18
	Socially Responsible Management Values (SRVM) scale	*3.38*	*0.96*

[a] All statements are reverse coded to ensure that higher values denote pro-environmental attitudes.
[b] Item is excluded due to low factor loading.

To maintain consistency with pro-environmental attitudes, all statements in Table 2.3 were reverse coded. An overall higher mean indicates conservationist management values. Although the mean value does indicate conservationist management values, the effect is not as strong as the biocentric individual values from Table 2.2. Respondents disagree the most with statement 24, "*the Federal government should subsidize the development and leasing of public lands to companies*," and slightly agree with statement 21, "*maintain resources today so we can develop them in the future*." Disagreement with statement 21 is interesting in that, based on individual values, future generations are

important with respect to public lands, but based on management values, resources should be developed for the sake of current generations.

Using the typology developed by Shields et al. (2002) for the National Survey on Recreation and the Environment, mean response levels for the statements indicate that the sample holds biocentric individual values and conservationist management values. That is, on average, respondents show concern for the environment and understand the need to limit how resources are used. For this sample, these values appear to be driven, in part, by current economic concerns and the wish to leave an environmental endowment for future generations.

2.6.3 Results of the Exploratory Factor Analysis

To validate the two-dimensional typology of *public land values*, I use exploratory factor analysis. Factor analysis is a commonly used statistical method that relies on the joint variation in large number of variables to reduce the dimensionality of the data set to a small number of unobserved variables referred to as factors (Afifi and Clark 2004). Because I am interested in finding easily identifiable factors and not to impose specific constraints, as is the case in confirmatory factor analysis, I conduct exploratory factor analysis (Afifi and Clark 2004). To facilitate identifying and describing each factor, I use an orthogonal varimax rotation, which maximizes the squared loadings or percent of variance explained by each variable in the factor (Abdi 2003). The benefit of this type rotation method is that it re-expresses the factor loadings so that each factor has a small set of variables with large loadings and a large number of variables with small loadings. Finally, I use the standard cut-off of 1.0 in the eigenvalue to retain all meaningful factors (Afifi and Clark 2004) and a cut-off value of 0.45 on factor loadings to identify the set of

variables with the highest loading in each factor. This factor loading cut-off value was selected, in part, because statements 5, 9, 17, and 22 appeared with loadings less than 0.45 and in more than one factor. At this cut-off, these four statements are dropped from any factor without meaningfully affecting the reliability score, Cronbach's alpha.

Results of the factor analysis are presented in Table 2.4, including a short summary of the respective statement. For each factor, I present the rotated loading if it is greater than or equal to the 0.45 cut-off value. The last column in Table 2.4 reports the reliability score, or Cronbach's alpha, for the factor, a measure of internal consistency calculated as the square of the correlation between the scale and the underlying factor (Cronbach 1951). The last three rows present the Eigenvalue, percentage of total variance explained, and the factor index value, respectively. The factor index value is the mean value for each of the three factors and is interpreted using the same range that measures the level of agreement to each *public land values* statement, from 1 'Strongly disagree' to 5 'Strongly agree.'

Exploratory factor analysis reveals 3 factor dimensions of *public land values*.[5] Factors 1 and 3 comprise statements from the individual value used in the NSRE scale. Although both have smaller reliability scores than the original dimension, 0.897 compared to 0.865 for Factor 1 and 0.879 for Factor 3, the difference is not that great. Furthermore, together they explain 83% of the variance (69% for Factor 1 and 14% for Factor 3). Factor 2 comprises all but one management value statement and yields a much higher reliability score than the original NSRE dimension, 0.873 compared to 0.863.

[5] Schultz (2001) finds a similar structure for environmental concern in an analysis of college student samples in the US and 10 other countries. Environmental concern is categorized as egoist, altruistic, and biospheric.

Table 2.4 Factor analysis results (n = 5832)

Public Land Value statements	Factors			*Cronbach's*
	1	2	3	*α*
Factor 1: Environmental activism				*0.865*
10 – *Limit use of products from scarce resources*	0.666			
11 – *Glad forests exist*	0.712			
12 – *Public lands are valuable*	0.706			
13 – *Stop buying products from polluting companies*	0.493			
14 – *Make sacrifices to slow pollution*	0.537			
15 – *Forests have the right to exist*	0.712			
16 – *Nature and humans have equal rights*	0.671			
Factor 2: Conservationist management values				*0.873*
18 – *Harvest more trees to meet human needs*		0.604		
19 – *Public lands are there to provide jobs and income*		0.732		
20 – *Develop resources due on economic grounds*		0.755		
21 – *Maintain resource today to develop in the future*		0.539		
23 – *Use forests for products*		0.731		
24 – *Federal government should subsidize development on public lands*		0.648		
25 – *Do not spend money on conservation programs*		0.535		
Factor 3: Personal conservation behavior [a]				*0.879*
1 – *Concerned about how public lands are used*			0.460	
2 – *Preserve natural resources*			0.697	
3 – *Interested in the environmental consequences of products*			0.760	
4 – *Sign a petition for an environmental cause*			0.691	
6 – *Get by with less now for future generations*			0.661	
7 – *Use recycled materials in manufacturing*			0.651	
8 – *Future generations are important in current decisions*			0.649	
Eigenvalue	8.33	1.91	1.72	
Percentage of total variance	0.69	0.16	0.14	
Factor index value [b]	4.07	3.45	4.12	

[a] Statements 5, 9, 17, and 22 are omitted because factor loadings were less than the 0.45 cutoff.

[b] Factor index value is computed as the average value of each factor. Overall mean = 3.88

The *environmental attitudes inventory* scale found in Milfont and Duckitt (2010) is used to label and characterize Factor 1 and Factor 3. The statements that comprise Factor 1, labeled *personal conservation behavior*, denote "taking care to conserve resources and protect the environment in personal every day behavior" (Milfont and Duckitt 2010, 90).

These set of statements deal more with how individuals perceive the environment and environmental concerns, describing a bit more passive behavior.

In contrast, the set of statements that comprise Factor 3, *environmental activism*, describes specific actions that individuals are willing to undertake on behalf of the environment. More specifically, *environmental activism* is "personal readiness to actively support or get involved in organized action for environmental protection" (Milfont and Duckitt 2010, 89).

Factor 2 contains all but one management statement from the NSRE. While I retain the description used in the NSRE, I do rename it for the purpose of this analysis and because it is a reduced scale compared to the original. *Conservationist management values* are views on how public lands should be managed (Shields et al. 2002, 22). The omitted management statement deals with how people perceive the job public land managers are doing to protect natural resources from overuse. The remaining statements deal directly with actions taken to either preserve or develop natural resources on public lands. High values denote support for conservationist natural resource policies, while low values denote support for development policies.

As mentioned earlier, respondents in the region, on average, hold biocentric individual values and conservationist management values. These results are confirmed with the factor index values. With respect to individual values, respondents on average agree with *personal conservation behavior* and *environmental activism*. However, respondents feel stronger about *passive* individual behavior than *active* behavior. In terms of management values, the results are somewhat higher than those measures with the original NSRE scale, 3.45 compared to 3.38.

2.6.4 Discussion

Results of the exploratory factor analysis confirm a separation of statements between individual and management values, revealing two underlying individual values resulting in three factor dimensions. On average, respondents in the region show pro-environmental attitudes, with biocentric individual values and conservationist management values. Estimated mean values for each identified factor dimension confirm this result, but also extend it by showing passive individual values to be slightly preferred over active individual values.

Before concluding this section, I present the mean values for each identified factor dimension at the Regional and state level. I estimate separate models for Arizona and New Mexico (Chapter 3 and 4) and include the factor dimensions to control for environmental attitudes (Chapter 4). As Table 2.5 shows, there is very little difference between the Regional and the state samples. However, *environmental activism* does show a slight, but not statistically significant difference across samples, with the New Mexico sample exhibiting slightly higher agreement with this individual value.

Table 2.5 Mean values of *Public Land Value* dimensions

Public land value dimension	Region [a]	Arizona	New Mexico
Environmental activism	4.07 (0.87)	4.06 (0.87)	4.09 (0.86)
Conservationist management values	3.46 (1.04)	3.45 (1.04)	3.46 (1.03)
Personal conservation behavior	4.13 (0.87)	4.13 (0.85)	4.13 (0.89)
Total observations	5576	2560	3016

Note: Standard deviation in parenthesis.
[a] Excludes observations from Oklahoma and Texas.

Overall, these results are consistent with the national (Shields et al. 2002) and regional (Haefele et al. 2005; Lybecker et al. 2005) NSRE results. The results also show respondents in the sample have more clearly defined individual values than management values. In terms of implications for the rest of this investigation, the sample appears to

show pro-environmental attitudes, which is expected to affect the analysis in Chapter 4. The multiplicity of values and attitudes identified in the next chapter also highlight the importance of not developing policies based on general results. As will be presented in the following chapters, how respondents react to changes in resource policy will depend on other personal characteristics, such as membership to a stakeholder group. Thus, policies should address the concerns of these groups to minimize any potential controversies that may arise during the planning and implementation phase.

Chapter 3 – Using Canonical Correlation Analysis to Identify Environmental Attitude Groups: Impacts for National Forest Planning in the Southwest

3.1 Introduction

In New Mexico and Arizona, the fifth and sixth largest states in the nation, the United States Department of Agriculture's Forest Service (USFS) land accounts for approximately 11 million acres, or 14% of the total of surface area (USFS 2010). In such a large region with considerable demographic diversity, it is important to consider the multiplicity of opinions regarding the environment and natural resource management. This is especially relevant given a recent change in the USFS planning rule that shifts the focus of planning from the traditional multiple-uses of resource model towards ensuring the sustainability of ecosystem services (Federal Register 2012).

It can, therefore, be argued that the new USFS planning framework incorporates two conceptual models of natural resources management: i) a commercial or *multiple-use model* that views resources as commodities that must be used for the benefit of human society (Rolston and Coufal 1991); and ii) a *stewardship of ecosystem services model*, which has a holistic or Leopoldian view of resource management that considers the natural environment, and current and future generations, integral components of the planning process (Kennedy and Koch 2004; Steel et al. 1994). This represents a notable departure from the traditional model of forest management that focused solely on *multiple-uses* (Kennedy and Koch 2004) and is expected to change how policy impacts are measured (Ruhl 2010).

One possible key to finding balance between the *multiple-uses* and the *stewardship of environmental services model* of forest management is an improved understanding of the full range and complexity of the environmental values of the general public, resource users, and other stakeholders. In the context of resource planning, values are assumed to

influence attitudes (McFarlane and Boxall 1996) and are helpful in predicting the public's reaction to changes in forest policy (Bengston 1994; Tarrant et al. 2003). That is, they are a means of describing environmental attitudes, the beliefs and behavioral intentions towards the environment (Milfont and Duckitt 2006). In this context, values represent an ideal measure of attitudes especially as they relate to resource management planning (Brown and Reed 2000) and a sustainable relationship towards the environment (Dietz et al. 2005) in the presence of heterogeneous population groups (Clement and Cheng 2011; Fischer 2010).

There is no single or simple approach to trying to get a handle on the multiplicity of values that might exist in a regional population, and distill them down to a set of distinct, identifiable attitudinal groups for planners. The contribution of this analysis is to make use of the unique household survey dataset described in Chapter 2. More specifically, in this chapter I use a combination of statistical methods to identify a robust set of general environmental attitudinal groups present in the regional population. The primary statistical method used and focused here, canonical correlation analysis (CCA), considers multi-variate sets of *public land value* statements and demographic characteristics simultaneously. In addition, the three factor dimensions identified and described in Chapter 2 are used to help characterize the latent relationships revealed by CCA. Technically, CCA is used to identify the latent relationships in the data, found by assigning weights to each variable in the multi-variate sets that represents the highest level of correlation between them, with each relationship being unrelated to all others. A description of each latent relationship is done by observing the size and sign of the weights for each variable.

CCA results provide a detailed description of seven statistically distinct environmental attitudinal groups in the Southwestern Region, described in summary form for both their *public land values* and demographic characteristics. By using demographic variables, I control for social and personal aspects that are likely to influence environmental attitudes (de Groot et al. 2002). Further, since long-term policies must also address how changes in demographic characteristics are likely to affect future management plans (Larson et al. 2011; Shinew et al. 2006), this analysis matches census projections to the environmental attitudes identified in CCA results. Results reveal a preference towards development management policies, but with a clear understanding of how such policies would impact the environment, which is largely consistent with the current overall Forest Service policy of sustainability of both ecosystem services and multiple-uses of natural resources (Federal Register 2012).

3.2 Background

Forest management planning, with its requirement for public input, benefits from an improved understanding of the full range and complexity of public values and attitudes (Minteer and Manning 1999; Spash 2006) to help minimize objections to planning efforts (Bengston 1994; Tarrant et al. 2003).[6] Such understanding can be the means of assessing the impact of changes in resource policy, recreation amenities and facilities, and non-use values of public lands (Clement and Cheng 2011; Kotchen and Reiling 2000; Minteer and Manning 1999), or of revealing the desirability to changes in policy and willingness to

[6] The National Forest Management Act (NFMA) of 1976 requires public input in the development, review, and revision of management plans. Plans are revised when conditions change, or at least every fifteen years, at the Forest, Regional, and National levels.

engage in trade-offs of environmental goods and services (Bengston 1994; Dietz et al. 2005; Spash 2006). It is also useful in shaping policy if value dimensions are connected to the set of demographic characteristics of values considered (Bengston 1994; Minteer and Manning 1999; Stern 2000).

Developing policies that align with the public's preferences is challenging but necessary to minimize conflicts, which means that management plans should reflect national concerns as well as local attitudes (Clement and Cheng 2011; Fischer 2010). Region 3 is unique in its demographic diversity: 6% of the population is Native American, 30% of households are Hispanic, and around 14% of households live in rural areas. The characteristics of the region lead to an expectation of diversity of environmental values and attitudes. Hence, forest managers must take special care in designing plans that ensure the best possible collaboration with the community to reduce any conflicts with the public (Allen et al. 2009). And, as noted, long-term policies must also address how changes in demographic characteristics are likely to affect future management plans (Larson et al. 2011; Shinew et al. 2006).

This investigation uses the set of 25 value statements presented in Table 3.1. Specifically, *public land values* are derived from a set of statements similar to those used in the Forest Services' 2000 National Survey on Recreation and the Environment (NSRE) and adapted to Region 3. The NSRE statements use a two-dimension typology to characterize values towards the environment: individual and management.[7] Individual values identify environmental attitudes as being either biocentric or anthropocentric.

[7] Explicit separation of an individuals' perception of their personal and societal behavior is done despite the one-dimensional nature of the NEP scale, an assumption that has been challenged empirically (Milfont and Duckitt 2010).

Management values identify attitudes towards natural resources management as either conservationist or development (Shields et al. 2002).

Table 3.1 *Public Land Value* statements (n = 5,832)

	Public Land Values	Mean (*SD*)
Individual values		
1	People should be more concerned about how public lands are used.	4.45 (*0.99*)
2	Natural resources must be preserved, even if some people must do without some products.	3.91 (*1.26*)
3	Consumers should be interested in environmental consequences of the products they purchase.	4.22 (*1.05*)
4	I would be willing to sign a petition for an environmental cause.	3.69 (*1.29*)
6	If we could just get by with a little less there would be more left for future generations.	3.95 (*1.17*)
7	Manufacturers should be encouraged to use recycled materials in their manufacturing and processing operations.	4.36 (*1.10*)
8	Future generations should be as important as the current one in decisions about public lands.	4.29 (*1.12*)
10	People should urge friends to limit their use of products made from scarce resources.	3.81 (*1.18*)
11	I am glad there are national forests even if I never get to see them.	4.49 (*1.03*)
12	People can think public lands are valuable even if they do not actually go there themselves.	4.48 (*1.00*)
13	I am willing to stop buying products from companies that pollute the environment even though it might be inconvenient.	3.86 (*1.18*)
14	I am willing to make personal sacrifices for the sake of slowing down pollution.	4.02 (*1.05*)
15	Forests have a right to exist for their own sake, regardless of human concerns and uses.	4.03 (*1.27*)
16	Wildlife, plants, and humans have equal rights to live and grow.	3.78 (*1.41*)
Management values [a]		
18	We should actively harvest more trees to meet the needs of a much larger human population.	3.37 (*1.39*)
19	The most important role for public lands is providing jobs and income for local people.	3.43 (*1.34*)
20	The decision to develop resources should be based mostly on economic grounds.	3.41 (*1.36*)
21	The main reason for maintaining resources today is so we can develop them in the future if we need to.	2.91 (*1.36*)
23	The primary use of forests should be for products that are useful to humans.	3.49 (*1.37*)
24	The Federal government should subsidize the development and leasing of public lands to companies.	3.92 (*1.38*)
25	The government has better places to spend money than devoting resources to a strong conservation program.	3.62 (*1.38*)

[a] All items were reverse coded to ensure higher scores represent pro-environmental attitudes.

Scale: 1 = 'Strongly disagree'; 2 = 'Somewhat disagree'; 3 = 'Neutral': 4 = 'Somewhat agree'; 5 = 'Strongly agree.'

The NSRE was a national survey administered through telephone interviews, receiving 7,069 responses out of a sample of 50,000 households (Shields et al. 2002). This method limited the time the researcher had to elicit information from the respondent, resulting in an incomplete coverage of *public land value* statements in the national sample. For example, the NSRE sample from Region 3 consisted of only 176 households, with an average of 50 responses per statement (Haefele et al. 2005). In contrast, this analysis uses data generated from a mail/internet survey format that allowed each respondent to be presented with all *public land value* statements. As discussed in Chapter 2, an unintended consequence of this greater coverage is the ability to validate the two-dimensional assumption of *public land values*. Furthermore, the significantly larger sample available in this study (11 times larger than the NSRE sample for Region 3) permits the use of statistical methods that can better capture the complexity of values towards National Forests and Grasslands in the Southwest.

3.3 Survey Data and Descriptive Statistics

For this analysis I use two sections: i) *Management of National Forests and Grasslands*, and ii) *Background characteristics*. The first section contains two sets of statements on the value for public lands and management objectives for National Forests and Grasslands, of which I use the set of statements on the value for public lands (see Table 3.1). The second section includes the demographic information presented in Table 3.2, such as income, education, gender, etc.

Table 3.2 Descriptive statistics

	Region		Arizona		New Mexico		Min	Max
	Mean	SD	Mean	SD	Mean	SD		
Household income (000's)	72.63	54.97	75.93	56.70	69.81	53.09	30	330
Age	57.20	14.30	57.65	14.04	56.67	14.62	19	99
Hispanic [a]	0.13	0.34	0.07	0.25	0.19	0.39	0	1
Male [a]	0.69	0.46	0.70	0.46	0.67	0.47	0	1
High school, GED, or less[a]	0.17	0.37	0.15	0.35	0.18	0.38	0	1
Some college education[a]	0.26	0.44	0.27	0.44	0.24	0.43	0	1
Bachelors or associate degree[a]	0.31	0.46	0.33	0.47	0.29	0.45	0	1
Graduate education or degree[a, b]	0.27	0.44	0.26	0.44	0.29	0.45	0	1
Years living in the area	23.25	19.71	21.34	18.41	23.90	20.26	0	90
Membership to a natural resource group								
Conservationist [a]	0.11	0.31	0.10	0.30	0.13	0.33	0	1
Producer [a]	0.01	0.11	0.01	0.09	0.01	0.11	0	1
Off-highway vehicle [a]	0.02	0.15	0.03	0.16	0.02	0.13	0	1
Sportsperson [a]	0.09	0.29	0.09	0.29	0.10	0.29	0	1
Hiker/Biker [a]	0.04	0.20	0.05	0.21	0.04	0.21	0	1
Not a member of a group [a]	0.75	0.43	0.76	0.43	0.74	0.44	0	1
Observations	5832		2560		3016			

[a] 0 = 'No'; 1 = 'Yes'.

[b] Omitted category

The data required additional cleaning to generate a usable sample. First, of the questionnaires that were returned, 778 had no responses to any question and are automatically dropped. An additional 1,016 observations are omitted because they contained five or more missing values statements, resulting in a usable data set of 5,832. For the remaining observations, missing public land value statements are imputed using the weighted mean value of the corresponding geographical region. Missing income observations are similarly imputed. Education attainment, a nominal variable, is imputed using a multinomial logistic regression method (StataCorp 2013).

As part of this analysis, I look at state-level results to contrast geographical differences in the sample. As shown in Table 3.2, respondents from Arizona earn a

higher income than the Region average. This result is consistent with the 2000 US Census; however, the mean household income of the sample is much higher than the mean in the Census, which was approximately $60,000 in 2006 after adjusting for inflation. Men are considerably over-represented in the data set; 69% are men compared to 2000 Census numbers of around 49% in the region, 50% in Arizona, and 49% in New Mexico. According to the 2000 Census, Hispanics comprise 30% of households in the Southwest, compared to 13% in the data set. In New Mexico, Hispanics represent 42% of households, and for Arizona they represent 25%. The sample also over-represents the highest levels of education attainment, especially with respect to individuals with a bachelors or associate degree. Finally, the average age in the sample is significantly higher than the 39 years-old average in the Census. A traditional strategy to compensate for over- or under-representation in the sample is to use survey weights. In this case, however, the nature of the statistical instrument, canonical correlation analysis, does not lend itself to incorporating survey weights into the estimation process. The analysis, therefore, does not make any inferences regarding the proportion of different attitudinal groups back to the larger population (i.e., all results and discussions apply to the resulting samples). Despite this, I am able to identify a diversity of attitudinal groups including a mix of environmental attitudes among under-represented groups such as Hispanics and Women.

A final set of demographic characteristics are included in the bottom half of Table 3.2: "membership to a natural resource group." A question in the survey asked respondents to indicate, amongst eight general choices, *whether they belonged to a group that had an interest in natural resources and outdoor recreation*. One of the choices

allowed respondents to specify a group not listed. Two of the choices, conservationist and environmentalist, are grouped into one category, *conservationist*. Among all groups, this last is the most frequently selected with approximately 11% of the respondents. The least selected category is *producer*, followed by *off-highway vehicle* and *hiker*/*biker* groups.

3.4 Methods

3.4.1 Exploratory Factor Analysis

Exploratory factor analysis revealed three factors of *public land values*.[8] The *environmental attitudes inventory* scale found in Milfont and Duckitt (2010) is used to describe Factor 1 and Factor 3. The statements that comprise Factor 1 (statements 1 to 4 and 6 to 8), here labeled *personal conservation behavior*, denote "taking care to conserve resources and protect the environment in personal every day behavior" (Milfont and Duckitt 2010). These set of statements deal more with how individuals perceive the environment and environmental concerns, describing a bit more passive behavior. In contrast, the set of statements that comprise Factor 3 (statements 10 to 16), *environmental activism*, describes specific actions that individuals are willing to undertake on behalf of the environment. More specifically, *environmental activism* is "personal readiness to

[8] While only summarized in this Chapter, full exploratory factor analysis results are available in Chapter 2. The four statements excluded from the analysis are: 5 '*The whole pollution issue has never upset me too much since I feel it's somewhat overrated*'; 9 '*I would be willing to pay five dollars more each time I use public lands for recreational purposes*'; 17 '*Donating time or money to worthy causes is important to me*'; and, 22 '*I think public land managers are doing an adequate job of protecting natural resources from being overused*.'

actively support or get involved in organized action for environmental protection" (Milfont and Duckitt 2010).

Factor 2 (statements 18 to 25) contains all but one management statement from the NSRE. While we retain the description used in the NSRE, it is renamed for the purpose of this analysis and because it is a reduced scale compared to the original. *Conservationist management values* are views on how public lands should be managed (Shields et al. 2002, 22). The omitted management statement deals with how people perceive the job public land managers are doing to protect natural resources from overuse. The retained statements deal directly with actions taken to either preserve or develop natural resources on public lands. High values denote support for conservationist natural resource policies, while low values denote support for development policies.

Estimated mean values for the three dimensions are shown in Table 3. The range of values follow the range used to measure agreement to each statement, that is 1 to 5, from 1 'Strongly disagree' to 5 'Strongly agree.' The results are largely consistent with prior national (Shields et al. 2002) and regional (Haefele et al. 2005; Lybecker et al. 2005) NSRE results. Respondents agree with environmental activism and personal conservation behavior, and weakly agree with conservationist natural resource management. As part of this analysis, the sample is separated by state to analyze nuances in values at a more disaggregated level, despite such differences not being apparent in the overall means. The expectation is that there are underlying differences between the full sample and the state sub-samples (Bengston 1994; Johnson et al. 2004; McFarlane and Boxall 1996).

Table 3.3 Regional and State *public land values*

Public Land Values dimension	Region [a]	Arizona	New Mexico
Environmental activism	4.07 (0.87)	4.06 (0.87)	4.09 (0.86)
Conservationist management values	3.46 (1.04)	3.45 (1.04)	3.46 (1.03)
Personal conservation behavior	4.13 (0.87)	4.13 (0.85)	4.13 (0.89)
Total observations	5576	2560	3016

Note: Standard deviation in parenthesis.
[a] Excludes observations from Oklahoma and Texas, which represented 4.39% of the Regional sample.

The empirical problem is how to sort through the large number of value statements developed in the NSRE and distill down to a set of distinct and statistically significant attitudinal groups. Factor analysis provided the initial step in reducing the dimensionality. To be useful for policymakers, the analysis relates the value statements with demographic characteristics that could influence the level of agreement for each dimension and nuances in held values (Bengston, 1994; Stern, 2000). While initially considered, a simple correlation analysis would, however, only be capable of estimating the pairwise correlation relationships independent of all other variables in the data. Regression analysis is richer because a group of independent variables may be used to explain one single dependent variable. Regression analysis would, however, result in a cumbersome amount of regressions (e.g., especially with the remaining 21 *public land value* statements), depending on the question of interest. Further, regression analysis assumes that the independent variables explain the dependent variable; this method requires distinguishing between the 'dependent' and the 'independent' variables. In some cases, the direction of causality may not be clear-cut, as is the case with the *public land value* statements. Other techniques that can link value-statements to demographic characteristics include cluster analysis and latent class analysis (see Aldrich et al. 2007). However, these methods identify groups in *one* data set with multiple variables based on

common response structures and not the relationships between two data sets, each with multiple variables.

3.4.2 Canonical Correlation Analysis (CCA)

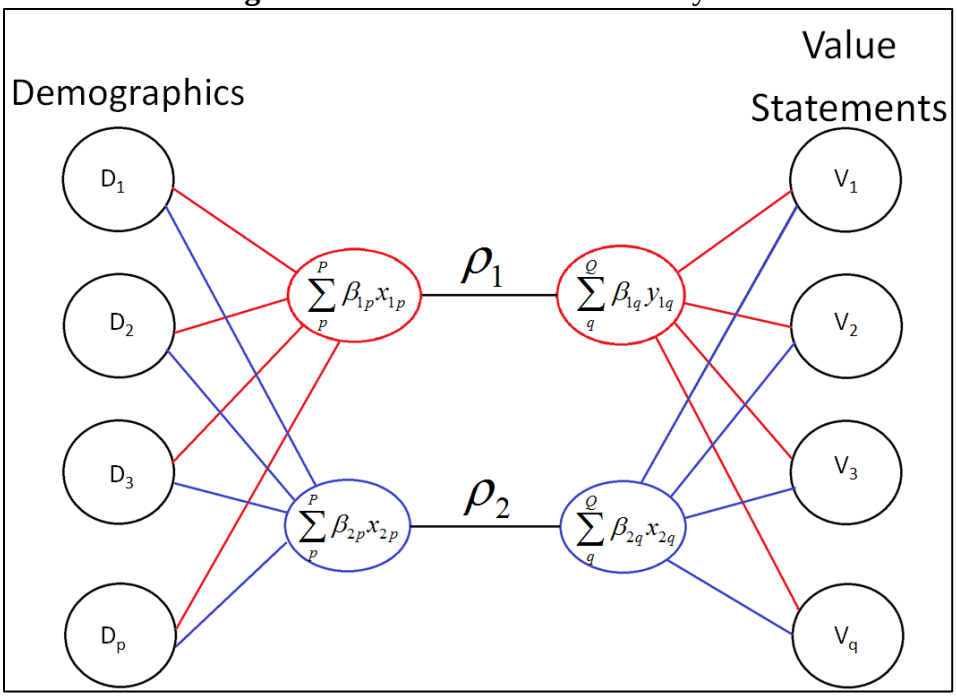
Canonical correlation analysis (CCA), as introduced by Hotelling (1936), is a multivariate data analysis technique that can handle large number variables on both sides of the relationship between a set of variables. The method does not assume a direction of causality (Clark 1975) and is, therefore, an appealing choice of method to identify the diversity of attitudes. By allowing for multiple variables on both the 'dependent' and the 'independent' side of the relationship, CCA allows for a deeper understanding of the connection between environmental attitudes and demographic characteristics than techniques that only have one 'dependent' variable and multiple independent variables.

This analysis uses CCA to examine simultaneously two sets of variables: (i) *public land value* statements; and (ii) a set of demographic characteristics. Individual characteristics are expected to influence the formation of environmental attitudes (Bengston 1994; Stern 2000; Vaske 2001). However, there is uncertainty whether certain demographic characteristics, for example natural resource group membership, are influenced by or influence individual values, so that I am unsure what set of statements and demographic items best describe each latent relationship. It is here that CCA is useful in evaluating and describing the latent relationships between the two set of variables.

As is shown in Figure 4, CCA estimates a coefficient, a canonical loading, for each variable. The linear combination of variables and associated canonical loadings from each variable set is called a canonical variate, and the associated canonical variates of

each variable set form a canonical function. The canonical loadings in each canonical function are estimated to maximize the canonical correlation ($\rho \in [0,1]$) between the canonical variates, while maintaining orthogonality among all other canonical functions.[9]

Figure 4 Canonical Correlation Analysis



Adapted from van der Burg and de Leeuw (1983)

Let **U** be a $(1 \times p)$ vector associated with **X** *public land value* statements and **V** be a $(1 \times q)$ vector associated with **Y** demographic characteristics, where *p* and *q* are the number of variables in each set. For the first latent relationship, (U_1, V_1), CCA estimates the best linear combination of **X** and **Y** variables given by:

$$(3.1)\ U_1 = a_1 X_1 + a_2 X_2 + \ldots + a_p X_p$$

$$(3.2)\ V_1 = b_1 Y_1 + b_2 Y_2 + \ldots + b_q Y_q$$

[9] The *canonical correlation* is not equivalent to the *coefficient of correlation*, i.e., a measure of variance. The variance in CCA can be found by estimating a redundancy index (Afifi and Clark 2004).

Let $\mathbf{\Omega}_{11}$ and $\mathbf{\Omega}_{22}$ be the variance matrix for *U* and *V*, respectively, and $\mathbf{\Omega}_{12}$ be the covariance matrix of *U* and *V*. The linear function with the highest correlation is the linear combination of:

$$(3.3)\ \mathbf{U}_1 = \mathbf{a}_1{}'\mathbf{\Omega}_{11}^{-1/2}\mathbf{X}, \text{ and}$$

$$(3.4)\ \mathbf{V}_1 = \mathbf{b}_1{}'\mathbf{\Omega}_{22}^{-1/2}\mathbf{Y}$$

that maximizes:

$$(3.5)\ \rho_1 = \max_{a,b}\ \mathrm{corr}(U_1, V_1) = \frac{\mathbf{a}'\mathbf{\Omega}_{12}\mathbf{b}}{\sqrt{\mathbf{a}'\mathbf{\Omega}_{11}\mathbf{a}}\sqrt{\mathbf{b}'\mathbf{\Omega}_{22}\mathbf{b}}},\ \text{subject to } var(U_1) = var(V_1) = 1$$

The maximization process works stepwise, determining orthogonal canonical functions with descending canonical correlation values. The maximum number of canonical functions is determined by the number of variables in the lowest dimension data set. The significance of the relationship between the canonical variates of each canonical function is tested using Bartlett's χ^2, which is estimated as:

$$(3.6)\ \chi^2 = -\left[(n-1) - \frac{1}{2}(p+q+1)\right]\ln\Lambda,$$

where *n* is the number of observations, *p* is the number of variables in the lowest dimension data set, and *q* is the number of variables in the data set with the greatest dimension. The variable Λ, Wilk's lambda, is estimated as:

$$(3.7)\ \Lambda = \prod_{i=1}^{p}(1-\rho_i^2), \text{ where } \rho_i \text{ is the } i^{\text{th}} \textit{ canonical correlation.}$$

The null hypothesis is that there is no significant relationship between the canonical variates of each canonical function, that is $\rho = 0$ (Bartlett 1941; Clark 1975). Rejecting the null hypothesis supports the existence of a relationship between the canonical variates, i.e. the canonical function is significant and the set of variables with their

respective canonical loadings describe the characteristics of a group (Afifi and Clark 2004). If the first canonical correlation is significant, then the second is tested by excluding the first canonical correlation in equation (3.7). Testing continues until the null hypothesis cannot be rejected at a specified level of significance (5% level of significance is used here).

Once the model is estimated, and significant canonical functions found, the size and sign of canonical loadings are used to interpret the results. No *t*-test exist for canonical loadings, so it is common to assign a cut-off value for the canonical loadings (Barcikowski and Stevens 1975; Lambert and Durand 1975; Clark 1975). While there is no standard rule, I base the interpretation of the results in this analysis on a cut-off value of 0.10 in absolute value to focus on the most relevant statements and characteristics for each group.

3.5 Empirical Results of the CCA

Table 3.4 shows the results of equation (3.6) for the 14 possible latent relationships (labeled here as Group 1 through Group 14, by ascending order of the size of the canonical loading) for the Region (or pooled sample), Arizona, and New Mexico.[10] Based on the Bartlett test, the first seven groups are statistically significant in the Regional sample and only the first six are statistically significant for the two state samples.

Table 3.4 Bartlett's χ^2 test of canonical function significance

	Regional	Arizona	New Mexico

[10] The total number of possible relationships is 14: 21 public land values statements represent the larger set of variables, compared to the 14 demographic characteristics.

Description	χ^2	d.f.	*p-value*	χ^2	d.f.	*p-value*	χ^2	d.f.	*p-value*
Group 1	2171.20	294	0.000	1073.10	294	0.000	1389.40	294	0.000
Group 2	1463.90	260	0.000	759.11	260	0.000	907.40	260	0.000
Group 3	835.84	228	0.000	496.63	228	0.000	542.45	228	0.000
Group 4	532.51	198	0.000	326.97	198	0.000	366.11	198	0.000
Group 5	373.37	170	0.000	232.99	170	0.001	246.75	170	0.000
Group 6	242.39	144	0.000	178.43	144	0.027	183.59	144	0.014
Group 7	154.55	120	0.018	125.30	120	0.352	132.47	120	0.206
Group 8	109.81	98	0.195	84.47	98	0.833	91.13	98	0.676
Group 9	76.00	78	0.543	59.57	78	0.940	62.82	78	0.894
Group 10	45.60	60	0.916	41.23	60	0.969	42.10	60	0.962
Group 11	29.96	44	0.948	26.10	44	0.985	28.01	44	0.971
Group 12	15.95	30	0.983	13.51	30	0.996	15.23	30	0.988
Group 13	8.04	18	0.978	5.75	18	0.997	7.14	18	0.989
Group 14	3.01	8	0.934	2.07	8	0.979	2.11	8	0.977

The null hypothesis is that there is no significant relationship between the canonical variates.

To confirm these results, the stability of the canonical loadings for each statistically significant group was verified using a split-sample validation process discussed in (McGarigal et al. 2000). The process involves randomly splitting the sample into sub-samples (60/40), and then conducting CCA on each sample split. Finally, the correlation between the canonical loadings of each split with respect to the full sample is estimated to determine the stability of the results.[11] If the loadings are highly correlated, close to 100% in absolute value, then the results of the full sample are stable. As presented in Table 3.5, the groups in the full sample are generally stable for both splits, except the case of Group 6 with respect to the 40% for the Regional sample and 60% for both state sub-samples. As each split was conducted based on random sampling without

[11] I also tested the stability of the results with only the value statements and found only slight differences compared to the results using both statements and demographic characteristics.

replacement, some deviations between the full sample and each split sub-sample should be expected.

Table 3.5 Pairwise correlation verifying stability of CCA

	Region		Arizona		New Mexico	
Split samples	*60%*	*40%*	*60%*	*40%*	*60%*	*40%*
Group 1	99%	24%	99%	79%	99%	0.4%
Group 2	40%	93%	98%	92%	98%	42%
Group 3	98%	93%	89%	78%	89%	53%
Group 4	94%	90%	23%	66%	23%	6%
Group 5	89%	45%	81%	73%	81%	32%
Group 6	93%	4%	0.2%	31%	0.2%	0.3%
Group 7	68%	34%				

Note: All correlations are in absolute value and with respect to full sample results.

3.5.1 Regional Sample

Table 3.6 presents the results for the seven CCA latent relationships (Group 1 through Group 7). Since environmental values are easier to interpret in summary form, I use the three value dimensions presented in Chapter 2 instead of each *public land value* statement to describe the post-estimation results (for the canonical loadings of each statement see Appendix A). The mean value for each dimension is calculated by taking the average value of the canonical loadings corresponding to each *public land value* dimension. Positive values represent average agreement with the value dimension while negative values represent average disagreement. For example, the mean value of *environmental activism* for Group 1 is positive, while for Group 2 it is negative. Therefore, the latent relationship that is described by Group 1 agrees with *environmental activism*, while the latent relationship that is described by Group 2 disagrees. Demographic characteristics are included to facilitate the description and comparison of the latent relationships.

Notwithstanding the cut-off value for loadings of 0.10, I begin by focusing on the groups where the loading for Hispanic, an under-represented group in the sample, to discuss the multiplicity of environmental attitudes in five of the seven groups. This demographic group is traditionally seen as having more anthropocentric attitudes towards the environment (e.g., Johnson et al. 2004). Policy at the regional level for the Southwest must take special care in considering their opinions given their growing share in the population (Campbell 1996; Ortman and Guarneri 2009).

Three of the groups, 1, 3, and 7, represent women and Hispanics. The loading for women is greater than that of being Hispanic for Groups 1 and 7. The loadings for Group 1 indicate that they are better educated and are more likely to be a member of a conservationist group than Groups 3 and 7. Group 3 is more likely to include younger individuals than Groups 1 and 7. Individuals from Group 7 are likely to live in a household that earns a higher income than Group 1, which is also a more important characteristic than in Group 3. This difference informs the level of agreement with respect to the *public land values* and thus the attitudes towards the environment. Whereas Groups 1 and 7 agree with the two individual values and hold conservationist management values, Group 3 disagrees with all three values. Personal conservation behavior is a stronger determinant of environmental attitudes for Groups 1 and 7. What distinguishes these two groups is the natural resource group they are likely members to; in the case of Group 1, they are likely to be members of a conservationist group and Group 7 to a sportsperson group. Overall, Group 1 mean *public land values* are relatively higher than Group 7. In all cases, members of all three groups are likely to be recently arrived to the area.

Table 3.6 Regional CCA results

Value [a]/ Characteristic	CCA Groups						
	1	2	3	4	5	6	7
Environmental activism	0.5049	-0.2890	-0.1756	-0.0778	0.0346	0.2307	0.1463
Personal conservation behavior	0.5317	-0.1710	-0.1969	-0.0525	0.0200	0.0571	0.1699
Conservationist management values	0.4084	0.2258	-0.4934	-0.2285	0.0370	0.0465	0.0670
Household income	-0.1322	0.4386	0.0555	-0.0226	0.0763	0.2567	0.2805
Age	0.0270	-0.3992	-0.6376	0.3474	0.3865	-0.0026	0.0876
Hispanic [b]	0.0552	-0.5102	0.6704	-0.0534	0.3495	0.3601	0.0013
Male [c]	-0.6089	0.1220	-0.0441	0.2327	0.4533	0.0675	-0.4228
High school, GED, or less[d]	-0.1695	-0.5894	0.0286	-0.3206	-0.0613	-0.3227	-0.1094
Some college education [d]	-0.0727	-0.1961	0.0741	0.0597	0.0711	-0.3519	0.2832
Bachelors or associate degree [d]	-0.0554	0.3124	0.0536	0.0916	-0.2193	0.4815	-0.2258
Years living in the area	-0.1327	-0.5060	-0.4316	-0.3868	-0.0417	0.5512	-0.0155
Conservationist	0.6214	0.2870	-0.1294	-0.3554	0.4619	-0.0347	-0.1655
Producer	-0.2664	0.0989	0.0268	-0.3997	0.0862	-0.1177	-0.1455
Off-highway vehicle	-0.2207	0.1306	-0.0366	-0.3278	0.1979	-0.1387	-0.2731
Sportsperson	-0.4116	0.2590	-0.0172	-0.3259	0.3964	0.0432	0.5103
Hiker/Biker	0.1982	0.1190	-0.0922	-0.0939	0.1639	-0.1878	-0.0118
Not a member of any group	-0.0976	-0.3350	0.1459	0.5064	-0.5559	0.1791	-0.1643

[a] Positive values represent greater agreement with the *public land value* dimension.

[b] Positive values denote Hispanic, negative Non-Hispanic.

[c] Positive values denote male, negative female.

[d] Graduate education is the reference category.

The other two Hispanic groups, 5 and 6, characterize males. Members of Group 6 are likely to have resided in the area for some time and are better educated than Group 5 individuals, who are more likely to be a member of natural resource group, especially a conservationist or sportsperson group. Group 6 individuals are more likely to live in a household that earn a higher income and Group 5 individuals are likely older. Another important distinguishing characteristic is the weak level of agreement to the *public land values* by Group 5 and the agreement to only environmental activism by Group 6. Both hold have positive values towards the environment, but the weak overall attitudes from Group 5 may be explained by the greater likelihood of belonging to all or some natural resource groups. In addition to a pro-environmental group, conservationist, and a recreationist group, sportsperson, the response alternatives included two groups that can be characterized as mechanized, off-highway vehicle and hiker/biker, and one that can be characterized as extractive, producer. Each group has slightly different views in terms of the extent to which humans may or should impact the environment, and these dissimilar views are likely leading to contradictory views with respect to how public lands are managed and their attitudes towards the environment (Clement and Cheng 2011).

The final two groups, 2 and 4, characterize Non-Hispanics and generally disagree with environmental activism and personal conservation behavior. Group 2, however, agrees with conservationist management values while Group 4 disagrees. This difference with respect to management values could be in part due to individuals from Group 2 being more likely to be members of a conservationist or sportsperson group. Differences are also likely due to individuals from Group 2 being better educated, younger, and belong to households that earn a higher income than individuals from Group 4. Overall,

both groups tend to disagree with individual *public land values*, but members of Group 2 hold more pro-environmental attitudes than Group 4 in terms of natural resource management.

3.5.2 Arizona and New Mexico samples

The corresponding canonical loadings for the *public land values* statements for the two state samples can be found in Appendix A. Similar to the full sample results, the focus of the state results is centered on Hispanics, given their relative share of the population and growing influence. Nuances in identified latent relationships for Hispanics are more apparent in the Regional and New Mexico results. There is a balance of relationships representing older respondents in the Regional and Arizona samples, and more relationships with younger respondents in the New Mexico sample. Respondents that have lived in the area the longest are more represented in Arizona results. Arizona also has more groups that agree with conservation management values and environmental activism.

3.5.2.1 Arizona Results

Table 3.7 presents mean values for each of the six CCA latent relationships for Arizona (Group 1 through Group 6). Groups 1, 4 and 6 characterize the environmental values of primarily female groups. Groups 1 and 6 are older, while Groups 4 and 6 are Non-Hispanic, and all live in households that earn a low income. Members of Group 6 are better educated than Group 4, which in turn are better educated than Group 1. Groups 1 and 4 are less likely to be members of any natural resource group, while Group 6 is more likely. Individuals from Group 6 are less likely to have lived in the area for some time compared to Groups 1 and 4. Group 1 generally agrees more with all three

dimensions of *public land values*, with the two individual dimensions being more important than the management dimension. Members of Group 4 agree more strongly with conservationist management values, which could be due to their higher likelihood of not being a member of a natural resource group. Group 6 only agrees with environmental activism.

Hispanics are also represented in Group 5. They are likely to be young, earn a high income, hold a membership to a natural resource group, including conservationist and off-highway vehicle, have either some college or a graduate degree, and have lived in the area for some time. They generally agree with environmental activism and conservationist management values and but disagree with personal conservation behavior. Of the three values, personal conservation behavior appears to be the most relevant and environmental activism the least. Their attitudes appear to be driven by their membership to a natural resource group; agreement with the conservation of natural resources could be due to membership to a conservationist group or to groups that favor access and use the National Forests.

Groups 2 and 3 generally earn a higher income, have the same level of education, but differ with respect to age (Group 2 is younger) and membership to a natural resource groups (Group 3 is more likely to hold a membership). Members of Group 3 generally agree with all three values, with conservationist management values being the most important for them. Members of Group 2 disagree with both individual values, but view agreeing with conservationist natural resource management values as more important. The difference with respect to age and income appears to define the different values towards public lands.

Table 3.7 Arizona CCA results

Value [a]/ Characteristic	CCA Groups					
	1	2	3	4	5	6
Environmental activism	0.5657	-0.0977	0.2524	0.0049	0.0490	0.0599
Personal conservation behavior	0.5469	-0.0138	0.1302	0.0597	-0.1151	-0.0117
Conservationist management values	0.3548	0.2065	0.5569	0.1083	0.1072	-0.0490
Household income	-0.1884	0.4323	0.2344	-0.0309	0.1209	-0.1550
Age	0.1440	-0.4041	0.4327	-0.6095	-0.3211	0.2426
Hispanic [b]	0.1795	-0.2670	-0.5622	-0.1853	0.2227	-0.4098
Male [c]	-0.6418	0.0128	0.0179	-0.4997	0.0408	-0.4320
High school, GED, or less [d]	0.0732	-0.6466	-0.0469	0.1138	0.1998	-0.0622
Some college education [d]	-0.0125	-0.2015	-0.1212	-0.1479	0.2352	0.4500
Bachelors or associate degree [d]	-0.1472	0.3096	0.0854	0.2529	-0.1475	-0.1051
Years lived in the area	0.0750	-0.4743	0.5676	0.2029	0.1118	-0.4657
Conservationist	0.5045	0.4711	0.2781	-0.2133	0.3817	-0.0704
Not a member of any group	0.0131	-0.2690	-0.3150	0.1472	-0.4663	-0.1281
Producer	-0.1526	-0.0214	0.0419	0.1482	0.1599	0.1576
Off-highway vehicle	-0.3392	-0.0337	0.0865	-0.0686	0.6419	0.1555
Sportsperson	-0.5299	0.0808	0.2161	-0.0057	0.1382	0.1592
Hiker/Biker	0.1097	0.1005	0.1011	-0.2472	0.2291	0.1178

[a] Positive values represent greater agreement with the public land value dimension.

[b] Positive values denote Hispanic, negative Non-Hispanic.

[c] Positive values denote male, negative female.

[d] Graduate education is the reference category.

3.5.2.2 New Mexico Results

Results presented in Table 3.8 indicate that all New Mexico groups likely disagree with all three *public land value* dimensions. This is an interesting departure from the Regional and Arizona samples and implies a different approach towards policy in this state, where management values are seen as most important. Another difference with the sample is the propensity to favor either membership to an extractive natural resource groups or to no group at all. Most groups are characterized as being young or well educated.

Older respondents are characterized in Groups 1 and 6. There is a clear distinction between both groups with respect to *public land values* and gender. Group 6, characterized as female, environmental activism is the only value that appears to define environmental attitudes. In contrast, Group 1, characterized as male, Hispanic, that have lived in the area for some time, defines environmental attitudes with all three *public land values*, with conservationist management values being the most important. Group 1 is either not likely to be a member of a group, or a member of a producer or sportsperson group. Group 6, on the other hand, exhibits weak likelihood for any natural resource group category. Individuals from both groups are likely to live in households that earn a lower income and both have a low level of education. Overall, the defining characteristic between these two groups is gender. Environmental attitudes for the female group (Group 6) are defined by environmental activism, whereas for the male group (Group 1), it is conservationist management values and passive individual values.

Table 3.8 New Mexico CCA results

Value [a]/ Characteristic	CCA Groups					
	1	2	3	4	5	6
Environmental activism	-0.1609	-0.5630	-0.1212	-0.0754	-0.0327	-0.1765
Personal conservation behavior	-0.2959	-0.4828	-0.1502	-0.1913	-0.0427	-0.0510
Conservationist management values	-0.4802	-0.0624	-0.3501	-0.2976	0.0053	-0.0177
Household income	-0.1488	0.4192	0.1955	0.1681	-0.0870	-0.0144
Age	0.1572	-0.2930	-0.6572	-0.1102	-0.4694	0.0192
Hispanic [b]	0.3814	-0.4669	0.6147	0.0949	-0.2911	-0.3261
Male [c]	0.3660	0.4459	-0.0871	0.0032	-0.4306	-0.1475
High school, GED, or less[d]	0.5250	-0.2645	0.0784	-0.3163	0.1141	0.2262
Some college education [d]	0.1930	-0.0966	0.0874	0.0581	-0.0780	0.5358
Bachelors or associate degree [d]	-0.0984	0.2271	0.0574	0.1930	0.2013	-0.3823
Years lived in the area	0.4731	-0.3448	-0.3131	-0.3138	0.2147	-0.4230
Conservationist	-0.6290	-0.1946	0.1450	-0.5343	-0.1601	-0.0017
Not a member of any group	0.3051	-0.2077	-0.1371	0.7067	0.3448	-0.1293
Producer	0.1740	0.3280	0.1440	-0.4792	0.1706	-0.0585
Off-highway vehicle	0.0114	0.1946	0.0548	-0.2884	-0.0781	0.0690
Sportsperson	0.1110	0.4057	0.1596	-0.4003	-0.3609	-0.1697
Hiker/Biker	-0.3054	-0.0217	0.0206	-0.2078	-0.0353	0.0659

[a] Positive values represent greater agreement with the *public land value* dimension.

[b] Positive values denote Hispanic, negative Non-Hispanic.

[c] Positive values denote male, negative female.

[d] Graduate education is the reference category.

Individuals from Groups 2 and 5 are characterized as Non-Hispanic. Individuals in both groups are likely males, young, and a member of a producer group. These groups differ with respect to the *public land values*. For Group 2, both individual values are important in defining environmental attitudes, with environmental activism being the most important. In contrast, Group 5 is harder to define, as they show weak overall agreement to all three, and it is demographic characteristics that distinguish the differences between these two groups. Individuals from Group 5 are likely to come from households that earn a low income, and have lived in the area for some time. Both groups are well educated, but individuals from Group 2 are likely to be members of off-highway vehicle or sportsperson groups. In fact, individuals from Group 5 are more likely not to be a member of any group, and thus have no real attachment to the environment, compared to the more active Group 2.

Individuals from Groups 3 and 4 are young women that live in households that earn a high income, have recently arrived to the area, and are Hispanic. For both, conservationist management values are more important in defining environmental attitudes, followed by personal conservation behavior. However, in contrast to Group 3, Group 4 finds environmental activism unimportant. Individuals from Group 4 are better educated and are likely not to be members of any natural resource group. Individuals from Group 3, on the other hand, are likely to be members of a conservationist, producer, or sportsperson group. Thus, like all other groups, environmental attitudes appears to be determined by membership to a natural resource group. Those groups whose environmental attitudes are defined by most *public land value* dimensions are also likely

to be members of multiple groups. It is this apparent interest in how natural resources are managed that is likely to lead to greater involvement into forest policy issues.

3.5.3 Discussion

One of the benefits of using canonical correlation analysis (CCA) to identify and characterize latent attitudinal groups is the ability to describe the multiplicity of environmental attitudes using demographic characteristics. For example, women, who have been traditionally characterized as having strong pro-environmental attitudes (Mobley et al. 2010; Steel et al. 1994), have shown a wider range of environmental attitudes in this analysis. Their views are informed by other personal characteristics, like age, education, and membership to a natural resource group.

Hispanics is a group that has been traditionally characterized as having weak pro-environmental attitudes, with differences usually discussed in terms of simple contrast between native and immigrant (Cordell et al. 2002; Johnson et al. 2004). The results in this analysis show Hispanics are indeed not one homogenous group with respect to environmental attitudes. Of the five groups that were characterized as Hispanic in the Regional sample, two describe Hispanic men, both of which have pro-environmental attitudes. Of the remaining three groups, one describes young women with anti-environmental attitudes and the other two older women with pro-environmental attitudes. More importantly for policymakers, Hispanic groups tended to have weak conservation management values, implying greater support for development policies than for conservationist policies.

The results show differences between the Region and state samples. Based on the typology used in Shields et al. (2002), most groups in Arizona and the Regional samples

have biocentric individual attitudes, and more importantly for policymakers, generally conservationist management values. In contrast, for the New Mexico sample, individual values are generally anthropocentric and management values are oriented toward developing natural resources. The Arizona sample yields groups that have more pro-environmental attitudes, while the New Mexico sample yields the opposite. The environmental attitudes for the New Mexico sample are defined, primarily, by membership to a natural resource group, implying a greater likelihood of concerns about issues regarding National Forest based on their involvement with stakeholder groups. These results suggest that state-specific natural resource policies should be pursued, with a regional focus towards conservationist natural resource management and an emphasis of working with stakeholder groups to generate consensus with the public. It is important to note that these inferences are based on the samples.

Higher levels of education are associated with stronger pro-environmental attitudes (Cottrell 2003; Mobley et al. 2010). Most groups tend to have a higher level of education than High School, consistent with the distribution in the data set. However, education attainment seems to be a weak indicator of *public land values*, consistent with empirical evidence of the weak association between education and environmental concern (McFarlane and Boxall 2000; Olli et al. 2001). The one interesting characteristic amongst most groups is membership to a natural resource group, which has been found to be an important determinant of environmental attitudes (McFarlane and Boxall 2000). This means that membership to natural resource and/or user groups are an indicator of concern for issues regarding public lands, requiring some consideration on the part of the Forest Service in discussions to changes in policy. However, caution must also be taken

when addressing these groups, as they are likely to have conflicting views on how resource should be managed and the degree to which recreations sites should be developed (Cutter et al. 2007).

3.6 Environmental Attitudes and Demographic Projections

The inclusion of demographic characteristics clearly reveals diversity in *public land values*. Over the long-run, the consequences of these findings, as they relate to projections from the 2000 U.S. Census, are discussed in this section. The area of study, Region 3 of the Forest Service, is unique, diverse, and is expected to grow in the coming decades (Day 2007; Lybecker et al. 2005). As the demographic characteristics of the region change over time, forest planners must be aware of the consequences in the use of National Forests and Grasslands and changes in attitudes towards the environment and resource management policies (Cordell et al. 2002; Johnson et al. 2004).

Using values is ideal in this context, as they influence behavior and attitudes towards the environment (Dietz et al. 2005; Tarrant et al. 2003) and are considered more stable over time (Manning et al. 1999; Stern et al. 1995). Differences in state-level results show that a one-size fits all approach towards management would not address local attitudes and preferences (Clement and Cheng 2011; Fischer 2010). Certain demographic characteristics exhibit general attitudes towards the environment; for example, Hispanics appear to disagree with conservationist management values, favoring development policies. Projected changes in the demographics of the area of study mean that looking forward current conservationist policies would have to be shifted towards a greater development of resources.

Over the next decades, the median age is expected to increase (Vincent and Velkoff 2010). Hispanics, the second largest group in the Western part of the United States (Campbell 1996), are expected to see their share of the population continue to grow (Ortman and Guarneri 2009). In New Mexico, women will continue to outnumber men (Census 2005a), but in Arizona, there is an expected shift towards more men (Census 2005b). Women are more likely to belong to a group with pro-environmental attitudes. For all samples, individual values matter most for women. Management values matter the most for men in the state samples, while for the Regional sample it is individual values. Women are expected to achieve higher growth in educational attainment than men (Day and Bauman 2000). The average level of education is also expected to increase amongst Hispanics (Day and Bauman 2000). Higher levels of education are related to conservationist management values, so that its influence on environmental attitudes will grow over time.

The Southwest is expected to see net domestic migration (Perry 2006). Hispanic groups are well represented in the Regional and New Mexico results, despite being underrepresented in the sample. In both the Regional and Arizona results, Hispanics tend to agree with *public land values* and disagree in the New Mexico sample. Individual values are most important in the Regional and Arizona samples, while management values matter most in the New Mexico sample.

Length of residency is another important variable in the New Mexico and Regional samples, denoting an importance that *place attachment* has on values.[12] Greater place

[12] *Place attachment* is a connection or bond to a particular place that does not generalize from area to area (William and Vaske 2003).

attachment, in this case using length of residency as a proxy, has been found to generate greater value towards recreation areas (Williams and Vaske 2003). There are more groups with recently arrived respondents in the New Mexico and Regional samples. Respondents with a longer residency generally agree with individual and management values in the Regional and Arizona samples. Individual values matter most for respondents that have lived longer in the area for the Regional samples, while both states samples show a balance between individual and management values.

For younger respondents, individual values matter most in the Regional sample, management in the Arizona sample, and mixed in the New Mexico sample. Younger respondents tend to disagree with individual values and agree with management values for the Regional and Arizona samples. Older respondents hold similar views towards management values in both samples, but tend to agree with individual values. Individual values are most important for older respondents in the Regional and New Mexico samples.

In the coming decades, the groups discussed in this section are expected to have greater impact on the overall environmental values of the Region, which will have an impact environmental attitudes and visitation patterns to National Forests and Grasslands (Chavez and Olson 2009; Cordell et al. 2002). Assuming that migration into the region is indicated by a shorter length of residency, it is recommended that region-level and Arizona policies focus on conservation of natural resources, while development policies should be pursued for New Mexico. Based on the results for the sample, similar policies would be acceptable to Hispanics, men, younger and older respondents. Unlike men, women in New Mexico would favor conservationist natural resource management

policies. Projected growth in the main demographic characteristics suggest that including conservationist management policies may be critical in designing acceptable forest plans, however, this must be balanced with some development policies.

3.7 Conclusions

Canonical correlation analysis (CCA) has identified seven distinct attitudinal groups across the region and six groups in state sub-samples, connected to both *public land value* statements and their demographic characteristics. There are similarities across certain groups when focusing on the three key value statement dimensions and demographic characteristics. In contrast to CCA, a simple regression analysis, or even the use of correlation tables, would not identify the nuances that can impact public responses to forest management. The analysis takes advantage of a preliminary factor analysis of the *public land value* statements to isolate three key value dimensions: (i) environmental activism, (ii) personal conservation behavior, and (iii) conservationist management values. Along with demographic characteristics, these three value dimensions are used to evaluate the multiplicity of public land values in the Southwest.

Overall, results indicate that most groups hold pro-environmental attitudes, with greater agreement for conservationist management values, followed by personal conservation behavior and environmental activism. CCA also reveals differences between the Regional and state samples (AZ and NM). For both the Regional and Arizona samples, environmentally active values are more important, while in the New Mexico sample, it is personal conservation behavior. This appears to explain the general attitudes among all identified groups in the Regional and Arizona sample that favor conservation management policies, compared to development management policies that

are preferred among groups from New Mexico. Therefore, forest planners should consider low-impact resource development policies that would not force environmental protest behavior by the public.

For policymakers, these results are important as they define a direction for resource management policy. There are certain personal characteristics amongst the identified groups that appear to be linked with support or agreement to environmental activism and conservation behavior: older age and living long in the area. Individuals who have lived in the region for some time are more likely to be environmentally active and supportive of environmental stewardship policies of public lands. This is an interesting result, as younger individuals were expected to have the most pro-environmental attitudes. An effort should be taken by regional and local planners to address their concerns regarding the direction of current policy and to seek their input during the development of future management plans. Planners should also consider the views of stakeholder groups to generate support for current resource policy and to determine the possible direction of development on public lands. Additionally, passive environmental behavior and support for conservationist policies suggests that low-impact policies would be favored by most groups.

But most basically, perhaps the key message is that there are no simple characterizations to the seven distinct, identifiably attitudinal groups from this analysis. What is clear is that simple bifurcations or single dimension stereotypes (e.g., along gender or race and ethnicity) don't exist. On the other hand it is clear that planners should never fall into the trap that there are somehow an infinite or countless number of

attitudinal groupings. The number of statistically distinct attitudinal groups in Region 3 is a little more than a handful, but it is a complex mix.

The articulated goals of the Forest Service include achieving sustainability by "integrating environmental, social, and economic issues and values" (USFS 2007). The current planning rule underlines the need to combine historical consideration of multiple use, with consideration of stewardship of ecosystem services (Federal Register 2012). Demographic projections suggest that the Forest Service is justified in pursuing such planning efforts at a regional level. Forest planners must design resource management guidelines that address local concerns and a complex mix of values and attitudes. Ideally, conservation programs must accompany natural resource development policies, with an understanding of the benefits to the public. What is clear is that planners must engage in greater outreach to local communities and stakeholder groups and engage in an on-going discussion about the effect of policy on the environment.

One weakness in the analysis is the inability to discuss the results in the context of a population-wide analysis. However, as discussed in Chapter 2, the data generation process suffered from low response rate, which is not unexpected in general population surveys (Connelly et al. 2003; Deaton 1997). Given the importance of stakeholder groups in the results, prior contact with them may have resulted in greater awareness among a group of individuals that would be more directly impacted by changes in forest management policy. Therefore, we would suggest future research involve stakeholder groups, both at the development phase of the survey, and in generating interest about the research project.

Chapter 4 – Accepting higher recreation fees at National Forests and Grasslands in the Southwest: the role of Environmental Attitudes

4.1 Introduction

A recent change in the national planning rule directs Forest Service managers to consider ecosystems services as they develop natural resource management plans (Federal Register 2012). One of the many benefits of ecosystems services provides is outdoor recreation, which promotes human well-being, health, and social relations (Millennium Ecosystem Assessment 2005). In order for the public to benefit from recreational ecosystems services, the Forest Service needs to attract visitors to public lands by providing an expected level of recreational services. These can include a wilderness experience, closeness to nature, developed parking facilities, security, etc. For many individuals, recreation on public lands provides a way of relieving stress and gathering with family (Chavez 2001; Chavez and Olson 2008; Burns et al. 2008). An understanding of preferences and values towards the environment is, therefore, necessary for the Forest Service as it attempts to achieve a consensus with the public for its forest management plans (Park et al. 2010).

Financial resources are necessary to implement plans that maintain and enhance ecosystem and recreational services. One source of funding is recreation fees authorized by the Federal Lands Recreation Enhancement Act (REA). According to the REA, to be able to collect fees a recreation site must provide, at the minimum, a specified set of amenities and facilities that enhance the visitor experience; these include developed parking areas, permanent restroom facilities, permanent trash receptacles, interpretive signs and/exhibits, picnic tables, and security. Fees are used fund maintenance, volunteer, and conservation programs, improved signage, or other improvements necessary to enhance the visitor experience. Most of the funds that are collected, up to

80%, must be spent on the site where they are collected, and the remainder 20% is available at the discretion of the public land agency (Bureau of Reclamation, Bureau of Land Management, Fish and Wildlife Service, National Park Service, and Forest Service). Of the approximately 20,800 recreation sites on Forest Service managed lands, only 4,000 collect fees under REA (USDOI and USDA 2012).[13]

The REA is set to expire within the next year, and given reduced appropriations and uncertainty on the renewal of this legislation, it is important for policymakers to determine whether a reasonable "visitor experience" and the protection of the environment can be funded through recreation fees and is acceptable to the public. Policymakers should also consider the impact that environmental attitudes have on the intention to pay for ecosystem service benefits (Liebe 2010; Meyerhoff 2006).[14] The purpose of this chapter is to determine how environmental attitudes affect the likelihood of accepting changes in recreation fees on a sample of households in the Southwestern region of the Forest Service (Arizona, New Mexico, Oklahoma, and Texas). I do not measure how high fees should go, which is more difficult to precisely determine (Rollins and Trotter 1999); instead I measure the degree of acceptance or rejection using two statements measured with a five point Likert-scale.

One statement concerns a fixed increase in user fees of $5 more each time public lands are used for recreation, the other statement does not set an amount but seeks to determine the importance of fees to support public lands. I also use the three summary

[13] In the Southwestern region of the Forest Service, approximately 504, or 34%, recreation sites charge a fee.

[14] Meyerhoff defines "intention" as *the most immediate and important predictor of a person's behavior* (p. 210).

dimensions of *public land values* discussed in Chapter 2 to control for the effect that environmental attitudes have on the level of acceptance or rejection. In identifying values and attitudes, care must be given to account for how beliefs are shaped by social and other external factors (Fischer 2010). Beliefs inform individuals about the state of the world and values influence their worldview, both of which are important in shaping attitudes towards the environment (Ajzen 1991; Dietz et al. 2005).

4.2 Background

Critics of recreation fees argue that no fees should be collected on public lands, or that, given this source of revenue, budget appropriations to public land management agencies should be reduced (Bengston and Fan 2001). In the case of the Forest Service, there has been added criticism, and a successful court challenge, to the practice of designating certain areas as High Impact Recreation Areas (HIRAs). [15] HIRAs comprise multiple recreation sites within a geographical area, like a lake. Under this arrangement, the Forest Service is able to use the facilities on one site to charge a recreation fee and the revenues are then used to pay for maintenance and other amenity improvements to all sites in the HIRA. As a result of the lawsuit, the Forest Service is reviewing all recreation fees that are charged and is even considering not charging fees.

The availability of amenities, facilities and services on public lands requires society to find the best way fund them. Despite the criticism of recreation fees on federal lands, the public is more likely to accept recreation fees than disruption to services (More and Stevens 2000; Burns and Graefe 2006). Fees gathered at the site are used to improve on-site facilities and amenities, to maintain the quality of services, and act as a rationing tool

[15] *Adams v. U.S. Forest Service*, 2012, Ninth Circuit Court of Appeals.

reducing congestion and improving resource protection (McLean and Johnson 1997). If fairness and equity are society's top priorities, then recreation fees should be eliminated and a greater budgetary allocation should be given to public land agencies. If on the other hand, the top concerns are congestion and insufficient funds at the federal and state level, then recreation fees should be used to off-set budgetary shortfalls. By charging recreation fees to those who visit and benefit from public lands, proponents argue, recreation users are forced to internalize the social cost of maintaining public lands (Martin 1999).

In this context, *public land values* represent an integral component of the benefit-cost analysis of recreation on public lands (Spash 1997). An important aspect in forming preferences towards resource management policies is the role of values and attitudes towards the environment (Dietz et al. 2005; Milon and Scrogin 2006; Spash 2000). For this analysis, values are not monetary, instead they are held values, *an enduring concept of the good related to forest and forest ecosystems and toward natural resources and the environment* (Bengston and Fan 2001; Bengston 1994). Held values enhance the perceived benefits people derive from outdoor recreation, leading greater use of lands for recreation and a willingness to pay for their protection based on existence values (Cooper et al. 2004). They are also helpful in defining attitudes, a measure of favor or disfavor with respect to the environment in general and National Forests and Grasslands in particular, which in turn is helpful in predicting behavior and choices (Dietz et al. 2005).

Attitudes influence preferences, which in turn impact the choices people make towards natural resource management policies, including the source of funding and the appropriate level of natural resource conservation or development. Identifying and

characterizing attitudes become especially relevant when dealing with questions regarding public land management (Clement and Cheng 2011; Fischer 2010; Minteer and Manning 1999) and motivations behind contingent valuation questions (Spash 2006; Ojea and Loureiro 2007; Kotchen and Reiling 2000).

The next section briefly discusses the variables used in this analysis. The empirical section is divided into two parts. First, the acceptability of higher fees and new fees to support public lands is inferred using an ordinal logit model. Second, I study a set of demographic segments that were found to have different opinions regarding the fee statements. The final section concludes.

4.3 Data

4.3.1 Descriptive statistics

The dependent variables are two statements from Section 2 of the survey (see Appendix E): a *public land value* statement concerning a $5 increase in recreation fees[16]; and a *management objectives* statement that that measures the support for introducing a fee to support public lands.[17] I use the three summary measures of *public land value* introduced in Chapter 2, and referred in this Chapter simply as *public land values*: *environmental activism*, *personal conservation behavior*, and *conservationist management values*, to describe the influence that environmental attitudes have on the two fee statements. A key assumption throughout this analysis is that values influence attitudes (McFarlane and Boxall 1996; Tarrant et al. 2003). A description of

[16] Question 6, statement 9 (see Appendix E): *I would be willing to pay $5 more each time I use public lands for recreation purposes.*

[17] Question 7, statement 23 (see Appendix E): *Introducing a recreation fee that goes to support public land.*

environmental attitudes in summary form is helpful in evaluating the desirability of changes in policy and willingness to engage in trade-offs of environmental goods and services (Bengston 1994; Dietz et al. 2005; Spash 2006).

It is important to note that this analysis does not make population-wide inferences. Descriptive statistics in Tables 4.1 and 4.2 indicate that the sample over-represents males, high income and educated individuals. The sample does, however, does match the share of Hispanics in the population, approximately 17% according to the 2000 US Census. Although survey weights are available to generate population-level estimates, using them would result in an incorrect interpretation and representation of beliefs and values. Beliefs and values are defined by social and contextual stimuli that are inherently specific to each individual (Ajzen 1991). Beliefs and values can be generalized, leading to a description of attitudes in the population, but such generalization would have to assume prior knowledge of all nuances in beliefs, norms, and values. It is, therefore, preferable to describe attitudes in the sample and make inferences of the respondents to the survey than to extend the analysis using survey weights and make incorrect or misleading statements regarding the public.

The average household size in the sample is 2.35 people, and less than a quarter of respondents hold a membership to a stakeholder group, with environmentalist, conservationist, and sportsperson groups being the most representative (see Table 4.15). The average household has spent 23 years in the area, with the median at 18 years. Over one third of households live within five miles of a national forest boundary. The average distance to a recreation site is 27.6 miles; the median is 16.7 miles, and 90% of households live within 65 miles of a recreation site.

Table 4.1 Descriptive statistics for *High Fee* statement

I would be willing to pay $5 more each time I use public lands for recreation purposes		*Strongly disagree*		*Somewhat disagree*		*Neutral*		*Somewhat agree*		*Strongly agree*	
Variable	Description	Mean	*S.D.*	Mean	*S.D.*	Mean	*S.D.*	Mean	*S.D.*	Mean	*S.D.*
Income	Household income (000's)	65.61	*46.88*	74.86	*56.69*	66.02	*46.61*	74.31	*56.85*	78.76	*60.98*
College	College degree [a]	0.50	*0.50*	0.58	*0.49*	0.52	*0.50*	0.59	*0.49*	0.63	*0.48*
Age	Age of the respondent (in years)	56.21	*14.13*	55.62	*13.45*	58.89	*15.27*	56.96	*14.01*	57.65	*14.27*
Residency	Residency (in years)	24.25	*20.73*	23.13	*19.42*	23.47	*19.62*	22.62	*19.39*	23.22	*19.63*
HH size	Household size	2.47	*1.47*	2.50	*1.36*	2.27	*1.25*	2.35	*1.26*	2.25	*1.27*
Visits	Trips to a National Forest [b]	1.41	*1.55*	1.20	*1.18*	0.90	*1.22*	0.96	*1.13*	0.90	*1.05*
Employed	Currently Employed [a]	0.55	*0.50*	0.60	*0.49*	0.50	*0.50*	0.58	*0.49*	0.57	*0.49*
Live near	Lives within 5 miles of forest [a]	0.41	*0.49*	0.40	*0.49*	0.36	*0.48*	0.34	*0.47*	0.34	*0.47*
Hisp	Hispanic [a]	0.19	*0.39*	0.15	*0.36*	0.15	*0.36*	0.18	*0.38*	0.17	*0.38*
Male	Male [a]	0.79	*0.41*	0.75	*0.43*	0.71	*0.45*	0.68	*0.47*	0.62	*0.48*
Member	Member of a natural resource group [a]	0.26	*0.44*	0.24	*0.43*	0.19	*0.39*	0.23	*0.42*	0.23	*0.42*
Public Land Values (1: Strongly disagree; 2: Somewhat disagree, 3: Neutral, 4: Somewhat agree, 5: Strongly agree.)											
Env. Act.	Environmental activism	3.60	*1.03*	3.81	*0.82*	4.03	*0.74*	4.18	*0.77*	4.39	*0.80*
Pers. Cons. Be.	Personal conservation behavior	3.65	*1.02*	3.88	*0.82*	4.14	*0.68*	4.28	*0.73*	4.35	*0.93*
Cons. Man. Val.	Conservationist management values	3.23	*1.05*	3.36	*0.96*	3.47	*0.87*	3.54	*0.97*	3.53	*1.20*
State of Residence [a]											
Arizona		0.44	*0.50*	0.48	*0.50*	0.43	*0.50*	0.42	*0.49*	0.44	*0.50*
New Mexico		0.53	*0.50*	0.48	*0.50*	0.50	*0.50*	0.54	*0.50*	0.51	*0.50*
Grasslands (Texas or Oklahoma)		0.03	*0.16*	0.04	*0.18*	0.06	*0.24*	0.04	*0.20*	0.05	*0.21*
Number of observations		*917*		*740*		*1,068*		*1,618*		*1,489*	

[a] 0 = No, 1 = Yes. Note: S.D. = Standard Deviation.

[b] 8 categories were created: 0 = no trips; 1 = 1-9; 2 = 10-19; 3 = 20-29; 4 = 30-39; 5 = 40-49; 6 = 50-90; 7 ≥ 91.

Table 4.2 Descriptive statistics for *New Fee* statement

Introducing a recreation fee that goes to support public land		*Not at all important*		*Not very important*		*Neutral*		*Somewhat important*		*Very important*	
Variable	Description	Mean	*S.D.*	Mean	*S.D.*	Mean	*S.D.*	Mean	*S.D.*	Mean	*S.D.*
Income	Household income (000's)	67.53	*50.38*	71.51	*52.44*	69.58	*50.15*	75.92	*57.77*	73.27	*57.50*
College	College degree [a]	0.53	*0.50*	0.57	*0.50*	0.56	*0.50*	0.60	*0.49*	0.57	*0.49*
Age	Age of the respondent (in years)	55.68	*13.89*	55.86	*13.20*	55.85	*14.62*	57.82	*14.34*	58.67	*14.30*
Residency	Residency (in years)	24.39	*19.89*	23.95	*19.54*	23.24	*19.72*	22.64	*19.62*	23.39	*19.81*
HH size	Household size	2.46	*1.47*	2.59	*1.61*	2.42	*1.36*	2.29	*1.19*	2.23	*1.21*
Visits	Trips to a National Forest [b]	1.38	*1.56*	1.31	*1.35*	1.03	*1.20*	0.98	*1.15*	0.87	*1.07*
Employed	Currently Employed [a]	0.56	*0.50*	0.60	*0.49*	0.58	*0.49*	0.56	*0.50*	0.53	*0.50*
Live near	Lives within 5 miles of forest [a]	0.44	*0.50*	0.41	*0.49*	0.35	*0.48*	0.35	*0.48*	0.34	*0.47*
Hisp	Hispanic [a]	0.19	*0.39*	0.15	*0.36*	0.16	*0.36*	0.16	*0.37*	0.20	*0.40*
Male	Male [a]	0.80	*0.40*	0.80	*0.40*	0.71	*0.45*	0.69	*0.46*	0.63	*0.48*
Member	Member of a natural resource group [a]	0.27	*0.44*	0.25	*0.43*	0.19	*0.40*	0.22	*0.42*	0.24	*0.43*
Public Land Values (1: Strongly disagree; 2: Somewhat disagree, 3: Neutral, 4: Somewhat agree, 5: Strongly agree.)											
Env. Act.	Environmental activism	3.56	*1.00*	3.78	*0.83*	3.97	*0.77*	4.13	*0.79*	4.38	*0.85*
Pers. Cons. Be.	Personal conservation behavior	3.63	*0.98*	3.84	*0.87*	4.01	*0.83*	4.20	*0.80*	4.44	*0.82*
Cons. Man. Val.	Conservationist management values	3.38	*0.94*	3.36	*0.94*	3.37	*0.96*	3.47	*1.02*	3.56	*1.17*
State of Residence [a]											
Arizona		0.44	*0.50*	0.45	*0.50*	0.42	*0.49*	0.45	*0.50*	0.44	*0.50*
New Mexico		0.52	*0.50*	0.52	*0.50*	0.54	*0.50*	0.50	*0.50*	0.52	*0.50*
Grasslands (Texas or Oklahoma)		0.04	*0.20*	0.04	*0.18*	0.05	*0.21*	0.05	*0.22*	0.04	*0.19*
Observations		*609*		*513*		*1,272*		*1,995*		*1,443*	

[a] 0 = No, 1 = Yes. Note: S.D. = Standard Deviation.

[b] 8 categories were created: 0 = no trips; 1 = 1-9; 2 = 10-19; 3 = 20-29; 4 = 30-39; 5 = 40-49; 6 = 50-90; 7 ≥ 91.

4.4 Empirical Results

4.4.1 Estimation approach

I use two statements to analyze the effect of environmental attitudes on changes in recreation fees. Agreement with each statement is measured using a five level Likert-type scale, from 'strongly disagree' to 'strongly agree' for the first statement (*High fee*), and from 'not important' to 'very important' for the second statement (*New fee*). This requires an estimation approach for ordered choices to measure the underlying continuous latent utility (Greene and Hensher 2010). The theoretical framework for the empirical model is the random utility model, which divides the utility function into observed and unobserved components:

(4.1) $y^*_{is} = \boldsymbol{\beta}'\mathbf{x}_i + \varepsilon_{is},\ i = 1,\ldots,n$ and $s = 1, 2.$

Where y^*_{is} is the continuous latent utility, $\mathbf{x}_i$ is a set of *K* observed individual characteristics that are assumed to be independent of ε_i, $\boldsymbol{\beta}$ is a vector of *K* parameters, ε_i is the unobserved error component for individual *i*, and *s* is the statement.

To estimate this ordered choice model, I use an ordered logit model, where the probability of observing choice *j* for statement *s* by individual *i* is:

(4.2) $Pr[y_{is} = j \mid \mathbf{x}_i] = Pr(\kappa_{j-1} < \boldsymbol{\beta}'\mathbf{x}_i + \varepsilon_i \le \kappa_j),\ \ \kappa_{j-1} = -\infty$ and $\kappa_J = \infty,$

where κ are cut-points along the real line that divide the range of utility into thresholds that are identified with the observed scale.

At issue in this analysis is the inclusion of environmental values identified through three summary measures of *public land values*; essentially a test of omitted variables. Equation (4.2), with the three summary measures of *public land values* becomes:

(4.3) $Pr[y_{is} = j \mid \mathbf{x}_i, \mathbf{z}_i] = Pr(\kappa_{j-1} < \boldsymbol{\beta}'\mathbf{x}_i + \boldsymbol{\gamma}'\mathbf{z}_{li} + \varepsilon_i \le \kappa_j),$

where $\mathbf{z}_i$ is a set of $L = 3$ *public land values* summary measures and $\boldsymbol{\gamma}_i$ is a vector of L parameters. A likelihood ratio test is used to determine whether (4.2) or (4.3) are the correct specifications for the latent utility in equation (4.1). In effect, the null hypothesis is that all $\boldsymbol{\gamma}$ parameters are equal to zero.

4.4.2 Expected results

The literature on the Recreation Fee Demonstration Program (RFDP), the legislation that preceded the current fee legislation, gives some guidance on the expected results of this analysis. In an investigation of the 1995 National Survey on Recreation and the Environment, Bowker et al. (1999) found support for fees among individuals with higher education, younger age, higher income, and living in the Western part of the US. Fee support generally centered on facilities, such as boat ramps and parking areas. A lower level of income, younger individuals, and Hispanics have been found to have an inverse relationship with respect to support for higher fees (Ostergren et al. 2005; More and Stevens 2000).

The ability of public land managers to seek input and discuss changes in fees has been also found to be helpful in mitigating any potential conflicts with the public (Kim and Crompton 2002; Park et al. 2010). In this analysis, membership to a natural resource group is used as a measure of concern for issues related to natural resource management. This follows from the belief that there are either utilitarian or pragmatic concerns regarding management policies from certain resource groups. For example, improvements to recreation areas that might generate ecological benefits is an example of utilitarian concerns, while similar improvements that lead to reduced congestions at a recreation site typify pragmatic concerns.

People who prefer recreation in an un-spoilt environment and/or are members of a natural resource group, such as conservationist groups, are more likely to prefer less development and may view fees as an ideal mechanism that restricts access to public lands (Nord et al. 1998). Mechanized recreationists, or members of mechanized groups, are more likely to prefer developed areas and increased access (Jackson 1987). These groups are likely to support changes in existing fees, but might view new fees as unnecessary.

Greater visitation (*Visits*), proximity to public lands (*Lives near*), or years lived in the area (*Residency*), are expected to increase the support for fees (Kyle et al. 2003; Chung et al. 2011). Some of these factors, along with membership to a natural resource group, are also likely to mitigate the influence of race (Bowker et al. 2006). However, greater visitation engenders users with some degree of ownership towards the site, making them more likely to disagree with new or higher fees (Reynisdottir et al. 2008; Park et al. 2010).

The leisure literature suggests a positive relationship between *place attachment*, a connection or bond to a particular place that does not generalize from area to area, and *dependence*, an ongoing connection to a site (William and Vaske 2003), on questions regarding recreation fees (Kyle et al. 2003; Chung et al. 2011). Living within 5 miles from a national forest is used as a proxy for *place attachment* and length of residency is used for *place dependence*. Empirically, the relationship between attachment, dependence, and fees, is unclear. Individuals or households living near public lands might be more likely to visit, and would therefore consider it unfair to pay for the provision of the public good. On the other hand, they may understand the need to collect

fees in order to ensure maintenance of facilities, funding for preservation programs, or the benefits of less congestion as a result of imposing a fee.

4.4.3 Full sample results

I start by estimating two models for each fee statement. To evaluate the effect of controlling for environmental attitudes in the analysis, Model 1estimates an ordinal logit regression with *public land values,* which is compared to Model 2, the regression without the *values*. To help in this comparison, I also estimate the predicted probabilities for each response category with respect to demographic characteristics. The Kruskal-Wallis rank test is then used to test if the mean response level for each *public land value* is similar to each other. This test helps determine if, for each level of agreement to each *public land value,* the mean response to the dependent variable is similar. The Kurskal-Wallis rank test assumes no probability distribution and combines all observations within each *public land value,* ranking them from smallest to largest. The average rank for the *public land value* is calculated by dividing the sum of the ranks by the number of observations. The test statistic follows a chi-square distribution with four degrees of freedom [d. f. = 5 response categories – 1] (Wackerly et al. 2001).

4.4.3.1 $5 more for recreation fees

Results for the regression with increasing recreation fees (*High fee*) as the dependent variable are presented in Table 4.3. Having *public land values* in the regression (Model 1) leads to smaller coefficients for being Hispanic, age, visits, living near a national forest, and household size. The coefficient on residency, employment, and a college degree is also higher in Model 1. Environmental activism (*EA*) and personal conservation behavior (*PCB*) increase the likelihood of agreement to new recreation fees.

Conservationist management values (*CMV*), on the other hand, decreases the likelihood of agreement. Based on the size of the coefficients, environmental activism is more important when defining agreement to an increase in recreation fees and management values the least. The statistically significant likelihood-ratio test confirms that the fit on the model with the three summary measures of public land values is an improvement.

Table 4.3 Ordinal Logit results for *High fee* (n = 5,832)

	Model 1 With PLVs		Model 2 Without PLVs	
	Coef.	*SE*	Coef.	*SE*
Income	0.004***	*0.000*	0.003***	*0.000*
College	0.292***	*0.050*	0.268***	*0.050*
Age	0.003*	*0.002*	0.006***	*0.002*
Residency	-0.004***	*0.001*	-0.002*	*0.001*
HH size	-0.057***	*0.020*	-0.082***	*0.019*
Visits	-0.176***	*0.021*	-0.182***	*0.021*
Employed	0.182***	*0.056*	0.142**	*0.056*
Lives near	-0.136***	*0.050*	-0.143***	*0.050*
Hisp	0.011	*0.067*	0.180***	*0.065*
Male	-0.292***	*0.053*	-0.511***	*0.052*
Env. Act. (EA)	0.639***	*0.038*		
Pers. Cons. Be. (PCB)	0.465***	*0.038*		
Cons. Man. Val. (CMV)	-0.282***	*0.030*		
Pseudo R^2	0.06		0.02	
Log Likelihood	-8605.0		-8988.0	
χ^2	1080.0		312.4	
AIC	17243.4		18004.8	
BIC	17356.8		18098.2	
LR test: $\chi^2_{(df=4)} = 767.37$, *p-value*: 0.0000				

Level of significance: *** p<0.01, ** p<0.05, * p<0.1

The Kruskal-Wallis ($K - W$) rank test of independence between the response categories in Table 4.4 shows the mean response to the fee statement differs for each summary measure. Respondents that tend to agree with the fee statements are more likely to agree with both individual values (*EA* and *PCB*). Regardless of the response

category, the level of agreement with conservationist management values goes from neutral to somewhat close to '*somewhat agree*.'

Table 4.4 *Public Land Values* by *High Fee* response category

		Environmental activism		Personal conservation behavior		Conservationist management values	
	Obs.	Mean	SD	Mean	SD	Mean	SD
Strongly disagree	917	3.60	1.025	3.65	1.016	3.23	1.048
Somewhat disagree	740	3.81	0.818	3.88	0.820	3.36	0.961
Neutral	1068	4.03	0.744	4.14	0.673	3.47	0.866
Somewhat agree	1618	4.18	0.768	4.28	0.726	3.54	0.967
Strongly agree	1489	4.39	0.803	4.35	0.927	3.53	1.199
$K-W\ \chi^2$ (d.f. = 4)		729.06		637.53		95.14	

Table 4.5 presents the effect that environmental attitudes have on the predicted probabilities for two types of individuals within the sample. The first is a Hispanic female earning $49,999, the median household income that is below the mean household income in the sample. The second is a male that takes more than 10 trips per year to a National Forest. Adding *public land values* in the model (Values – Model 1) reduces the probability of *strongly disagree* and *strongly agreeing* with the statement and increases it to the *somewhat agreeing* category. There is also an increase in the number of predicted *neutral* responses in Model 1, indicating a moderating effect of the environmental attitudes on the acceptability of this policy. For the second type of individual, the relationship between agreeing with the policy is the opposite of the first. In the model without *public land values* (No Values – Model 2), the response is skewed towards both disagree response categories. This is to be expected given the negative sign of the coefficients for *male* and *visits* in Table 4.3. When public land values are included in the model, the predicted probabilities shift towards the middle response categories. That is,

the predicted probabilities shift from either strongly supporting or rejecting the policy to a more moderate position.

Table 4.5 Predicted probabilities for *High fee* scenarios

	Female, Hispanic, median household income [a]		Male, over 10 reported trips to a National Forest	
Response category	Values	No Values	Values	No Values
Strongly Disagree	0.1186	0.1030	0.3212	0.3795
Somewhat disagree	0.1228	0.0975	0.2069	0.1924
Neutral	0.2003	0.1632	0.2075	0.1808
Somewhat agree	0.3111	0.3009	0.1790	0.1607
Strongly Agree	0.2471	0.3354	0.0854	0.0865

[a] Sample median household income is $49,999. Sample mean household income is $72,630.20

These results indicate the importance of controlling for environmental attitudes in this type of policy question. The effect is not to enhance support for the policy, rather to attenuate full support or rejection of the policy. I also note the positive relationship between higher recreation fees and individual *public land values* (*EA* and *PCB*). Support for an increase of $5 in recreation fees depends on the level of agreement with the two individual *public land values* and not with the management factor dimension. The results presented in Table 4.3 show that active involvement in the environment (*EA*) is the driving force behind such support in the full (or Regional) sample. It is development of natural resources, the negative coefficient on conservationist management values (*CMV*), which increase the likelihood of support for higher fees.

4.4.3.2 New fees to support public lands

Table 4.6 presents the results for introducing a new fee to support public lands (*New fee*). A dummy variable for membership to any natural resource group is included in the regression for this statement. Results are generally consistent with increasing recreation fees. The coefficient for household income is unchanged between the models.

Table 4.6 Ordinal Logit results for *New fee* (n = 5,832)

	Model 1 With PLVs		Model 2 Without PLVs	
	Coef.	*SE*	Coef.	*SE*
Income	0.003***	*0.000*	0.003***	*0.000*
College	0.126**	*0.051*	0.103**	*0.050*
Age	0.010***	*0.002*	0.012***	*0.002*
Residency	-0.006***	*0.001*	-0.004***	*0.001*
HH size	-0.056***	*0.020*	-0.077***	*0.019*
Visits	-0.138***	*0.021*	-0.157***	*0.021*
Employed	0.082	*0.057*	0.047	*0.056*
Lives near	-0.175***	*0.051*	-0.178***	*0.050*
Hisp	0.126*	*0.068*	0.311***	*0.067*
Male	-0.288***	*0.054*	-0.507***	*0.053*
Member of a group	0.129**	*0.059*	0.112*	*0.058*
EA	0.569***	*0.036*		
PCB	0.555***	*0.036*		
CMV	-0.356***	*0.030*		
Pseudo R^2	0.06		0.02	
Log Likelihood	-8206.0		-8573.0	
χ^2	1019.0		284.7	
AIC	16447.4		17175.9	
BIC	16567.5		17276.0	
LR test: $\chi^2_{(df=4)} = 734.48$, p-value: 0.0000				

Level of significance: *** p<0.01, ** p<0.05, * p<0.1

Environmental activism (*EA*) and personal conservation behavior (*PCB*) increase the likelihood of new fees, while a conservationist management values (*CMV*) reduces the likelihood. The coefficient for household income does not change between models. The remaining variables do change when *public land values* are introduced as part of the explanatory variables, with most resulting in a lower coefficient. The effect of group membership and length of residency increases with *public land values*. The likelihood of accepting a new fee increases with college education, age, employment, Hispanic, and membership to a natural resource group; and decreases with size of household, visitation, living near a forest boundary, male, and length of residency. This last result is interesting

in that it was expected to be positive for both policies (Kyle et al. 2003; Chung et al. 2011). For this sample, the coefficient is consistently negative and significant. The Kruskal-Wallis rank test results in Table 4.7 show that the *public land values* among response categories are statistically different and that individuals that find the statement important are more likely to agree with individuals values and weakly agree with the management value.

Table 4.7 *Public Land Values* by *New Fee* response category

		Environmental activism		Personal conservation behavior		Conservationist management values	
	Obs.	Mean	SD	Mean	SD	Mean	SD
Not important	609	3.56	0.997	3.62	0.976	3.38	0.940
Somewhat unimportant	513	3.78	0.833	3.84	0.870	3.36	0.937
Neutral	127	3.97	0.773	4.01	0.829	3.37	0.955
Somewhat important	1995	4.13	0.791	4.20	0.793	3.47	1.017
Very important	1443	4.38	0.854	4.44	0.818	3.56	1.168
$K-W\,\chi^2$ (d.f. = 4)		687.21		661.97		67.23	

Table 4.8 presents the predicted probabilities for the same two types of individuals as in Table 4.5. Consistent with the results for *higher fees*, Hispanic women are more likely to support *new fees* for public lands and men that visit often are somewhat less likely to support it. For Hispanic women, the probabilities in Model 2 (No Values) are skewed towards support, while for men that visit often the predicted probabilities are more evenly spread out across response categories. As before, including *public land values* as independent variables (Values – Model 1) shifts the probabilities to the middle response categories in both cases.

Table 4.8 Predicted probabilities for *New fee* scenarios

	Female, Hispanic, median household income [a]		Male, over 10 reported trips to a National Forest	
Response category	Values	No Values	Values	No Values
Not Important	0.0674	0.0591	0.1457	0.1637
Somewhat unimportant	0.0707	0.0565	0.1287	0.1257
Neutral	0.2127	0.1687	0.2861	0.2637
Somewhat important	0.3868	0.3616	0.3085	0.2973
Very Important	0.2624	0.3541	0.1310	0.1496

[a] Sample median household income is $49,999. Sample mean household income is $72,630.20

Unlike the results in Table 4.5, the predicted probabilities for males that visit a National Forest often doesn't change as much. That is, for this particular policy, the effect of public land values is not as noticeable as with Hispanic women. One reason for this is the significance of Hispanics for this statement, compared to the non-significant coefficient in the *higher fee* statement, all else being the same. Overall, *public land values* have a moderating effect on the level of importance for the statement on *new fees* to support public lands. However, as these results show, caution must be taken when making policy inferences across individuals in the sample.

4.4.3.3 Discussion

Having a higher level of education and being a member of a natural resource group increases the likelihood of acceptability. More visits and living near a national forest decreases the likelihood of accepting changes in fees. Being employed or earning a higher income increases the likelihood of accepting higher or new fees. The result for income has important consequences with respect to equity, as this result indicates fees are more acceptable to higher income household than lower income households, consistent with previous findings in the literature (More and Stevens 2000; Ostergren et al. 2005). As expected, men are less likely to support changes in fee. What is unexpected is the

result from Hispanics, who appear to prefer charging than new fees to support public lands. This result could be due to the nature of the statement itself. As no fee is stated, they may be assuming that the fee increase is not substantial. This is important because research on this group has found fees are a barrier of entry (Burns et al. 2008), especially as it affects their financial situation (Chavez 2008). Therefore, Hispanics might consider a fee that supports public lands as a way of distributing the cost of maintaining and improving all recreation sites, regardless of use.

The effect of including *public land values* is to moderate the level of acceptance or rejection to changes in current fees. A major difference between each fee statement is the underlying *public land value* dimension that affects the level of support. In the case of higher recreation fees, support is driven primarily by active participation recreation (environmental activism); in the case of new fees, support is driven by both individual values (environmental activism and personal conservation behavior). This suggests two different approaches by policymakers to ensure support for these policies. Acceptance of higher fees would require a direct appeal to active participants in the environment, highlighting the role that more resources would have on protecting the environment. New fees, on the other hand, would require an appeal to both active and passive participants in the environment. In this case, the emphasis should be on how fees will help protect the environment and how this will minimize the negative impact from human uses. Interestingly, it is development management values that lead to support for both fee policies. This implies that, on average, respondents also desire the Forest Service to highlight how these new resources will benefit humans.

Support for new fees may in part be explained by the unspecified amount, suggesting that willingness to pay is higher than current fee levels, while at the same time not providing an upper bound for public lands. This also suggests further analysis of certain demographic characteristics is warranted. The following sections is based on and contributes to leisure literature that has shown differences in support for public land management policies based on use and personal characteristics (Johnson et al. 2004). Findings suggest that certain groups are willing to accept changes in fees, and that their concerns are different from the rest of the sample.

4.5 Testing For Structural Differences

This part of the analysis uses a statistical test to determine differences in the level of support for each fee statement among certain demographic segments. A statistically significant difference indicates that the underlying groups that comprise each segment have a distinct opinion regarding the statement compared to the rest of the sample. In terms of changes in the fee policy, controlling for this heterogeneity is helpful in identifying and addressing the varying needs and concerns.

A likelihood ratio test designed for categorical models is used to determine whether structural differences exist between specific segments and the rest of the sample (Greene and Hensher 2010). Under the null hypothesis, there are no differences between the groups that represent each demographic segment; for example, there are no difference in the parameter estimates between men and women in the sample. The alternative hypothesis suggests a difference in agreement, requiring a separate analysis for each group in the segment. The steps in the test include estimating a restricted model, all the observations in the model, extracting the log likelihood, and then estimating unrestricted

models, one for each group of the segment. A likelihood ratio test statistic is calculated as twice the difference of the sum of the log likelihoods for the unrestricted models and the restricted model:

$$(4.4)\ LR = 2\left(\left[\sum_{g=1}^{G} LL_g\right] - LL_r\right),$$

where g is the number of segments in the characteristic and r denotes restricted model.

This statistic follows a chi square distribution, with degrees of freedom given by the number of levels minus one, times the number of parameters in the restricted model plus the number of levels in the ordinal categorical dependent variable minus one (Greene and Hensher 2010). Results of the structural test for a set of demographic segments are presented in Table 4.9, with those segments that reject the null hypothesis highlighted in bold and italics.

Table 4.9 Structural change test results

Variable	$5 more in recreation [a]		New fees to support public lands [b]	
	χ^2	*p-value*	χ^2	*p-value*
Gender	***40.98***	***0.0009***	18.04	0.4527
Hispanic	23.41	0.1364	***33.24***	***0.0156***
Arizona	***489.06***	***0.0000***	***27.19***	***0.0756***
New Mexico	***471.81***	***0.0000***	***32.27***	***0.0204***
Grasslands (OK and TX)	***31.66***	***0.0166***	17.71	0.4752
Member of a group	***36.33***	***0.0041***	***32.46***	***0.0194***

[a] Critical value $\chi^2_{17} = 27.59$

[b] Critical value $\chi^2_{18} = 28.87$

Gender, membership to a natural resource group, and state of residence are segments or characteristics that exhibit differences of opinion regarding higher recreation fees. Differences between Hispanics and Non-Hispanics, residents of Arizona and New Mexico, and membership to any natural resource group are present in the statement regarding new fees that would support public lands.

4.5.1 Gender

Based on the coefficient for gender in the restricted model (Table 4.3), women are more likely to agree to higher fees than men. The coefficient on household income does not change between men and women. College education and being employed are higher in the model with only men. Age is positive and significant for men, while it is negative and not significant for women. Women that live in larger households, have visited a National Forest, agree with environmental activism values, and live near a National Forest are less likely to agree with higher recreation fees. Men that have a college degree, are older, or agree with personal conservation behavior values are likely to support to higher recreation fees. Men that have lived in the area for a long time or agree with conservationist management values are less likely to agree with higher recreation fees.

Women have been found to hold greater protectionists values than men (Tarrant et al. 2003) and support for higher fees, which is likely to reduce congestion, could be justified by this belief. *Environmental activism* is a more important value for women than for men in accepting higher recreation fees and *conservationist management values* is more important for men. *Personal conservation behavior* is relatively similar for both men and women. Being employed and length of residency are important determinants of for higher fees for women, while living near a National Forest and household size are important determinants of support for men. Age has a positive and significant relationship for women and a negative and non-significant relationship for men.

Table 4.10 Ordinal Logit results for gender and *High fee*

	Men		Women	
	Coef.	*SE*	Coef.	*SE*
Income	0.004***	*0.001*	0.004***	*0.001*
College	0.316***	*0.060*	0.204**	*0.093*
Age	0.005**	*0.002*	-0.002	*0.004*
Residency	-0.005***	*0.002*	-0.002	*0.002*
HH size	-0.022	*0.024*	-0.144***	*0.037*
Visits	-0.155***	*0.024*	-0.237***	*0.041*
Employed	0.198***	*0.068*	0.142	*0.100*
Lives near	-0.098	*0.061*	-0.221**	*0.092*
Hisp	0.061	*0.079*	-0.049	*0.129*
Env. Act.	0.586***	*0.044*	0.798***	*0.076*
Pers. Cons. Be.	0.480***	*0.044*	0.441***	*0.074*
Cons. Man. Val.	-0.322***	*0.037*	-0.198***	*0.055*
Male				
Observations	4,074		1,758	
Pseudo R^2	0.052		0.067	
Log Likelihood	-6114		-2470	
χ^2	674.0		354.1	

Level of significance: *** p<0.01, ** p<0.05, * p<0.1

As Table 4.11 shows, although men generally agree to higher fees, their level of agreement is not as strong as for women. Predicted probabilities show that women are more likely to support the policy, with 62% agreeing with higher recreation fees. Disagreement in the restricted, or pooled sample, appears to be driven by men. This is could be due, in part, to a greater role that conservationist management values have towards rejecting this policy for men.

Table 4.11 Gender: predicted probabilities

	Sample	Men	Women
Strongly disagree	0.1320	0.1554	0.0832
Somewhat disagree	0.1325	0.1448	0.1024
Neutral	0.2075	0.2089	0.1984
Somewhat agree	0.3029	0.2895	0.3294
Strongly agree	0.2252	0.2014	0.2866

4.5.2 Hispanic

Based on the coefficient in the restricted model (Table 4.6), Hispanics are more likely to support new fees than Non-Hispanics. As presented in Table 4.12, there are some similarities between both groups, for example, high income households, women, and respondents that agree with environmental activist values and personal conservation behavior are more likely to support new fees. Respondents that have visited a forest or disagree with conservationist management values are less likely to support new fees. On the other hand, Non-Hispanics with a college degree or better are more likely to support new fees than Hispanics with a similar level of education attainment.

Table 4.12 Ordinal Logit results for Hispanic and *New fee*

	Hispanic		Non-Hispanic	
	Coef.	*SE*	Coef.	*SE*
Income	0.006***	*0.002*	0.003***	*0.000*
College	-0.137	*0.127*	0.170***	*0.056*
Age	0.003	*0.005*	0.011***	*0.002*
Residency	-0.001	*0.003*	-0.007***	*0.001*
HH size	-0.024	*0.042*	-0.072***	*0.022*
Visits	-0.123**	*0.055*	-0.138***	*0.023*
Employed	-0.010	*0.140*	0.095	*0.062*
Lives near	0.055	*0.129*	-0.217***	*0.056*
Male	-0.348***	*0.134*	-0.284***	*0.059*
Member of a group	0.346**	*0.173*	0.099	*0.063*
Env. Act.	0.712***	*0.094*	0.552***	*0.040*
Pers. Cons. Be.	0.449***	*0.090*	0.578***	*0.040*
Cons. Man. Val.	-0.237***	*0.063*	-0.378***	*0.035*
Hispanic				
Observations	993		4,839	
Pseudo R^2	0.074		0.057	
Log Likelihood	-1369		-6820	
χ^2	219.2		818.9	

Level of significance: *** p<0.01, ** p<0.05, * p<0.1

Individual values (EA and PCB) are positively related to support for new fees, with the coefficient on environmental activism being the higher for Hispanics and personal conservation behavior being higher for Non-Hispanics. Predicted probabilities in Table 4.13 show slightly more support for new fees by Hispanics than Non-Hispanics, confirming the results of the restricted ordinal logit model.

Table 4.13 Hispanic: predicted probabilities

	Sample	Hispanic	Non-Hispanic
Not important	0.0836	0.0863	0.0826
Somewhat unimportant	0.0847	0.0748	0.0867
Neutral	0.2373	0.2229	0.2410
Somewhat important	0.3746	0.3615	0.3778
Very important	0.2198	0.2545	0.2119

4.5.3 State of residence

As a matter of designing policy, care needs to be given to local concerns to avoid implementing region-wide policies that, although appealing to some groups, are rejected by most groups in the area (Clement and Cheng 2011). Determinants of support for both statements at the state level are analyzed in this subsection. Using values is ideal in this context, as they reflect local attitudes towards the environment (Fischer 2010). As shown in Table 4.11, structural differences are present for both fees statements in the sample for both Arizona and New Mexico. In the case of the Grasslands area, comprised of western counties in Oklahoma and Texas, only the statement on a $5 higher recreation fee showed statistical structural difference. This state-level analysis begins with the statement on a $5 higher recreation fee and concludes with the statement on new fees to support public lands.

4.5.3.1 State of residence *$5 more* in recreation results

In designing and implementing policies that would raise current fees, policymakers must be aware that the underlying values for *public land values* and demographic determinants that lead to support of such policies are likely to differ from state to state. For the Grassland sample, beside the three *public land values*, the only significant demographic characteristic is women. Agreement with the two individual values (*EA* and *PCB*) increases the likelihood of support for higher recreation fees, with environmental attitudes being the most important. Disagreement with conservationist management values (*CMV*) decreases the likelihood of support for higher recreation fees.

Results in the first and third column in Table 4.16 show that differences in support for higher recreation fees between Arizona and New Mexico are due to being Hispanic and personal conservation behavior (*PCB*). In the first case, Hispanics in Arizona are more likely to support the policy than Hispanics in New Mexico. Residents from the state of New Mexico that agree with personal conservation behavior are more likely to support higher recreation fees than residents in Arizona. Residents from Arizona or New Mexico that live in households that earn a higher income, have a college degree, do not visit a National Forest often, have recently arrived, are women, or live in small households are more likely to support high recreation fees. New Mexico residents that do not live near a National Forest, or are older are more likely to support higher recreation fees. Arizona residents that are employed are more likely to support this change in fee policy.

Table 4.14 Ordinal Logit results by state of residence and fee statement

	Arizona		New Mexico		Grasslands
	High Fee	*New Fee*	***High Fee***	*New Fee*	***High Fee***
Income	0.004***	0.004***	0.004***	0.003***	0.003
	(*0.001*)	(*0.001*)	(*0.001*)	(*0.001*)	(*0.002*)
College	0.275***	0.155**	0.368***	0.083	0.260
	(*0.077*)	(*0.077*)	(*0.072*)	(*0.072*)	(*0.247*)
Age	0.008***	0.012***	0.001	0.008***	-0.003
	(*0.003*)	(*0.003*)	(*0.003*)	(*0.003*)	(*0.013*)
Residency	-0.006***	-0.007***	-0.006***	-0.006***	0.003
	(*0.002*)	(*0.002*)	(*0.002*)	(*0.002*)	(*0.006*)
HH size	-0.053*	-0.068**	-0.075***	-0.039	0.077
	(*0.029*)	(*0.028*)	(*0.029*)	(*0.028*)	(*0.107*)
Visits	-0.144***	-0.151***	-0.195***	-0.123***	0.008
	(*0.031*)	(*0.032*)	(*0.029*)	(*0.029*)	(*0.183*)
Employed	0.098	-0.003	0.203***	0.127	0.179
	(*0.086*)	(*0.087*)	(*0.078*)	(*0.078*)	(*0.292*)
Lives near	-0.274***	-0.281***	-0.003	-0.056	-0.361
	(*0.076*)	(*0.077*)	(*0.071*)	(*0.071*)	(*0.400*)
Hispanic	0.154	0.420***	-0.070	-0.028	-0.264
	(*0.123*)	(*0.124*)	(*0.085*)	(*0.086*)	(*0.455*)
Male	-0.393***	-0.303***	-0.215***	-0.296***	-0.481*
	(*0.083*)	(*0.083*)	(*0.073*)	(*0.074*)	(*0.285*)
Member of a group	*N.A.*	0.143	*N.A.*	0.124	*N.A.*
	N.A.	(*0.090*)	*N.A.*	(*0.081*)	*N.A.*
Env. Act.	0.015	0.495***	1.194***	0.642***	0.624***
	(*0.055*)	(*0.056*)	(*0.054*)	(*0.050*)	(*0.173*)
Pers. Cons. Be.	1.292***	0.612***	-0.128**	0.497***	0.377**
	(*0.061*)	(*0.056*)	(*0.050*)	(*0.049*)	(*0.179*)
Cons. Man. Val.	-0.192***	-0.335***	-0.346***	-0.369***	-0.487***
	(*0.046*)	(*0.046*)	(*0.042*)	(*0.042*)	(*0.162*)
Observations	2,560		3,016		256
Pseudo R^2	0.100	0.064	0.079	0.057	0.043
Log Likelihood	-3,633	-3,578	-4,336	-4,259	-371
Model χ^2	808.5	487.0	740.6	518.5	33.2

Level of significance: *** p<0.01, ** p<0.05, * p<0.1.
Standard errors in italics and parenthesis.

The effect of *public land values* also shows differences across the state samples. For the New Mexico sample, of the two individual values, only personal conservation behavior (PCB) is positive and statistically significant, indicating a much greater

importance that every daily behavior towards conserving and protecting the environment has in generating support for this type of policy. For the Arizona sample, both individual values are statistically significant. For this sample, agreement with environmental activist values (*EA*) increases support for higher recreation fees, while support for personal conservation behavior decreases it. Agreement with conservationist management values (*CMV*) decreases the likelihood of support for both states. As mentioned above, both individual values lead to support of higher fees for the Grasslands sample, with environmental activism being the most important.

4.5.3.2 State of residence *new fees* to support public lands results

Results for new fees to support public lands are presented in second and fourth column in Table 4.14. Differences across state samples are due primarily for demographic characteristics that a statistically significant in the Arizona sample but not in the New Mexico sample. For the Arizona sample, being Hispanic, having a college education, living in a small household, and living far from a National Forest lead to support for new fees for public lands. Residents that live in households that earn a higher income, are older, have not lived long in the area, do not visit a National Forest often, and women are more likely to support new fees for public lands.

Unlike higher recreation fees, agreement with individual values leads to support for new fees. However, there are differences in which individual value is a greater determinant of support. In contrast to the New Mexico sample, for the Arizona sample personal conservation behavior (*PCB*) increases the support for new fees more than environmental activism (*EA*). That is, the willingness to more actively support the environment through organized action in New Mexico leads to greater support for the

policy, than every day personal behavior to protect resources and the environment by respondents from Arizona. For both states, agreeing with conservationist management values (*CMV*) reduces the likelihood of support for new fees for public lands.

4.5.3.3 Discussion

Thus far, the implication is that when presenting changes to fee policies to the public, care must be taken to address local concerns with respect to the environment. In the case of Arizona, the policy must be discussed in the context of how it will help improve the environment. For New Mexico and the Grasslands area, on the other hand, it must be presented in such a way that the policy is an active means of helping improve the environment. At a more micro level, such changes in fees are likely to be rejected by residents that live near a National Forest and long-time residents of either Arizona or New Mexico.

4.5.4 Group membership

Finally, I estimate separate models based on natural resource group membership. The survey included a question on whether or not the respondent was part of any group with an interest in natural resource or outdoor activities (Question 21 in Section 5 of the survey in Appendix E). Respondents were allowed to choose any that applied among eight response options presented in Table 4.15, as well as a '*No*' and an '*Other*' option. Three groups, Sportsperson, Conservationist, and Environmentalist, were selected the most by respondents in the sample. The two groups that would represent high impact on the environment and are more likely to prefer greater access and development of natural resources, Producer and Off-Highway vehicle (OHV), were the least chosen.

Table 4.15 Membership to a specific natural resource group

Natural resource group	Mean [a]	SD	Obs.
Conservationist	0.383	0.486	510
Environmentalist	0.323	0.467	252
Producer	0.050	0.217	66
Off-Highway vehicle	0.095	0.294	127
Sportsperson	0.416	0.493	430
Hiker/Biker	0.189	0.392	554

[a]Min (No) = 0; Max (Yes) = 1.

An indicator variable for group membership (*Member of a group*) was created, where 1 denotes that the respondent that stated being part of at least one of the eight choices and 0 otherwise. A test for differences between members of any group and non-members indicated structural differences in the two sub-samples, and thus each are analyzed in this sub section. This aspect of the investigation is important for policymakers, as attitudes towards forest policies have been found to depend on the type of recreation activity or membership to a stakeholder group (McFarlane and Boxall 1996; Cordell et al. 2002; Williams and Vaske 2003; Teisl and O'Brien 2003). Membership to a stakeholder group is likely to influence values and attitudes, as individuals often self-select into a group based on a common set of values (McFarlane and Boxall 2000).[18] Therefore, an understanding of the relationship between environmental attitudes, membership, and policy will help reduce conflicts when changes are presented to the public and plans are implemented (Tarrant et al. 2003; Thapa and Graefe 2003).

4.5.4.1 Membership to a group and *$5 more* in recreation

The ordinal logit results for each statement and for members and non-members are presented in Table 4.16. Results for higher recreation fees (column 1 and 3) reveal that

[18] Tests on membership to a specific natural resource group show that those that are are statistically different have small samples size, making inferences suspect.

age is a significant determinant of support for higher fees for members of a natural resource group, while for the non-member sample, being employed, not having lived in the area for a long time, and a small household are significant determinants of support. Although not significant, Hispanic respondents that do not belong to any stakeholder group are more likely to support higher recreation fees than Hispanics that do belong to any group. Regardless of group membership, agreement with individual values leads to support for higher recreation fee, with environmental activist values being the main determinant of support in terms of *public land values*. Other determinants of support include having a college degree or better, women, and living far from a forest. This result is helpful for policymakers as both samples share many of the same characteristics.

4.5.4.2 Membership to a group and *new fees* to support public lands

Results in the second and fourth column in Table 4.16 show that being Hispanic increases the likelihood of support for new fees in the member sample, while having a college education or better and living in a small household increases the likelihood for the non-member sample. For both samples, as income or age increases, the likelihood of support for new fees also increases. Respondents that do not live near a National Forest, or do not visit often are more likely to support new fees. Similarly, women and older individuals are also more likely to support new fees for public lands.

Table 4.16 Ordinal Logit results by group membership and fee statement

	Member		Non member	
	High Fee	***New Fee***	High Fee	***New Fee***
Income	0.003***	0.002**	0.004***	0.004***
	(*0.001*)	(*0.001*)	(*0.001*)	(*0.001*)
College	0.384***	0.042	0.250***	0.133**
	(*0.109*)	(*0.110*)	(*0.057*)	(*0.058*)
Age	0.010**	0.017***	0.002	0.008***
	(*0.004*)	(*0.005*)	(*0.002*)	(*0.002*)
Residency	-0.004	-0.005*	-0.004***	-0.006***
	(*0.003*)	(*0.003*)	(*0.001*)	(*0.001*)
HH size	-0.036)	-0.054	-0.063***	-0.057***
	(*0.047*	(*0.047*)	(*0.022*)	(*0.022*)
Visits	-0.164***	-0.119***	-0.178***	-0.141***
	(*0.037*)	(*0.037*)	(*0.026*)	(*0.026*)
Employed	0.057	0.104	0.228***	0.077
	(*0.118*)	(*0.121*)	(*0.064*)	(*0.064*)
Lives near	-0.232**	-0.309***	-0.115**	-0.138**
	(*0.104*)	(*0.105*)	(*0.058*)	(*0.058*)
Hispanic	-0.023	0.352**	0.016	0.090
	(*0.167*)	(*0.173*)	(*0.073*)	(*0.074*)
Male	-0.469***	-0.390***	-0.240***	-0.264***
	(*0.123*)	(*0.123*)	(*0.060*)	(*0.060*)
Env. Act.	0.693***	0.639***	0.619***	0.553***
	(*0.080*)	(*0.074*)	(*0.044*)	(*0.042*)
Pers. Cons. Be.	0.401***	0.635***	0.486***	0.542***
	(*0.080*)	(*0.076*	(*0.043*)	(*0.041*)
Cons. Man. Val.	-0.266***	-0.438***	-0.297***	-0.348***
	(*0.072*)	(*0.071*	(*0.034*)	(*0.034*)
Observations	1,333		4,499	
Pseudo R^2	0.07	0.07	0.06	0.06
Log Likelihood	-1,944	-1,866	-6,643	-6,323
Model χ^2	288.1	292.8	809.7	742.3

Level of significance: *** p<0.01, ** p<0.05, * p<0.1.
Standard errors in italics and parenthesis.

For both samples, agreement with both individual values increases support for new fees, however, in the case of the member sample, differences between the coefficients are smaller than in the non-member sample. Disagreement with conservationist management values also increases support for new fees, however, the effect of this value is greater in

the member sample than in the non-member sample. Overall, *public land values* are greater determinants of support for members than non-members, with environmental activism being the most important value. This is to be expected, especially for group members, as an environment that is well managed will allow them to enjoy nature for recreational purposes (Jackson 1987). The higher coefficient for environmental activism indicates that, for both sub-samples, they would seek to do all that they can to preserve it by taking a more active role (Thapa and Graefe 2003).

4.6 Conclusions

This analysis extends a growing recreation literature that incorporates environmental attitudes into willingness to pay analysis for ecosystem services (e.g. Spash 2006; Ojea and Loureiro 2007; Ojea and Loureiro 2009; Spash et al. 2009). I analyze the effect of environmental attitudes on the acceptability to changes in recreation fees in the Southwest, a growing and diverse region of the country. The data used for this analysis was gathered as part of a broader research agenda that sought input from the public regarding the scope of resource management of National Forests and Grasslands in the Southwest, and it is the first time such an analysis is being undertaken with this data set.

Overall, as respondents visit National Forest more often, they are less likely to support either higher recreation fees or new fees, except for the households in the Grasslands area. For this exception, the coefficient is not statistically significant. Being employed is only significant in the New Mexico sample for the higher fee statement. Living near a forest has opposite effects for both statements for the New Mexico sample. For the statement dealing with new fees, living near a forest increases support; for higher fees, it has the opposite effect. A possible explanation for these effects is that

respondents living near a forest, in this case within 5 miles, visit a National Forest more often than those that live farther away and are less likely to support higher fees if it has a direct impact on their behavior. On the other hand, an unspecified new fee for public lands is viewed more favorably, especially given pro-environmental values. To verify this, I tested an interaction between visitation intensity and living near a forest and found no significant effect.

Results also show differences between certain groups and the sample. For all groups, environmental activism is a major determinant for support for higher recreation fees or new fees for public lands. Similarly, conservationist management values leads to a rejection of both policies. Personal conservation behavior increases the likelihood of support for both policies, except for the New Mexico sample in the statement on higher recreation fees. The results confirm the need to engage in a public discussion on changes to fee structures or management plans. Research has found that people support fees if the objective is to restore sites (Vogt and Williams 1999). In this regard, *public land values* are helpful in understanding what underlying attitudes would lead to greater support for changes in current forest management plans.

In effect, environmental attitudes act as selection mechanism in which individuals with similar values, regardless of personal characteristics, '*vote*' in the same way. The findings in this chapter suggest that environmental attitudes have a moderating effect on two possible changes to recreation fees; an increase of $5 per visit and an unspecified new fee to support public lands. Whether or not individuals with similar attitudes truly act in a fashion consistent with the underlying values is an empirical question that requires additional investigation, although research has shown that attitudes are a good

predictor on intention to pay for an environmental good (Meyerhoff 2006). This analysis is limited to identifying determinants amongst a set of demographic characteristics and discussing which values lead to greater support. How the fairness of such a policy is perceived by each group is beyond the scope of the survey and any consideration of changes to the current fee structure would require additional input from stakeholder groups to better measure their interests or concerns.

Chapter 5 – Reauthorizing the Federal Lands Recreation Enhancement Act: Impact to Recreation Demand of National Forests in the Southwest

5.1 Introduction

The travel cost and the quality of on-site amenities are some of the most important characteristics in determining the probability that a particular recreation site on public lands is selected over other alternatives. Public land agencies are tasked with enhancing the visitor experience at recreation sites by offering facilities and amenities, such as developed campsites, permanent toilet facilities, developed parking, etc., and engaging in conservation and preservation efforts of natural resources and the environment (Vincent 2010). Public land agencies are also faced with reduced budgets to manage the preservation and conservation of natural resources, the safety and security of users, and the provision of a reasonable recreational experience. As a means of addressing this shortfall in funding, public land agencies view recreation fees as a solution (Park et al. 2010; Schroeder and Louviere 1999). At issue in this chapter are the consequences of the sunset provision of the current fee legislation, the *Federal Lands Recreation Enhancement Act* (REA), which is set to expire in December 2014.

If the recreation fee legislation is not extended, many of the improvements and services that enhance the visitor experience may not be available in the long-run, even with an accumulated capital reserve (DOI and USDA, 2009). This chapter uses the travel cost model to study the effects on recreation demand of changes in fees on a sample of households in Arizona and New Mexico. The empirical framework adopts a corner solution model that controls for multiple recreation sites for which no visits are observed. This approach is based on a two-stage household budgeting process. The first stage represents the decision to visit a National Forest and the second the choice of a recreation site among a set of alternatives.

From a policy and planning perspective, this analysis helps inform the discussion on the impact that fees have on recreation demand for public lands. In addition to not renewing the current fee legislation, three other changes are considered: (i) increasing fees by $5 on sites that currently charge a fee; (ii) charging a flat $5 fee at all sites currently charging a recreation fee; and (iii) introducing a $5 fee on eligible sites that are currently not charging a fee. The first change would occur if the legislation is renewed and the Forest Service requires additional financial resources to make up any additional short-falls in the budget. The second change, charging a flat fee, has been found to be an effective mechanism in reducing recreation demand for fishing in the Gulf of Mexico (Kim et al. 2007). The final change is linked to the first, in that recreation sites must meet a minimum of on-site facilities in order to be able to charge a fee. However, not all eligible sites are currently charging a recreation fee, which represent a potential source of additional funds for the Forest Service.

Fees have been controversial, especially as most recreation areas have not required a fee, leading to an expectation of free access to public lands (Rollins and Trotter 1999). Once fees have been enacted, there are disagreements with respect to where financial resources should be directed. Some groups prefer sites to be restored to their original state (Vogt and Williams 1999), while others would prefer resources be directed towards improving access at the expense of the environment (Jackson 1987). For many users, fees imply improvements to recreation sites and they are willing to incur higher costs as long as it is offset by improved services (Schroeder and Louviere 1999). Ultimately, whether or not to reauthorize the program depends on the benefits that society receives from the program as well as public perceptions from on-going maintenance of eligible

recreation sites. For forest planners, this analysis may contribute to the upcoming discussion on extending the current recreation fee legislation, as well as provide support changes in the current fee structure, whether it is to raise fees, charge a flat fee, or introduce fees to eligible sites.

5.2 Background

The *Federal Lands Recreation Enhancement Act* (REA) allows public land agencies from the Department of Interior (Bureau of Reclamation, Bureau of Land Management, Fish and Wildlife Service, and National Park Service) and the Department of Agriculture (Forest Service) to charge recreation fees in order to enhance the visitor experience by providing and maintaining amenities and facilities (Vincent 2010). Unlike previous legislation, the REA permits public land agencies to keep all fee revenues, of which 80% are retained at the site where they are collected and the rest spent at the discretion of the agency. This provision in the REA is a departure from the earlier legislation that sent fees to the Federal government's general fund (Vincent 2010). [19] Maintenance budgets for sites that do not charge a fee must rely on the budgetary allocation and on the remaining 20% of revenues from fees. Thus, recreation fees are an important source of funding that support and maintain visitor facilities and services, and as discretionary funding for other agency needs.[20]

Changes to recreation fees must undergo a public review process that includes the input and recommendation from a Recreation Resource Advisory Committee (RRACs),

[19] The 1964 *Land and Water Conservation Fund Act.*

[20] Recreation fees may also be used to fund long-term projects as a result of the expected stream of revenues (DOI and USDA 2009). However, the accumulated savings cannot be used for system-wide long-term projects.

which is an advisory body comprised of various stakeholder groups designated by the planning agency (Vincent 2010). Public land agencies also are required to seek additional input from the public, but RRACs play a crucial role in guiding fee policy for public land agencies (USFS 2006). According to the REA, the ability to charge a fee depends on the level of development and availability of certain amenities and facilities. Providing and maintaining such services at a reasonable level would require, at the very least, extending the current fee legislation.

Supporters argue that benefits should accrue to the site and that revenues be used to improve facilities and amenities of the recreation site (Bengston and Fan 2001). These resources are necessary to maintain the quality of services (Vaske et al. 1999) and act as a rationing tool to deal with congestion and resource protection (McLean and Johnson 1997). It is the ability to use local sources of revenue to meet maintenance needs and visitor improvements that has generated the support for fees on public lands (Bowker et al. 1999; Vaske et al. 1999; Bengston and Fan 2001). Indeed, when people were asked if they would support recreation fees, most agreed as long as funds were used to support the recreation site and to improve environmental services (Kyle et al. 2003; Burns and Graefe 2006; Park et al. 2010; Chung et al. 2011). Despite this, some consider recreation fees on public lands to be unethical and that they amount to double taxation (Martin 1999; Bengston and Fan 2001; Vincent 2010). Fee are seen as unfair to frequent visitors (Schwartz and Lin 2006; Nord et al. 1998) and underprivileged groups, such as lower income households (Ostergren et al. 2005; Kim and Crompton 2002).

Among public land agencies, the Forest Service is a special case given the practice of designating certain areas with multiple recreation sites as a high-impact recreation area

(HIRA). Regardless of what site an individual visits a fee is charged at the access site to cover the maintenance needs of all remaining sites in the HIRA. This practice has generated considerable controversy among advocacy groups and led to a lawsuit challenging this arrangement.[21] HIRAs are usually located within two hours of large population centers and are meant to provide a wide range of recreation opportunities (USFS 2005). It is this reduced travel cost, compared to other recreation sites that results in controversy. For example, low income and minority groups are more likely to visit forests near urban areas and are thus more likely to be affected by recreation fees (Chavez 2001; Burns et al. 2008).

5.3 Data

5.3.1 Data preparation

The theoretical framework of the empirical model is the random utility model and a two-stage decision process. In the first stage, an individual or household decides to visit public lands for recreation purposes. The second stage involves deciding what types of recreation activity they wish to engage in. During this second stage, individuals or households decide to visit a recreation site, among a set of possible alternatives (the choice set) that best fit their desired recreation activity and that maximizes utility based on the attributes of the recreation site (Cutter et al. 2007). To facilitate the analysis, and control for heterogeneity in the types of activities that recreationists engage in, observations are categorized into two general types of recreation activities: Day and Active. This categorization is based on how the recreation site is described according to an inventory provided by the Southwestern Regional office of US Forest Service. Active

[21] See *Adams v. U.S. Forest Service*, 2012, Ninth Circuit Court of Appeals.

is comprised of sites designated as trail heads, snow sites, and horse trails. Day sites represent observation sites, picnic sites, day areas, and information sites/fee stations. Table 5.1 shows the recreation site designations for each recreation activity used in this analysis, along with the number of sites under each designation.

Table 5.1 Recreation site categories

		Number of sites [a]	
Recreation Activity	FS designation	General	Total
Day	Observation site	158	364
	Picnic site	146	
	Day area	39	
	Info site/ Fee station	21	
Active	Trail-head	502	530
	Snow site	18	
	Horse trail	10	

[a] Excludes sites in Texas and Oklahoma

A necessary condition for estimation of a travel cost model is to identify the chosen recreation site. With on-site sampling, for example the Forest Services' National Visitor Use Monitoring Survey (see English et al. (2002) for details), this is not an issue, as the researcher is at the chosen recreation location. However, for stated methods using mail surveys, the individual must not only recall the National Forest or Grassland, but also the site that was visited at some point in time. The presence of HIRAs in the Region also affects the ability of an individual to correctly identify the specific recreation site they have visited. Instead, they are likely to remember a general recreation area.[22] Given the distances involved, the variety of recreation alternatives on public lands, and the disaggregated nature of national forests in the West (Crawford 2006), identifying a specific site and not just the forest is necessary for a reliable estimate of travel cost. Due

[22] For example, approximately 338 of the observations in the sample (5%) identified a general recreation area.

to this important requirement, this analysis uses a subset of the data discussed in Chapter 2: respondents living in Arizona and New Mexico that identified a specific recreation site in a National Forest.

Of the 6,847 respondents that provided information on number of trips taken, only 910 offered enough information to identify a specific recreation site. Of these 910 observations, the usable sample consists of 566 observations: 291 Active recreation observations and 275 Day recreation observation. The omitted observations consist of Water and Camping recreation, [23] as well as 37 observations from Texas and Oklahoma (see Appendix B).[24] Being able to only use a subset of the sample is a frequent issue with this type of analysis. Whitehead and Haab (1999) use a sub-sample of 1,914 anglers, out of a sample of 8,865 observations from the Southeastern regional sample of the Marine Recreation Fishery Statistics Survey. This sub-sample represents only small game fishing and private/rental boat users and is used to avoid complications with nesting structures. In a travel cost analysis of anglers in Tennessee, Jakus et al. (1997) use a sub-sample of 369 out of a sample of 2,974 respondents. In this case, individuals were contacted over the phone and were asked which reservoir in Tennessee they visited most often. Similar to the data issues in this analysis, only a sub-set of the sample (12.4%) was able to recall a specific site.

[23] The underlying data for Water and Camping was sparse, yielding counter-intuitive estimates and as a result these two activities are excluded from this analysis.

[24] The omission of the observations from Oklahoma and Texas do not change the results.

5.3.2 Demographic characteristics

The process of selecting demographic characteristic variables began by estimating the pairwise correlation with respect to each other and to the dependent variable. For example, household size is highly correlated with number of young children and teenage children. Each variable was tested separately to determine which contributed the most to the model using the likelihood ratio test and the Akaike (AIC) and Bayesian (BIC) information criterion. As a final step, the identified variables are jointly tested using a likelihood ratio test, where the null hypothesis is that a model with only the implicit price for recreation as a covariate is a not statistically different from a model with the full set of covariates.

The literature on the travel cost model commonly includes age, gender, household size, and income as personal characteristics that are likely to shift recreation demand (Haab and McConnell 1996; Fletcher et al. 1990). In this analysis, I include employment and membership to natural resource group are included as explanatory variables. For example, an important result in Chapter 4 finds membership to a natural resource group is a significant determinant of acceptability of new or higher recreation fees, and is likely to be associated with recreation demand. This analysis provides evidence that additional personal characteristics are helpful in generating robust travel cost estimates.

Table 5.2 shows descriptive statistics for the variables age, having children 13 to 17, male, household income and a dummy indicator variable for individuals that visited a site that is over 100 miles from their residence are variables used for both recreation activities. Having visited a site over 100 miles from the residence is used as a proxy for familiarity with the recreation site. Familiarity and frequent use of a recreation site

generates a sense of place attachment and general support for fee programs, as long as resources are spent on-site (Kyle et al. 2003; Chung et al. 2011). However, for some frequent users, place attachment may also lead to feeling that they are entitled to reduced prices (Park et al. 2010).

Table 5.2 Demographic characteristics

Characteristic	Active		Day	
	Mean	SD.	Mean	SD
Number of trips	15.39	31.30	11.15	19.07
Age	52.06	13.56	54.90	13.59
Have children 13 to 17	0.21	0.60	0.19	0.54
Male (0 = No, 1 = Yes)	0.76	0.43	0.68	0.47
Monthly household income (in '000)	7.01	4.82	6.71	4.85
Distance to visited site ≥ 100 mi (0 = No, 1 = Yes)	0.32	0.47	0.36	0.48
Hispanic (0 = No, 1 = Yes)	0.13	0.34	0.18	0.38
Unemployed (0 = No, 1 = Yes)	0.01	0.10	0.03	0.16
Hours worked per week	31.07	21.11	29.07	21.48
Hiker or Biker group (0 = No, 1 = Yes)	0.06	0.24	0.06	0.24
Environmental group (0 = No, 1 = Yes)	0.12	0.33	0.08	0.28
Observations	291		275	

Note: Characteristics specific to each activity are shaded in grey. SD: Standard deviation.

According to the 2000 US Census, Hispanics represent 30% of the population in the Region. Hispanics are under-represented in both the Active recreation sample (13%) and the Day recreation sample (18%). Similarly, the sample over-represents men, which are 49% of the population but represent over 68% of respondents in any recreation activity. The average age of the respondents in the sample is also greater than average age in the Region, which is around 39 years.

A solution to this under- and over-representation would be to use survey weights. Despite the availability of survey weights it would be problematic to include them with such a small subset of the sample, as they were not generated with this type of analysis in mind. That is, they were not generated based on prior information regarding the

distribution of recreation activities (see McCollum et al. 2008 for a description of the survey weights). The grouping of the observations by type of recreation activity may in fact not be representative of the distribution in the population. Although survey weights may be included in the analysis, it is likely to lead to incorrect population-level inferences.[25] Thus, the discussions and conclusions are limited to the usable sub-sample and not the general population.

Some characteristics in Table 5.2, Hispanic, employment, and natural resource group, are activity-specific and are shaded in grey. As a result of the variable selection process, these variables were found to improve model fit for one of the two activity models. The survey questionnaire has a question regarding membership to a natural resource group, and options included being a member of a sportsperson group, producer group, off-highway-vehicle user group, etc. As is shown in Chapter 4, group membership plays a significant role in predicting preferences towards changes in recreation fees. For this analysis, only two groups are found to improve model fit: Hiker/Biker group (Active) and Environmental group (Day). Employment status was also included in the questionnaire, of which being unemployed and number of hours worked per week was found to improve model fit for Active and Day recreation, respectively.

5.3.3 On-site amenities and facilities

Additional information used in this analysis is the site-specific attributes presented in Table 5.3. The first set of characteristics is on-site facilities, coded as binary variables. Information on the availability of these facilities is provided by the Southwestern region

[25] It can also be shown that not using survey weights does not pose a problem for bias, see Deaton (1997).

(Region 3) of the U.S. Forest Service (see Appendix C for full description). The first four facilities, Parking, Site access, Site information, and Tables are used for both recreation activity categories. Parking facilities denote the presence of either a wheel stop or parking barrier. Site access facilities indicate that the recreation site has either a stairway, pathway, or is accessible for disabled persons. Site information indicates that the site has an exhibit, signs, or information kiosks. Tables denote the availability of a bench, picnic or serving table on site. Water site amenities are facilities used only for the Activity recreation model and denote a site with a beach, depth marker, buoys or erosion control facilities. Sanitation/garbage, social amenities, and water recreation access facilities are used only for Day recreation. Social amenities include playgrounds, tennis or volleyball courts, bike racks, playgrounds, or horse pits. Water recreation access facilities include docks, fishing platforms, ramps, or dump stations.

Table 5.3 Site-specific attributes

Attribute	Active		Day	
	Mean	SD	Mean	SD
Facilities				
Parking	0.336	0.473	0.526	0.500
Site access	0.308	0.462	0.658	0.475
Site information	0.662	0.473	0.719	0.450
Tables	0.115	0.319	0.584	0.494
Water recreation amenity	0.068	0.252	0.308	0.462
Sanitation/Garbage	0.130	0.337	0.377	0.485
Social amenity	N/A	N/A	0.022	0.147
Water recreation access	0.015	0.122	0.050	0.217
Spatial amenities				
Wildland Urban Interface [WUI]	0.353	0.478	0.399	0.490
Fire damage (< 1 mile) [Fire 1]	0.238	0.426	0.226	0.419
Fire damage (1 to 2 miles) [Fire 2]	0.121	0.326	0.127	0.333
Inventoried Roadless Area (< 1 mile) [IRA 1]	0.308	0.462	0.245	0.431
Inventoried Roadless Area (1 to 2 miles) [IRA 2]	0.075	0.264	0.091	0.288
Wilderness area (< 1 mile) [Wild 1]	0.457	0.499	0.339	0.474
Wilderness area (1 to 2 miles) [Wild 2]	0.074	0.261	0.083	0.276

Note: Activity-specific characteristics are shaded in grey. SD = Standard deviation

The second set of characteristics in Table 5.3 are four spatial amenities: Wildand Urban Interface, Fire damage, Inventoried Roadless area, and Wilderness area; created using geographical information systems (GIS) information available in the Southwestern regional website of the U.S. Forest Service.[26] These variables add a spatial heterogeneity dimension that is not readily available with the information on facilities and other recreation amenities. Furthermore, research has shown the importance of including measures of spatial amenities in recreation analysis (e.g. see Loomis et al. 2001; Creel and Loomis 1991; Hanink 1995; Bell and Dalton 2007). They spatial amenities also limit the types of recreation activities that can be performed at each recreation site. For example, no mechanized recreation is allowed on a Wilderness area, while it is allowed on a limited basis on an Inventoried Roadless area (see Appendix D for a full description). Other recreationists may prefer to visit a site that is relatively near a Wildland Urban Interface, a buffer area between nature and human development. Depending on the types of recreation activities they wish to perform, some may prefer to visit a site that has recently experienced a forest fire (Loomis et al. 2001).

In the context of this analysis, GIS is further used to measure the distance from each recreation site to the edge of a polygon that represents the spatial amenity. In some cases, the recreation site is within the polygon, so that the distance is essentially zero. In other cases, there is some distance from the recreation site to the edge of the polygon. These variables are coded as 1 if the recreation site is within 1 to 2 miles from the spatial amenity and 0 otherwise. Three of the spatial amenities, Fire damage, Inventoried Roadless area, and Wilderness area, have two levels. The first level indicates that the site

[26] Region 3 U.S. Forest Service GIS data is available in this link.

is either on the polygon or within 1 mile from the edge. The second level indicates that the site is within 1 to 2 miles from the edge of the polygon.

5.3.4 Generating Travel Cost

The analysis determines travel distance and time using GIS based on geocoded respondent addresses and recreation sites. This information is used to estimate the travel cost from the residence to each recreation site in the area of study. A destination specific travel cost for each observation in the usable sample is calculated with the following equation, using the traditional 1/3 opportunity cost of time (Hagerty and Moeltner 2005):

$$(5.1)\, TC_{i,j} = 2\left[\left(AAA \times D_{i,j}\right) + \left(\frac{1}{3} \times T_{i,j} \times \left(\frac{Y_j}{2000 \text{ hrs.}}\right) \times \left(\frac{1 \text{ hour}}{60 \text{ minutes}}\right)\right)\right] + Fee_i,$$

where, *AAA* is equal to \$0.145 per mile, the AAA average operating cost per mile for small, medium, and large sedans (2007 Edition of *Your Driving Costs*, 7)[27]; $D_{i,j}$ is one-way travel distance in miles to site *i* by household *j*; $T_{i,j}$ is one-way travel time in minutes to site *i* by household *j*; Y_j is annual household income (in US \$); and Fee_i is the fee paid to visit site *i* (in US \$). Both distance and travel time were calculated using the Network Analysis module in ArcGIS. Fee information was provided by the Southwestern regional office of the U.S. Forest Service.[28]

5.3.5 Visitation to Region 3 recreation sites

The total number of trips taken by the respondents in the usable sample is 7,545, of which 2,059 were to sites that charge a fee and the remaining 5,486 to sites that do not

[27] The survey was administered in 2007 and households were asked about their recreation patterns for a period covering 2006 and 2007.

[28] The day recreation fee is used for this analysis and involves a parking fee irrespective of the number of people in the vehicle.

charge a fee. Arizona respondents reported a total of 4,145 visits, of which 35.2% were to sites that charge a recreation fee. New Mexico respondents reported 3,400 visits, 25.8% to sites that charge a recreation fee. As shown in Table 5.4, average trips to Day recreation sites that charge a fee are higher than to sites that do not. For Active recreation, non-fee sites are preferred based on average reported visits.

Table 5.4 Trips to sites by recreation activity

	Active [a]		Day	
Trips	Fee	No fee	Fee	No fee
Average	10.21	16.95	12.50	10.24
Standard Deviation	13.57	34.78	21.52	17.26
Respondents	67	224	110	165
Total trips	*684*	*3796*	*1375*	*1690*

[a] Means are statistically different at 5%.

Besides the possibility of not renewing the current recreation fee legislation, increases of $5 on current and potential sites, as well as a flat fee of $5 on all sites are considered in the analysis. Such increases in fees might seem marginal. As Table 5.5 shows, for the sites that were selected in the sample, the mean fee is well below five dollars, with a median fee of $0. A fee hike is more likely to affect Day recreationists more, while an introduction of a fee would more likely affect Active recreationists mostly, as they currently pay the least in recreation fees.

Table 5.5 Fees at selected sites

	Active	Day
Mean	0.65	2.41
Median	0.00	0.00
Standard Deviation	1.74	5.57
Maximum fee	10	50

Source: USFS Region 3, Albuquerque Regional Office.
The minimum fee is $0.

5.4 Empirical Approach

5.4.1 Corner solution travel cost model

The travel cost literature has shown the importance of using choice sets with multiple recreation sites to generate unbiased welfare estimates (Haab and Hicks 1997). The types of activities and amenities available at each recreation site help define which sites, among all possible choices, are likely to be chosen by recreationists (McClellan and Medrich 1969; Parsons et al. 1999). However, including all available recreation sites would result in biased estimates and lead to incorrect policy conclusions (Freeman 2003). Some remote sites are not likely to be visited, and including them would be analogous to including outliers in regression analysis, leading to a biased coefficient on travel cost, which is used to generate the monetary value of consumer surplus. Even when using a subset of alternatives, the choice set will still be of a considerable size, making the random utility model the preferred theoretical approach (Parsons and Needelman 1992).

The area of study, the Southwestern region of the Forest Service, is such that only a subset of available sites is likely to be considered by the individual, setting demand for all other sites to zero and leading to a corner solution (Phaneuf and Herriges 1999). If the distance is great, then the probability is further reduced, as the opportunity cost of time negatively affects the utility function (Ettema 2005). This will also lead to corner solutions, as individuals are assumed to visit those site that offer the most recreation alternatives and that are the closest (Golob 2000; Phaneuf and Herriges 1999).

The corner solution method evaluates the recreation decision by identifying and linking two distinct components: participation and choice. Herriges et al. (1999) discuss three empirical approaches for corner solution models: 1) the linked model; 2) Kuhn-

Tucker; and 3) repeated nested logit. The linked model estimates *choice* and *participation* sequentially, while both the Kuhn-Tucker and the repeated nested logit model estimate both stages simultaneously. However, the Kuhn-Tucker is a non-linear model that becomes burdensome as more alternatives are included in the process.[29] The repeated nested logit model is an attractive alternative to estimating a corner solution model, however, it assumes each trip is taken during a specified choice occasion and is independent of past visits. The problem with this model is that the analyst specifies the choice occasion and there are no defined criteria for establishing it. Furthermore, assuming away past experiences precludes the possibility of learning from them, which is a strong assumption to make without additional attitudinal information (Herriges et al. 1999). In the face of these uncertainties and assumptions, I decide to use the linked model.

5.4.2 Choice model

The linked corner solution approach incorporates the choice of a site with the decision to visit a National Forest under the two-stage household budgeting process (Hausman et al. 1995) using the assumption of weak separability in recreation goods (Phaneuf 1999). The linked approach first estimates site selection to generate the expected maximum utility of the choice given all possible alternatives. The expected maximum utility from recreation sites is monetized into the implicit price for recreation,

[29] Consumer surplus is estimated using numerical simulation procedures. The Linked model ensures a closed-form solution and is an easier way of estimating consumer surplus. von Haefen (2010) suggests using a traditional RUM-based model after finding biases from significant policy changes with the Kuhn-Tucker approach.

which is used as an independent variable in the participation model (Hausman et al. 1995).

The *choice* of a recreation site among all possible alternatives is estimated using a random utility model (RUM). Given the geographical extent of the area under study, sites within the same National Forest are better substitutes than sites in different National Forests. For example, the loss of a recreation site in northwest New Mexico is not likely to impact the choice of a recreation site in southwest Arizona. A nested logit model of site choice can accommodate recreation sites that are grouped into forest-specific nests, which specifies within-forest sites as better substitutes for each other than sites in other forests.

This analysis uses a two-level nesting structure to model site choice. In the top level, the individual decides which forest, among the 11 in the Region, to visit, and the bottom level the individual decides which recreation site in the forest to visit. Let K be the total number of nests in the upper level and k indicate a particular nest or forest. The number of alternative sites in the lower level for nest k is indicated by J_k. The number of alternatives each individual faces across the region during a choice occasion is given by $\sum_{k=1}^{K} J_k$.

The discrete choice recreation decision involves choosing among multiple alternatives, as a function of site-specific characteristics. The indirect utility for observation i from visiting site j in nest k is given by:

$$(5.2)\quad U_{ijk} = V_{ijk} + \varepsilon_{ijk},$$

where V_{ijk} is the deterministic portion of indirect utility and ε_{ijk} are individual preferences and characteristics that are unobserved by the researcher. I suppress the individual index,

i, for the rest of this model. The deterministic portion of indirect utility is assumed to be a function of site-specific characteristics:

$$(5.3)\ V_{jk} = V_{jk}(y - p_{jk}, \mathbf{q}_{jk}),$$

where, y is hourly household income, p_{jk} is the travel cost to site j in nest k, and $\mathbf{q}_{jk}$ is a vector of site-specific attributes. For this analysis, site attributes are on-site facilities (e.g., parking, sanitation, signage, etc.) and spatial characteristics (e.g., near a designated wilderness area, fire damage, etc.).

The random component in (5.2) is assumed to follow a generalized extreme value (GEV) distribution.[30] This distribution has the desirable property of having a closed form solution for the expected maximum utility and allows alternatives to be grouped into nests (Haab and McConnell 2002). Another important property of this distribution is that it relaxes the independence of irrelevant alternatives (IIA) assumption across all possible alternatives, while still retaining IIA within the nest. Therefore, sites in a nest are better substitutes than sites in other nests (Hausman et al. 1995). The inclusion of another alternative in a nest will not influence choice probabilities in another nest (Fotheringham 1988; Pagliara and Timmermans 2009). For example, an individual considering visiting a recreation site in Forest A may also consider recreation sites in Forest B. However, a change in fees for a recreation site in Forest B would not necessarily affect the

[30] The GEV has the following cumulative distribution:

$F(\boldsymbol{\varepsilon}) = \exp\left(-\sum_{k=1}^{K}\left[\sum_{j=1}^{J_k}\exp\left(\frac{-\varepsilon_{jk}}{\theta_k}\right)^{\theta_k}\right]\right)$, where K is the total number of nests, J_k is the number of alternatives in nest k, and θ_k is the dissimilarity coefficient of nest k (Train 2009).

probability of selecting a given site in Forest A sites, but would affect the probability of selecting alternative recreation sites in Forest B.

The probability that an individual chooses site *j* in nest *k* is given by:

$$(5.4)\ \pi_{jk} = Pr(V_{jk} + \varepsilon_{jk} > V_{lk} + \varepsilon_{lk}) \quad \forall l \neq j$$

The unconditional probability of site *j* in nest *k* is:

$$(5.5)\ Pr(j,k) = \frac{\exp\left(\frac{V_{jk}}{\theta_k}\right)\left[\sum_{l=1}^{J_k}\exp\left(\frac{V_{lk}}{\theta_k}\right)\right]^{\theta_k - 1}}{\sum_{m=1}^{K}\left[\sum_{l=1}^{J_m}\exp\left(\frac{V_{lm}}{\theta_m}\right)\right]^{\theta_m}},$$

where θ_k is the dissimilarity coefficient, a measure of the degree of independence among alternatives in nest *k*. The dissimilarity coefficient can be thought of as a measure of correlation, $\rho_k = 1 - \theta_k$ (Train 2009). As the dissimilarity coefficient approaches zero, alternatives in the nest become correlated and less independent, consistent with the assumptions of the nested logit. As the dissimilarity coefficient approaches one, the model reduces to a conditional logit model without a nesting structure (Haab and McConnell 2002; Train 2009). [31]

The unconditional probability given in equation (5.5) is the product of the conditional probability of choosing alternative *j* given that nest *k* has been selected and the marginal probability that nest *k* is selected (Haab and McConnell 2002; Train 2009):

$$(5.6)\ Pr(j,k) = Pr(j \mid k) \times Pr(k), \text{ where}$$

[31] This is verified using a likelihood ratio test, comparing the log likelihood of the conditional logit model with that of the nested logit model (Haab and McConnell 2002).

$$(5.7)\ Pr(j|k) = \frac{\exp\left(\frac{V_{jk}}{\theta_k}\right)}{\sum_{l=1}^{J_k}\exp\left(\frac{V_{lk}}{\theta_k}\right)},$$

$$(5.8)\ Pr(k) = \frac{\left[\sum_{l=1}^{J_k}\exp\left(\frac{V_{lk}}{\theta_k}\right)\right]^{\theta_k}}{\sum_{m=1}^{K}\left[\sum_{l=1}^{J_m}\exp\left(\frac{V_{lm}}{\theta_m}\right)\right]^{\theta_m}}.$$

The marginal probability $Pr(k)$ represents the top level of the nest and the conditional probability $Pr(j|k)$ represents the bottom level, which take the form of logits (Train 2009).

The deterministic portion of the indirect utility function in (5.3) is linear in income and site-specific characteristics (Parsons and Hauber 2002):

$$(5.9)\ V_{jk} = \beta_y(y - p_{jk}) + \boldsymbol{\beta}'\mathbf{q}_{jk},$$

where $\beta_y y$ is an additive constant that will not affect the site choice probability in equation (5.4) and is dropped hereafter, so that (5.9) becomes:

$$(5.10)\ V_{jk} = -\beta_y p_{jk} + \boldsymbol{\beta}'\mathbf{q}_{jk}.$$

Substituting (5.10) into (5.7) and (5.8) yields:

$$(5.11)\ Pr(j|k) = \frac{\exp\left(\frac{-\beta_y p_{jk} + \boldsymbol{\beta}'\mathbf{q}_{jk}}{\theta_k}\right)}{\sum_{l=1}^{J_k}\exp\left(\frac{-\beta_y p_{lk} + \boldsymbol{\beta}'\mathbf{q}_{lk}}{\theta_k}\right)},\ \text{and}$$

$$(5.12)\ Pr(k) = \frac{\left[\sum_{l=1}^{J_k} \exp\left(\frac{-\beta_y p_{jk} + \boldsymbol{\beta}' \mathbf{q}_{jk}}{\theta_k}\right)\right]^{\theta_k}}{\sum_{m=1}^{K}\left[\sum_{l=1}^{J_m} \exp\left(\frac{-\beta_y p_{lm} + \boldsymbol{\beta}' \mathbf{q}_{lm}}{\theta_m}\right)\right]^{\theta_m}}.$$

Substituting (5.11) and (5.12) into (5.6):

$$(5.13)\ Pr(j,k) = \frac{\exp\left(\frac{-\beta_y p_{jk} + \boldsymbol{\beta}' \mathbf{q}_{jk}}{\theta_k}\right)}{\sum_{l=1}^{J_k} \exp\left(\frac{-\beta_y p_{lk} + \boldsymbol{\beta}' \mathbf{q}_{lk}}{\theta_k}\right)} \times \frac{\left[\sum_{l=1}^{J_k} \exp\left(\frac{-\beta_y p_{jk} + \boldsymbol{\beta}' \mathbf{q}_{jk}}{\theta_k}\right)\right]^{\theta_k}}{\sum_{m=1}^{K}\left[\sum_{l=1}^{J_m} \exp\left(\frac{-\beta_y p_{lm} + \boldsymbol{\beta}' \mathbf{q}_{lm}}{\theta_m}\right)\right]^{\theta_m}}.$$

Equation (5.13) can be rearranged to an equivalent expression to equation (5.5) (see Train 2009). Let $\gamma_{jk} = 1$ if site j in nest k is chosen, 0 otherwise. The likelihood function is given by:

$$(5.14)\ L(\boldsymbol{\beta}, \theta_1, \ldots, \theta_K \mid \mathbf{q}_{jk}) = \prod_{k=1}^{K}\prod_{j=1}^{J_k} Pr(j,k)^{\gamma_{jk}}$$

Using (5.6) this expression can be re-written as:

$$(5.15)\ L(\boldsymbol{\beta}, \theta_1, \ldots, \theta_K \mid \mathbf{q}_{jk}) = \prod_{k=1}^{K}\prod_{j=1}^{J_k} [\Pr(j \mid k) \times \Pr(k)]^{\gamma_{jk}}$$

The log-likelihood function for each individual is:

$$(5.16)\ \ln L(\boldsymbol{\beta}, \theta_1, \ldots, \theta_K \mid p_{jk}, \mathbf{q}_{jk}) = \sum_{k=1}^{K}\sum_{j=1}^{J_k} \gamma_{jk} \ln[Pr(j \mid k)] + \sum_{k=1}^{K}\sum_{j=1}^{J_k} \gamma_{jk} \ln[Pr(k)]$$

The full information maximum likelihood approach is used to jointly estimate all parameters for (5.16) over all observations in the sample.

A key component of the linked model is the log of the denominator in equation (5.5) that links the upper and the lower level nests, representing information regarding all

alternatives in the nest (Train 2009). This component is referred to as the inclusive value, the expected maximum utility an individual receives given the alternatives in a nest for a given choice (Heiss 2002):

$$(5.17)\ IV = IV(y, \mathbf{p}, \mathbf{q}) = \ln\left(\sum_{m=1}^{K}\left[\sum_{l=1}^{J_m}\exp\left(\frac{-\beta_y p_{lm} + \boldsymbol{\beta}'\mathbf{q}_{lm}}{\theta_m}\right)\right]^{\theta_m}\right)$$

5.4.3 Participation model

The second stage of the estimation process uses the result from equation (5.17) to link the site choice model to the participation model. In this second stage, participation is expressed as the number of reported trips to the chosen site. Number of trips is a non-negative integer, estimated using a Negative Binomial model, a count data approach (Hellerstein 1992; Hellerstein and Mendelsohn 1993; Winkelmann and Zimmermann 1995). The general form of the *participation* model for individual *i* is:

$$(5.18)\ T_i = h(\mathbf{L}_i, \mathbf{Z}_i, y_i) + u_i,$$

where T_i is the total trips taken in 2007 by individual i, $\mathbf{L}_i$ is the variable linking both stages of the recreation decision, $\mathbf{Z}_i$ are individual and household characteristics that influence the recreation decision, and y_i is monthly household income.

The linking variable controls for the effect on participation of changes in site characteristics in a given choice occasion. The approach that is used to link both stages of the decision process through the inclusive value relies on generating a price index ($\tilde{p}_i$), defined as the negative per trip consumer surplus (Hausman et al. 1995).[32] Under

[32] Other suggested methods to link both models include using the inclusive value from equation (5.17) to predict the number of trips (see Herriges et al. 1999). Welfare is

this approach, the price index that is included in equation (5.18) may also be interpreted as the monetized utility per trip (Herriges et al. 1999, 172):

$$(5.19)\ \tilde{p}_i = \frac{-IV_i}{\beta_y}.$$

Thus, equation (5.18) is re-written as:

$$(5.20)\ T_i = h_i(\tilde{p}_i, Z_i, y_i) + u_i.$$

The consistency of the two-stage budgeting process that links the implicit price from equation (5.19) to the participation model in equation (5.18) is explained in Hausman et al. (1995, 11–12). Taking advantage of the assumption of constant marginal utility of income for small changes to income (Haab and McConnell 2002; Train 2009), welfare is estimated as the area under the demand curve before and after the introduction of policy:

$$(5.21)\ W_i = \int_{\tilde{p}^1}^{\tilde{p}^0} \hat{h}_i(\tilde{p}_i, \mathbf{Z}_i)dp.$$

5.4.4 Choice Set Definition

An important aspect of the analysis is the set of alternatives an individual faces at the moment of choosing a recreation site. As Figure 5 shows, this is especially significant for an area of study with multiple recreation alternatives and spatially disaggregated National Forests (Crawford 2006). Based on the sample used in this analysis, approximately 75% of available recreation sites had no stated visit. A recreation site with no visits could be due, in part, to its proximity to sites in the same vicinity, (e.g., a High

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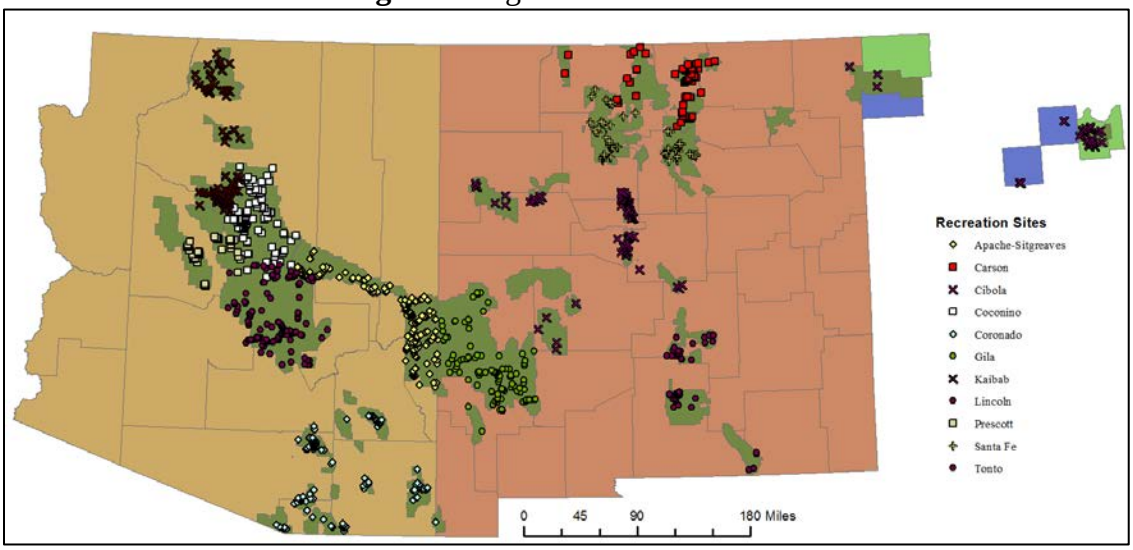
estimated as either the product of the change in the inclusive value, before and after the policy, and the predicted number of trips after the policy; or the difference between the product of the inclusive value and the predicted number of trips, before and after the policy.

Impact Recreation Area). For example, Ashurst Lake in the Coconino National Forest (Mormon Lake Ranger District) has three site alternatives: a campground, a fishing site, and a boating site. Each recreation site is a *potential site* in the same *area*. That is, each is likely to be in a choice set of possible alternative recreation sites. Of the *potential sites* in the choice set, only one is reported in the survey as the *choice site*. The respondent is likely to visit all the sites, but only one is stated as the destination. This problem also applies at an aggregate level, as the Mormon Lake area, for example, has a variety of recreation areas in close proximity.

Figure 5 Region 3 recreation sites



The transportation literature was one of the first that focused on the selection of a site in space that would satisfy the needs for recreation of the population (McClellan and Medrich 1969). Using this background, later literature defined site selection by probability models. A key assumption is that people will select the sites that most fit their recreation demand, i.e., the site that offers the best array of recreation opportunities, such as hiking, mountain biking, etc. (Termansen et al. 2004). Implicit in this assumption is that some sites have a low probability of selection.

For the nested logit model, the composition of the *choice set* will have a direct impact on the inclusive value, an index of quality of recreation opportunities that is determined, in part, by the characteristics of all substitute sites in the nest (Carson et al. 1989). Keeping in mind that an improper selection of alternatives in the *choice set* will lead to biased welfare results, distance from the residence to the site is used in generating the choice sets (Parsons and Kealy 1992; Thill 1992; Haab and Hicks 1999; Parsons et al. 2000; Whitehead and Haab 1999). Further, *choice sets* are generated such that irrelevant alternatives are not included because there is no gain in the efficiency of welfare estimates.

The literature on choice set definition offers little guidance on setting a distance threshold or the size of the choice set. Early work by Parsons and others restricted the choice set to be between 2% to 9% of available sites using simple random sampling (e.g. Feather 1994; Haab and Hicks 1997; Parsons and Kealy 1992; Parsons and Needelman 1992; Parsons and Hauber 2000; Parsons et al. 2000). A primary reason at the time was to reduce the burden on computing time, as larger choice sets implied a longer estimation time. Distance effects were not as important since the analysis was usually restricted to one state or a (relatively) small region. With advances in computing and a greater availability of GIS, the focus has shifted to using spatial boundaries. For example, Whitehead and Haab (1999) tested distance thresholds up to 360 miles in two states, Louisiana and North Carolina. They find that restricting the choice set to only recreation sites within a 4.5 hour driving time from the home residences captures a reasonable set of substitutes. Removing sites beyond the threshold helps eliminate unrealistic substitutes.

Termansen et al. (2004) compared using choice sets drawn from random sampling and geographical boundaries. The sampling choice sets were generated using random draws that selected up to 300 sites. The geographical choice sets were generated at 25 kilometer (km) increments; starting at 25 km and up to 250 km. As the size of the choice set increased, moving from the small sample random draws to the spatial choice sets decreased the variation in the estimated parameters. The optimal choice set was found at either a spatial boundary of 181 km or a random draw of 100 sites.

Based on this literature, choice sets were generated using distance from each individual's residence. However, some individuals visited sites well outside a threshold of 250 miles from their residence resulting in no alternatives around the site. This led to counter intuitive results for the participation model; the sign on the coefficient for the implicit price for recreation in equation (5.20) was unexpectedly positive. Model diagnostics revealed that the problem was the size and sign of the estimated inclusive value from equation (5.17), which affected the implicit price in equation (5.19). A primary contributor to these counter-intuitive results was the choice set generated for some observations that resulted in a negative inclusive value. To solve this problem, an alternative approach is adopted that generates choice sets for each observation by first identifying one site in each National Forest and applying a buffer around it. The buffer consists of two semi-circles, one moving away from the identified site and the other between the identified site and the residence.

The identified site is either the nearest recreation site for each forest or the site that the individual visited. A buffer is then placed around the identified site, outside which sites in the forest are excluded. To explore the empirical consequences of different buffer

distances, multiple buffers were created by varying the distance away from the identified sites. Each buffer was then tested by estimating the participation model from equation (5.20) and observing the sign of the coefficient for the implicit price of recreation. For the purpose of verifying each buffer, the only variable included in the estimated model is the implicit price of recreation. This process resulted in multiple buffers with the expected sign on the coefficient. Based on the level of significance of the coefficient for the implicit price, the selected has a 210 mile diameter, or a 3.5 hour driving time from the identified site to any other site within the buffer.

5.5 Empirical Results

Prior to estimating each model, a correlation table was generated with all recreation facilities and the dependent variable. Facilities that were highly correlated were set aside; facilities that were not highly correlated were used as a base set of facilities. Each facility that had been set aside was added based on a likelihood ratio test and AIC/BIC fit statistics. Only facilities that improved model fit are included as part of the final set of facilities. Based on this, a site-specific profile of spatial amenities and on-site facilities is created. To confirm the use of the identified spatial amenities and on-site facilities, and to test the robustness of the model, the set of variables that represent spatial and on-site facilities is estimated separately and compared to a model with both sets.

5.5.1 Choice model

As a first step in the analysis, the robustness of the *choice model* for each recreation activity is verified by systematically adding facility and spatial variables. The purpose is to detect any potential problems with the main variable of interest, travel cost, and to compare the effects of each variable set independent of the other. A total of three models

are estimated for each recreation activity (Model 1 to 3). Model 1 estimates the *choice model* only with the facilities. Spatial amenities alone are estimated in Model 2, and Model 3 is used to generate the linking variable for the second stage model.

Table 5.6 Active recreation *choice model* robustness test (n = 291)

	Model 1: Facilities		Model 2: Spatials		Model 3: All	
	Coef.	SE	Coef.	SE	Coef.	SE
Travel Cost	-0.009***	0.001	-0.009***	0.001	-0.010***	0.001
Parking	1.022***	0.205			0.867***	0.197
Site access	0.960***	0.197			1.055***	0.184
Site information	-0.059	0.215			-0.076	0.193
Tables	0.357	0.221			0.407*	0.210
Water rec. amenity	-0.354	0.282			-0.709***	0.236
WUI			0.982***	0.195	0.821***	0.163
Fire 1			-0.208	0.261	0.003	0.226
Fire 2			-0.960***	0.345	-1.034***	0.342
IRA 1			0.670***	0.239	0.696***	0.220
IRA 2			0.354	0.360	0.960***	0.338
Wild 1			1.089***	0.212	1.380***	0.208
Wild 2			-0.721	0.483	-0.332	0.458
Dissimilarity coefficients						
Apache-Sitgreaves θ	1.503***	0.106	1.510***	0.116	1.579***	0.123
Carson θ [a]	1.000	N/A	1.000	N/A	1.000	N/A
Cibola θ	1.307***	0.112	1.321***	0.114	1.255***	0.112
Coconino θ	1.634***	0.139	1.650***	0.144	1.693***	0.149
Coronado θ	1.752***	0.176	1.455***	0.209	0.912***	0.153
Gila θ	2.204***	0.201	1.911***	0.178	2.198***	0.202
Kaibab θ [a]	1.000	N/A	1.000	N/A	1.000	N/A
Lincoln θ	1.338***	0.205	1.471***	0.193	1.274***	0.192
Prescott θ	1.324***	0.239	1.218***	0.244	1.146***	0.223
Santa Fe θ	1.834***	0.165	1.877***	0.184	1.810***	0.183
Tonto θ [a]	1.000	N/A	1.000	N/A	1.000	N/A
Log Likelihood	-1024.0		-1026.0		-987.3	
χ^2 (*p-value*)	125.6	(*0.000*)	112.1	(*0.000*)	240.9	(*0.000*)

Level of significance: *** p<0.01, ** p<0.05, * p<0.1

[a] The dissimilarity coefficient was constrained to 1 to ensure convergence in the maximum likelihood model.

Table 5.6 presents the results for Active recreation. Facilities change only slightly when both sets of site attributes are estimated in the same model, and show no changes in the sign of the coefficient. Water recreation amenity becomes statistically different from zero in Model 3, as does Inventoried Roadless area within 2 miles (IRA 2) from the recreation site. All but one spatial amenity, Fire damage within 1 mile from the site (Fire 1), changes sign, going from a negative to a positive and is statistically not different from zero. The coefficient on Travel Cost is higher, in absolute terms, in Model 3. Overall, there is a significant improvement in fit in Model 3, with lower log likelihood and a higher model chi square.

Results for Day recreation are presented in Table 5.7. The coefficients for Parking, IRA 2, and Wild 2 go from negative to positive when all variables are included (Model 3), but are statistically not different from zero. The coefficient on Travel Cost is consistent throughout all the models. With the exception of Parking, IRA 2 and Wild 2, there are no significant changes in the size of the coefficients across the models. Interestingly, Model 3 show only a slight improvement compared to Model 1, but is much better than Model 2. This suggests that facilities have a greater impact on site selection than spatial amenities for Day recreation. The only spatial amenity that is statistically significant in all models is Fire damage within 2 miles (Fire 2), indicating that Day recreationist prefer a site that is fairly well developed and not too remote from human development.

Table 5.7 Day recreation *choice model* robustness results (n = 275)

	Model 1: Facilities		Model 2: Spatials		Model 3: All	
	Coef.	SE	Coef.	SE	Coef.	SE
Travel Cost	-0.007***	0.001	-0.007***	0.001	-0.007***	0.001
Parking	-0.153	0.208			0.072	0.210
Site access	0.366	0.240			0.329	0.238
Site information	0.394*	0.235			0.359	0.231
Tables	-0.477*	0.254			-0.566**	0.246
Sanitation/Garbage	0.745***	0.251			0.679***	0.240
Social amenity	0.864**	0.378			0.841**	0.350
Water rec. access	0.765**	0.308			0.718**	0.318
WUI			-0.275	0.199	-0.247	0.210
Fire 1			0.064	0.297	0.233	0.289
Fire 2			0.679**	0.288	0.820***	0.300
IRA 1			0.394*	0.239	0.243	0.238
IRA 2			-0.030	0.289	0.116	0.294
Wild 1			0.319	0.281	0.284	0.279
Wild 2			-0.022	0.338	0.240	0.343
Dissimilarity coefficients						
Apache-Sitgreaves θ	1.580***	0.113	1.389***	0.127	1.448***	0.139
Carson θ [a]	1.000	N/A	N/A	N/A	1.000	N/A
Cibola θ	1.476***	0.129	1.460***	0.150	1.452***	0.146
Coconino θ	2.007***	0.196	1.973***	0.193	1.955***	0.201
Coronado θ	1.287***	0.103	1.124***	0.129	1.031***	0.135
Gila θ	1.710***	0.161	1.799***	0.167	1.686***	0.190
Kaibab θ [a]	2.095***	0.182	1.989***	0.166	1.996***	0.185
Lincoln θ	1.000	N/A	1.000	N/A	1.000	N/A
Prescott θ	1.481***	0.155	1.469***	0.141	1.544***	0.164
Santa Fe θ	2.314***	0.287	2.440***	0.287	2.221***	0.286
Tonto θ [a]	1.000	N/A	1.000	N/A	1.000	N/A
Log Likelihood	-990.6		-1002.0		-984.4	
χ^2 (*p-value*)	96.43	(*0.000*)	71.38	(*0.000*)	115.0	(*0.000*)

Level of significance: *** p<0.01, ** p<0.05, * p<0.1

[a] The dissimilarity coefficient was constrained to 1 to ensure convergence in the maximum likelihood model.

5.5.2 Choice model discussion

For both Active and Day, Model 3 yields a lower log likelihood compared to the other two models, showing improvements in model fit. The stability of the Travel Cost

coefficient is also a good sign of the robustness of the model. The choice model for each recreation activity must be consistent with random utility model (RUM) theoretical framework. A common way to ensure consistency is to observe the value of the dissimilarity coefficient (θ), the degree of similarity or substitutability of alternatives in the nest (Herriges and Kling 1997; Hauber and Parsons 2000). A higher coefficient ensures that independence from irrelevant alternatives (IIA) holds within each nest and not across all nests, consistent with the generalized extreme value (GEV) distribution that defines a nested model. A strong test of consistency with RUM is the range defined by the Daly-Zachary-McFadden (DMZ) condition, that is, the coefficient must be between 0 and 1 (Herriges et al. 1999). However, as is the case in Model 3 in Tables 5.6 and 5.7, the dissimilarity coefficients take a value greater than 1. This is allowed if the subset of alternatives in the choice set contain all the relevant data, such that the subset represents a choice compatible with random utility maximization, a condition known as *local consistency* that was introduced by Börsch-Supan (1990).[33]

The coefficient on Travel Cost has the expected negative sign and is significant in the model with the full set of site attributes. Having parking facilities increases the likelihood of site selection for both recreation activities, but is statistically different from zero for Active recreation only. Site access, such as ramps for disabled people, increases the likelihood of site choice, but is only statistically different from zero for Active recreation. Site information reduces the likelihood of site selection for Active recreation, while for Day, it increases the likelihood. The availability of Tables works in the

[33] Another requirement for *local consistency* is for the choice probabilities to be non-negative (Koning and Ridder 2003).

opposite direction, increasing the likelihood for Active recreation and reducing it Day recreation.

Model diagnostics revealed a set of facility variables unique to each recreation activity in explaining site choice. For Active recreation, Water recreation amenities was found to be the only other important variable in explaining choice, and its availability reduce the likelihood of site selection. In the case of Day recreation, three additional facilities were found to be important in determining site choice: Sanitation/Garbage, Social Amenities, and Water recreation access facilities. The availability of all three facilities is likely to increase the likelihood of site selection.

With respect to spatial amenities, an Active site on a Wildland Urban Interface (WUI), within 1 mile of a Wilderness area, or up to 2 miles from an Inventoried Roadless Area is more likely to be selected. On the other hand, a recreation site that shows fire damage within 1 to 2 miles is less likely to be selected. The only statistically significant spatial amenity for Day recreation is fire damage within 1 to 2 miles from the recreation site (Fire 2), which increases the likelihood of the site being selected. Both Active and Day prefer a site that is on a designated Wilderness area, which prohibits any mechanized recreation and leaves the area as primitive as possible.

Based on these site characteristics, Active recreationists prefer, on average, sites that offer ease of access and that are not near water. They also prefer sites that are well protected from human development and are relatively far from any recent forest fires. Day recreationists prefer sites that provide amenities for social gatherings and access to water and appear to dislike having tables on the site. It may be that Day recreationists

appreciate the health benefits in the form of human well-being that are provided by the ecosystem services provided at public lands.

5.5.3 Participation model robustness test

The robustness of the *participation* model is also verified by estimating three models, as presented in Tables 5.8 for Active recreation and 5.9 for Day recreation. For this model, demographic characteristics are grouped into two categories: (i) *core* and (ii) *supplemental*. The *core* characteristics are consistently used in the Travel Cost literature: age, household size, gender, and household income. For this analysis, however, having children 13 to 17 is used instead of household size. Initial diagnostics revealed both to be highly correlated with each other, but having children 13 to 17 was found to be a better fit for the model than household size.

The other category is *supplemental* and includes additional variables that are found to be important determinants in the *participation* model. Having visited a site over 100 miles from the residence is the only *supplemental* characteristic that is common to both recreation activities. It takes a value of 1 if the site the respondent visited was over 100 miles driving distance from the residence, 0 otherwise. Heterogeneity based on the distance travelled to the recreation site was revealed when the choice sets for the *choice model* were being defined; similarly, diagnostics also revealed this variable to be an important determinant of the *participation* model. Each recreation activity, Day and Active, also has different *supplemental* characteristics describe similar demographic features. For example, both activities have a different variable that controls for employment status: being unemployed (Active) and number of hours worked per week

(Day).[34] Membership to a natural resource group is another shared demographic feature, with Hiker/Biker group for Active recreation and Environmentalist group for Day recreation. Finally, being Hispanic is an important determinant for Day recreation only, which is consistent with findings from National Forests near urban centers in California (Chavez 2001).

Table 5.8 Active recreation *participation model* robustness test (n = 291)

	Model 1 Core		Model 2 Supplemental		Model 3 Specific	
	Coef.	SE	Coef.	SE	Coef.	SE
Price for recreation [a]	-0.0007	0.0006	-0.0012*	0.0006	-0.0012**	0.0006
Age	-0.007	0.005	-0.004	0.005	-0.005	0.005
Having children 13 to 17	-0.156	0.101	-0.133	0.104	-0.128	0.102
Male	0.575***	0.163	0.453***	0.170	0.467***	0.163
Household income	0.016	0.015	0.007	0.017	0.007	0.014
Unemployed			-0.629	0.690	-0.623	0.682
Hours worked			0.000	0.004		
Hiker or biker group			0.562*	0.288	0.549*	0.281
Environmental group			-0.151	0.207		
Being Hispanic			0.039	0.241		
Visited site ≥ 100 mi			-0.558***	0.153	-0.547***	0.148
Constant	2.803***	0.332	3.133***	0.416	3.150***	0.344
Dispersion parameter	0.214***	0.080	0.152*	0.081	0.154*	0.081
Log Likelihood	-1081		-1071		-1071	
χ^2 (*p-value*)	17.78	(*0.003*)	37.84	(*0.000*)	37.24	(*0.000*)

Level of significance: *** p<0.01, ** p<0.05, * p<0.1

[a] The *p-value* for Price of recreation is: 0.257 (Model 1); 0.066 (Model 2); and 0.049 (Model 3).

Model 1 estimates a model with only the *core* variables. Model 2 includes the *supplemental* features for both recreation activities, and Model 3 only uses the core and the supplemental characteristics specific to the recreation activity. As presented in Table

[34] Pairwise correlations revealed both variables to be weakly correlated (less than 10%) with respect to household income.

5.8 for Active recreation, the coefficient on Price for recreation (the linking variable between the *choice* and *participation* models) is not statistically different from zero in Model 1. As the *supplemental* features are included (Model 2 and 3), Price for recreation becomes statistically different from zero at the 10% level of significance. Of the four *core* characteristics, only Male is statistically different from zero. All the Day recreation *supplemental* features are not statistically different from zero, while member to a Hiker/Biker group and visited a distance site both are across Models 2 and 3. As can be seen in both Table 5.8 and 5.9, having visited a site of 100 miles is an important variable in making Price become statistically different from zero. This suggests that fees are so low that only the inclusion of significant travels costs is making price important. In terms of robustness of the model, results show the coefficients to be relatively similar across the three models, with no changes in the sign of the coefficients.

Results for Day recreation presented in Table 5.9 show the coefficient for Price for recreation become statistically different from zero once the *supplemental* features are included. Unlike Active recreation, both Age and Male are statistically different from zero. Membership to an Environmentalist group and being Hispanic are the only two *supplemental* features that are statistically different from zero, and both are specific to Day recreation. A likelihood ratio test indicates that Model 3 is statistically different from Model 2 ($\chi^2 = 6.74,\ p-value: 0.034,\ \text{d.f.} = 2$). To verify which model, 2 or 3, is a better fit, I estimated the Bayesian Information Criterion (BIC), which is lower for model 3 (1915.1 vs. 1910.6). Therefore, Model 3 is used in the final specification of the *participation* model for Day recreation.

Table 5.9 Day recreation *participation model* robustness test (n = 275)

	Model 1 Core		Model 2 Supplemental		Model 3 Specific	
	Coef.	SE	Coef.	SE	Coef.	SE
Price for recreation [a]	-0.0009	0.0005	-0.0015***	0.0005	-0.0014***	0.0005
Age	-0.008	0.005	-0.015***	0.005	-0.015***	0.005
Having children 13 to 17	-0.212	0.138	-0.134	0.137	-0.153	0.138
Male	0.433***	0.145	0.454***	0.140	0.488***	0.140
Household income	-0.006	0.015	-0.010	0.015	-0.010	0.015
Unemployed			0.563	0.398		
Hours worked			-0.004	0.003	-0.004	0.003
Hiker or biker group			0.588**	0.282		
Environmental group			0.391	0.252	0.615***	0.229
Being Hispanic			-0.514***	0.173	-0.571***	0.174
Visited site ≥ 100 mi			-0.382***	0.135	-0.416***	0.134
Constant	3.015***	0.408	3.900***	0.439	3.835***	0.445
Dispersion parameter	0.072	0.085	-0.057	0.088	-0.033	0.087
Log Likelihood	-939.7		-921.1		-924.4	
χ^2 (*p-value*)	18.11	0.003	55.44	0.000	48.69	0.000

Level of significance: *** p<0.01, ** p<0.05, * p<0.1

[a] The *p-value* for Price for recreation is: 0.103(Model 1); 0.003 (Model 2); and 0.008 (Model 3)

5.5.4 Participation model discussion

As expected, the coefficient on the implicit price for recreation has the correct sign and is similar in magnitude across Active and Day recreation. The recreation activities differ in the sign of the coefficients for the *supplemental* features and household income. This is taken as evidence in support of including *supplemental* features that describe differences between the two recreation activities and justifies estimating separate models for each.

For Active recreation, being a Male or a member of a Hiker/Biker group increases the number of trips taken for recreation, while visiting a site that is over 100 miles is likely to reduce the number of trips taken. Recreationists that are younger, Male, Non-Hispanics,

or members of an Environmentalist group are more likely to have taken more trips to Day recreation sites. Day recreationists that travel to a site farther than 100 miles from their residence are less likely to visit the site often. Households with higher income are more likely to visit an Active site, while lower income households are more likely to visit a Day site. Unemployed respondents are more likely to visit a Day site than an Active site.

Based on these behavioral characteristics, the effects of changes in the current recreation fee structure are analyzed in the next section. *A priori*, not renewing the recreation fee legislation will reduce the current cost of recreation and may have a positive effect on welfare. This change in fees is expected to benefit Day recreationists the most, as they are more likely to visit a site that charges a fee and pay a higher average fee. Similarly, a $5 increase in current recreation fees is likely to impact Day recreationists' more than Active recreationists. The effect of a flat fee depends on the number of respondents that pay more than $5 in recreation fees, relative to those that pay less. The same would apply to a policy that would introduce a recreation fee to eligible sites that are currently not charging a fee.

5.6 Welfare Results of Fee Policy Scenarios

The empirical model links number of trips taken and site selection using the inclusive value, the expected maximum utility an individual receives given the alternatives in the choice set in a given choice occasion. This behavioral link helps predict the change in the number of trips due to changes in prices, as well as the associated effects on welfare. For this analysis, changes to welfare are estimated using the measure defined in equation (5.21) and developed by Hausman et al. (1995):

$$(5.22)\quad W_i = \int_{\tilde{p}^1}^{\tilde{p}^0} \hat{h}_i(\tilde{p}_i, \mathbf{Z}_i)dp,$$

where $\tilde{p}_i$ is the linking variable between both models is the implicit price for recreation, or the monetized value of utility. $\tilde{p}^0$ indicates the recreation fee before the policy change and $\tilde{p}^1$ indicates the recreation fee after the policy change. Change in welfare is an estimated value of the reduction in welfare based on the difference between the predicted number of trips before and after a change in fee policy (equation 5.22).

Table 5.10 presents the predicted point estimates for four changes in the current fee policy, along with the lower and upper bound 95% confidence intervals, for: (i) setting fees to $0 as a result of not reauthorizing the fee legislation; (ii) charging a flat $5 fee at sites that are currently charging a fee; (iii) increasing current recreation fees by $5; and, (iv) introducing a $5 fee on eligible sites not currently charging. The effect of the first policy change, not reauthorizing current legislation, increases welfare for both recreation activities as the cost of travel reduces, on the margin, for all individuals that visit a recreation site that currently charges a fee. Based on the estimated changes in welfare, Day recreationists are expected to receive higher increase in welfare than Active recreationists. This result is not unexpected, as 40% of Day recreationists in the sample visit a site that charges a fee and pay, on average $5.30. A flat fee, the second policy change, has a positive effect on both recreation activities, but the effect is not significant for Active recreationists. Around 23% of Active recreationists in the sample visit a site that charges a fee, and pay, on average, $4.54. A flat fee will increase the travel cost slightly, but will not reduce welfare.

Table 5.10 Change in welfare per person per year (in US$)

Change in fee policy	Active			Day		
	Mean	95% C.I.		Mean	95% C.I.	
		Upper	Lower		Upper	Lower
(i) Dropping all fees: not reauthorizing fee legislation	18.92	21.86	15.98	23.00	26.31	19.70
(ii) Charge a $5 flat fee at sites currently charging a fee	0.11	0.95	(0.74)	3.19	5.16	1.21
(iii)A $5 increase to current recreation fees	(18.65)	(15.76)	(21.54)	(19.74)	(17.38)	(22.09)
(iv) Introduce a $5 fee on eligible sites not charging	(1.59)	(0.99)	(2.20)	(5.03)	(4.21)	(5.85)

Note: Parenthesis denotes a reduction in welfare.

Welfare is reduced for the third and fourth policies. The effect is greatest for the third policy, a $5 increase to current recreation fees, yielding relatively similar reductions on welfare for both recreation activities. Intuitively speaking, this reduction in welfare is due primarily to the low level of current recreation fees throughout Region 3 National Forests. The median fee is $0 for Day and Active sites, and the mean fee is less than $3 for Day site and $1 for Active sites. Therefore, a fee hike of such magnitude leads to such a loss in welfare, especially as recreationist have become accustomed, and in fact, expect low recreation fees at public lands (Park et al. 2010). Finally, introducing a $5 fee on eligible sites also reduces welfare, with a greater negative effect on Day recreation. This last result is explained by the 16% of observations that visited a fee-eligible Day site, compared to 1% of Active observations that visited a similar type of site. Considering the number of recreation sites in the Region for both types of recreation activities, 530 Active and 364 Day, the effect of a price hike at eligible sites is not as widespread as an overall price hike would be.

Increasing fees leads to a reduction in welfare, while eliminating or charging a flat fee improves welfare. For all policies, the effect is greatest for Day recreation. If the

legislation is renewed, and the Forest Service required additional funds, introducing fees to eligible Active sites would have a lower negative effect on welfare than doing so on Day sites. A flat fee has a marginal effect on Active recreation and, in fact, increases welfare for Day recreationists. This information may be useful when considering changes to fee structures and weighing the concerns of multiple stakeholders (McCarville and Crompton 1987). In this case, the Recreation Resource Advisory Committees would have an important role to play in reducing any possible controversies with the public.

5.7 Conclusions

With reduced budgets, changes in the current fee structures must be considered by all public land management agencies. However, they must also anticipate the possibility that current legislation will not be renewed, and if renewed, not before the current enabling legislation expires. This chapter investigates the effects of changes in the current fee structure. Based on survey responses regarding recreation sites, observations are grouped into two recreation activities: Active and Day. These recreation activities are generated based on the site descriptions provided by the Southwestern office of the US Forest Service. Robustness checks confirmed the need to separate the observations into these recreation activity categories, as the potential activities at each site define which sites are the most likely to be chosen by recreationists (McClellan and Medrich 1969; Parsons et al. 1999).

Individuals or households are likely to visit one or two sites over a choice occasion, so that the variety of recreation sites, the geographical extent of the area of study, and the disaggregated nature of National Forests lead to a presence of corner solutions in recreation demand (Herriges et al. 1999). To control for the presence of multiple

recreation sites with zero visits, recreation demand is estimated using a linked corner solution travel cost model. This chapter contributes to the travel cost literature by estimating changes in recreation demand using a corner solution model on a unique sample of in Arizona and New Mexico. This analysis also contributes to the upcoming debate on renewing the current fee legislation, which has allowed public land agencies engage in significance improvements to facilities and other visitor services, as well as to fund natural resource conservation projects (USDOI and USDA 2012).

This analysis also expands on the set of demographic characteristics used in travel cost analysis, such as age, gender, household size, and income (e.g., Jakus et al. 1997; Hesseln et al. 2003; Loomis et al. 2001), to a set of characteristics that have traditionally not been used, such as membership to a natural resource group. The inclusion of these other variables, or *supplemental* features, help explain differences in behavior and characteristics of the two recreation activity groups. Taking advantage of an inventory of geocoded recreation sites and spatial features on National Forest land, this analysis uses geographical information systems (GIS) to generate a spatial amenity profile of each recreation site. This information, along with facility information provided by the Forest Service, is used to generate a site-specific profile of each recreation site in the Southwestern region.

Four policy changes in recreation fees are analyzed: (i) not renewing current legislation, which is set to sunset in 2014; (ii) charging a flat $5 fee at sites currently charging a fee; (iii) increasing current recreation fees by $5; and (iv) introducing a $5 fee on eligible sites not currently charging a recreation fee. Eligible sites are those that meet all the minimum facility criteria set in the current legislation, but that are not currently

charging a recreation fee. Results show that not renewing the legislation, or charging a flat $5 fee, increases welfare to both recreation activities. Increasing current fees or introducing a fee on eligible sites reduces welfare to recreationists in the data set. The effect of these policies is felt the most by Day recreationists, as they are more likely to visit fee charging sites. Although a flat fee does increase welfare for Active recreation, the effects are marginal and not significant compared to Day recreation.

For the Forest Service to consider the possibility changing current fees, consultation with stakeholder groups and the public would be necessary to reduce any controversies. The use of collected funds must also be clearly articulated and must be shown to benefit the recreation site (Burns and Graefe 2006; Chung et al. 2011). Certainly an argument could be made that fees are paid by those who use the National Forests the most (Martin 1999) and are used to maintain the quality of services, facilities and amenities (Bengston and Fan 2001; Vaske et al. 1999).

I do add an important caveat to these conclusions. The usable sample is a reduced sub-set of an original sample of 6848 observations, a loss of about 91.7% of the observations. During the course of data preparation, I encountered a familiar problem with travel cost models, the inability of some respondents to recall a recreation site they had visited. With advances in GIS and the use of internet survey methods, adding a detailed recreation map of the area of study, or using at the very least the ranger district to segment the area, would help individuals recall a recreation area they had recently visited. A set of questions or statements could also be included to generate a recreation profile, which could then be matched with on-site site information to predict a specific recreation site.

Chapter 6 – Conclusions

6.1 Conclusions

Understanding the public's underlying values towards the environment is essential in developing policies that impact ecosystem services on public lands. Through this understanding, policymakers are better able to determine the level of support for policy, essential in reducing conflicts or controversies in public policy related to the environment (Bengston and Fan 2001; Park et al. 2010). Environmental values are an ideal way of conceptualizing environmental attitudes, a determinant of behavior towards the environment and the intention to accept or reject policy (Ajzen 1991; Meyerhoff 2006). In this investigation, I contribute to a growing literature that makes environmental attitudes a key aspect of economic analysis and the need to consider nuances in environmental attitudes. I study the role that environmental values have towards accepting changes in recreation fees at National Forests and the effect that such changes have on recreation demand on a sample of households in the Southwest.

This investigation first identified and characterized the environmental attitudes of latent groups in the sample using a set of *public land value* statements and demographic characteristics. I used this information, along with census projections, to discuss the impact of changes in the perceived environmental attitudes of the region in the long-run. I then measured the effect that environmental values have on the level of agreement with two statements that deal with changes in recreation fees. At a time when the demographic characteristics of the population are changing (Shinew et al. 2006), identifying and characterizing values is important because they represent an enduring concept that humans have towards the environment (Bengston 1994). An innovative feature of this analysis is the use of three summary measures of *public land values* that

have been derived from an exploratory factor analysis. An important result is the diversity of environmental attitudes within demographic segments of the sample of households. This variability not only extends across demographic characteristics, that is, differences between gender and ethnicity, but also within groups, for example young women compared to older women. I concluded this investigation by analyzing the effects on recreation demand from changes in recreation fees. A principal aspect is the impact that changes in fee legislation will have on both the demand for recreation benefits on public lands and the ability to supply an expected level of facilities and amenities that enhance the visitor experience. In the following section I summarize the results for each chapter. Policy implications are presented at the end.

6.2 Summary of findings

The investigation begins in Chapter 2 with the results of an exploratory factor analysis on the *public land value* statements. The purpose of this factor analysis is to generate summary measures of *public land values* that facilitate the subsequent analysis and discussion of environmental attitudes and forest policy. Factor analysis indicates the presence of three orthogonal factors, two individual values and one management value. An index calculated for each factor indicates that individual values are more relevant in forming environmental attitudes than management values.

In addition to values, other factors have been found to influence environmental attitudes (Steg and Vlek 2009). For example, demographic characteristics have been used as proxies for the personal capabilities that are required for particular actions (Stern 2000). Therefore, personal capabilities, characteristics, and environmental values are likely to influence attitudes towards the environment. I start to examine this relationship

in Chapter 3 using canonical correlation analysis (CCA) to identify and describe, in summary form, latent environmental attitude groups in the sample. To complement these results, I explore the consequences for forest policy from changes in the demographic characteristics of the region. Overall, findings suggest support for the newly established Forest Service environmental stewardship planning rule. The majority of the latent groups exhibit variability in the relevant demographic characteristics and display pro-environmental attitudes. Management values are found to be a central underlying value of environmental attitudes, in contrast to the general results from Chapter 2. The importance of this seemingly contradictory outcome is that policymakers and researchers must take caution in defining and discussing environmental attitudes by controlling for other personal characteristics. There is relatively stronger support for conservationist management policies, although state-specific policies should be considered based on the results from the New Mexico sample. This suggests a low-impact regional resource policy and greater outreach to stakeholder groups.

In Chapter 4, I find that environmental attitudes have a moderating effect on accepting two changes in fees, a $5 increase in recreation fees and an unspecified fee to support public lands. Consistent with the findings from Chapter 2, individual values play a greater role in defining group-level environmental attitudes. Support for higher recreation fees is driven primarily by active individual values; support for new fees is driven by both active and passive individual values. From a policy standpoint, to achieve support for higher fees, policymakers must appeal directly to active participants in the environment by allocating the new funds to projects that protect and enhance the environment. New fees, in contrast, involve support from a broader part of the public,

individuals that are at least passive participants in the environment, so that resources should be used to minimize the damage caused by humans.

In Chapter 5, I consider the effects of changes in current fee policy on recreation demand. Specifically, the consequences of not renewing the current legislation that allows public land agencies collect user fees at designated recreation sites. These financial resources are important for public land agencies facing increasing cuts in their budgets; relying on them to fund maintenance of amenities and facilities, as well as natural resource preservation and restoration projects. I also study the effects on recreation demand for a $5 hike in fees, imposing a flat fee on all sites currently charging, and introducing a $5 recreation fees to eligible sites that are not currently charging a user fee. I split the sample into Active and Day recreation to control inherent heterogeneity in the site attributes that are likely to influence site choice (McClellan and Medrich 1969; Parsons et al. 1999). Ignoring such differences would lead to biased welfare estimates (Cutter et al. 2007).

As would be expected, dropping all fees as a result of failing to renew the current fee legislation will increase welfare in the sample, as does charging a flat fee. In contrast, a fee hike and introducing recreation fees on eligible site not yet charging will reduce welfare. The effect of these policies is felt more by Day recreationist, as they visit fee sites more often than Active recreationist. The analysis does have an important limitation; it is conducted on a reduced sample of observations that reported a specific recreation site in the survey. This stems from the difficulty of remembering a specific recreation site from over 1,400 recreation sites in the Southwestern region of the Forest Service, spread across 11 National Forests and 1 National Grassland in Arizona, New

Mexico, and parts of western Oklahoma and Texas. Each respondent did receive a map of the National Forests and Grasslands in the area, however, it was meant as a reference and not an additional data gathering tool. Additional details, like a ranger district, high impact recreation areas, or most popular sites could have helped individuals remember what site they had visited the most. The data generation process also included a website, which could also have been used as a tool to help individuals choose a recreation site.

6.3 Policy implications

The results of this dissertation are important for planners at the Forest Service in relation to the recent planning rule that requires forest managers to consider the impact of policy on ecosystem services (Federal Register 2012). This directive expands the established planning method, a *multiple-use model* that is concerned only with the commodity aspects of natural resource and their impact on humans, to considering the effect on nature by adopting a *stewardship of ecosystems model*. Under this new model, it is the impact on ecosystem services, including humans and nature, that represents the benchmark to which policy must be measured, requiring a greater understanding of how humans value the environment as a whole (Ruhl 2010). The policy I analyze in this dissertation is the Federal Lands Recreation Enhancement Act, which authorizes collecting recreations fees on public lands. Fees are used to both fund natural resource conservation projects and recreation amenity improvements in public lands (Vincent 2010). Therefore, changes in fees are likely to have an impact on the amount of resource that is available to protect the environment and to ensure a reasonable visitor experience.

An interesting finding is the relationship between natural resource groups and environmental attitudes. Natural resource groups act as a selection mechanism in which

individuals with similar attitudes, regardless of other personal characteristics, '*vote*' in the same way. Whether or not individuals with similar attitudes act in a fashion consistent with the underlying values is an empirical question that requires additional research, especially since environmental attitudes have been shown to be a good predictors on intention to pay (Meyerhoff 2006). Another interesting finding is the moderating effect that environmental attitudes have on two possible changes to recreation fees: an increase of $5 per visit and an unspecified new fee to support public lands. I conclude by measuring the effect of changes in fee on recreation demand. This is especially relevant, as the current legislation that authorizes agencies like the Forest Service to charge and collect fees on public lands is set to expire in 2014.

In terms of impact to recreation demand, as expected, higher recreation fees will reduce welfare; dropping fees will increase welfare. What is surprising is the effect of a flat fee on the two recreation activities under consideration. In the case of active recreation, which involves more physical activity than the other recreation activity, Day, welfare will be reduced only marginally; while for Day there will be a greater, but still small reduction in welfare. As a matter of policy, the Forest Service may be interested in structuring all fees at a similar level, and this result indicates that it is possible to synchronize all fees. Furthermore, it provides forest managers and policymakers with an alternative to dropping all fees. Additional research should be conducted with stakeholder groups and visitors to determine whether the results in this investigation are consistent with expectations.

One behavioral aspect that was not included in the survey, and which would be helpful in future research, is a question on the fairness of the current fee structure and

where resources should be allocated (Meyerhoff 2006). In Chapter 4, I show that attitudes play a moderating role in questions dealing with the acceptability or importance of fees; however, whether or not the fees are viewed as helpful or that fulfill another behavioral concern is not explored. The survey questionnaire does address some management objectives (Question 7 of the survey questionnaire in Appendix E), but these are broad objectives designed to make regional policy and are not specific to the recreation site or to the visitor experience. Research has consistently shown that recreationists are willing to accept fees as long as the use of such resources are clearly defined (Chung et al. 2011), for example, to improve on-site services (Park et al. 2010; Bengston and Fan 2001) or to restore recreation sites damaged by human use (Vogt and Williams 1999). A clear understanding of environmental attitudes is helpful to predict intentions towards the environment and with respect to paying for preservation of public lands. I believe that controlling for environmental attitudes, fairness, and the impact on the visitor experience is helpful in developing policies that are funded through recreation fees on public lands, considered by many as a public goods they may be willing to pay for in order to preserve (Vogt and Williams 1999; Burns and Graefe 2006; Reynisdottir et al. 2008).

From a policy standpoint, this research provides the ideal motivation to extend the current legislation, both in terms of duration and scope. It is also helpful in considering expanding the number of recreation sites that are currently charging a fee to all eligible sites that should be charging a fee. This would provide much needed relief in terms of the agency's budget, helping address maintenance back-logs that are likely present at eligible sites that are not charging recreation fees. As past research has shown, and this

investigation has found, stakeholder groups must be part of any conversation. Certainly working with Recreation Resource Advisory Committees is a useful mechanism that should be expanded to as many stakeholder groups as possible. This would be helpful both in the planning and implementation stage, as not all groups have the same objectives with respect to conservation and preservation efforts (Fischer 2010; Johnson et al. 2004), but working with these groups will facilitate informing users and reducing any potential controversies (Clement and Cheng 2011; Fischer 2010).

Thus, another important avenue of future research is eliciting more information from members of stakeholder groups. In Chapter 3 and 4, I show how important they are in determining both environmental attitudes and acceptance to changes in recreation fees. The role that stakeholder groups have on defining values and thus characterizing attitudes should be of no surprise. There is a clear relationship between the values people hold and the types of groups they are likely to join. Research has been conducted on user groups, such as campers, active users (Vogt and Williams 1999), and mechanized or appreciative users (Jackson 1987; Jackson 1986; Thapa and Graefe 2003; Berns and Simpson 2009). Additional research on stakeholder groups would be helpful in designing policies that incorporates their concerns during the planning stage. It would also be helpful in defining a sampling frame to increase the response rate. This may also add saliency to the questionnaire, one of the weaknesses of the questionnaire used in the survey. The inherent risk, however, is that non-members may not be contacted.

Appendix A – Chapter 3 *Public Land Values* Canonical Loadings

Table A.1 Regional *public land values* canonical loadings

	Public Land Value statements	Regional CCA groups						
		1	2	3	4	5	6	7
Personal conservation behavior								
1	People should be more concerned about how public lands are used.	0.3429	-0.2186	-0.4967	-0.0917	0.2069	0.1444	0.2590
2	Natural resources must be preserved, even if some people must do without some products.	0.7354	-0.0922	-0.1219	0.1904	-0.0189	0.0477	0.2328
3	Consumers should be interested in environmental consequences of the products they purchase.	0.5284	-0.0513	-0.1682	-0.1426	-0.0197	0.0800	0.2767
4	I would be willing to sign a petition for an environmental cause.	0.7809	0.0745	0.1065	0.1264	0.2481	-0.0116	0.1168
6	If we could just get by with a little less there would be more left for future generations.	0.6055	-0.2158	-0.1490	0.0754	-0.2159	0.0293	-0.1191
7	Manufacturers should be encouraged to use recycled materials in their manufacturing and processing operations.	0.3477	-0.3440	-0.3075	-0.2085	0.0420	-0.0072	0.2075
8	Future generations should be as important as the current one in decisions about public lands.	0.3809	-0.3500	-0.2411	-0.3172	-0.1023	0.1173	0.2153
Environmental activism								
10	People should urge friends to limit their use of products made from scarce resources.	0.5798	-0.1807	0.1328	-0.0663	0.1322	0.2147	0.3107
11	I am glad there are national forests even if I never get to see them.	0.3133	-0.2985	-0.3824	0.0300	-0.2473	0.4112	0.2381
12	People can think public lands are valuable even if they do not actually go there themselves.	0.3494	-0.2588	-0.4377	0.0694	-0.1694	0.1854	0.3900
13	I am willing to stop buying products from companies that pollute the environment even though it might be inconvenient.	0.5532	-0.2067	-0.1737	-0.2308	0.1925	0.0088	0.2284
14	I am willing to make personal sacrifices for the sake	0.5156	-0.1912	-0.1635	-0.2311	0.2200	0.5127	0.1209

Public Land Value statements		Regional CCA groups						
		1	2	3	4	5	6	7
	of slowing down pollution.							
15	Forests have a right to exist for their own sake, regardless of human concerns and uses.	0.6307	-0.3534	-0.1353	0.0013	-0.0317	0.3286	-0.1449
16	Wildlife, plants, and humans have equal rights to live and grow.	0.5927	-0.5339	-0.0696	-0.1172	0.1458	-0.0464	-0.1188
Conservationist management values								
18	We should actively harvest more trees to meet the needs of a much larger human population. [a]	0.5288	0.0666	-0.5332	-0.2138	0.0342	-0.2398	-0.0377
19	The most important role for public lands is providing jobs and income for local people. [a]	0.3546	0.2898	-0.6315	0.0439	0.0798	0.0013	0.0804
20	The decision to develop resources should be based mostly on economic grounds. [a]	0.4321	0.2615	-0.5071	-0.2347	0.0308	0.2254	-0.0132
21	The main reason for maintaining resources today is so we can develop them in the future if we need to. [a]	0.4016	0.5624	-0.2149	-0.4494	-0.1150	-0.0049	-0.1970
23	The primary use of forests should be for products that are useful to humans. [a]	0.4855	0.2294	-0.4705	-0.3309	-0.1933	0.0009	0.2780
24	The Federal government should subsidize the development and leasing of public lands to companies. [a]	0.1926	0.0464	-0.7538	-0.1819	0.1922	0.1610	0.0626
25	The government has better places to spend money than devoting resources to a strong conservation program. [a]	0.4632	0.1245	-0.3426	-0.2324	0.2300	0.1817	0.2956

[a] Items are reverse coded to ensure that positive scores represent pro-environmental attitudes.

Table A.2 Arizona *public land values* canonical loadings

	Public Land Value statements	Arizona CCA groups					
		1	2	3	4	5	6
Personal conservation behavior							
1	People should be more concerned about how public lands are used.	0.4473	-0.0197	0.5264	-0.2034	-0.1871	-0.0680
2	Natural resources must be preserved, even if some people must do without some products.	0.6627	0.1579	0.0840	0.0251	-0.2460	0.1406
3	Consumers should be interested in environmental consequences of the products they purchase.	0.4906	0.0615	0.1104	0.2009	-0.0582	-0.0229
4	I would be willing to sign a petition for an environmental cause.	0.6691	0.3333	-0.1626	-0.0465	-0.0461	-0.1448
6	If we could just get by with a little less there would be more left for future generations.	0.6439	-0.0084	-0.0993	0.1283	-0.2984	0.0385
7	Manufacturers should be encouraged to use recycled materials in their manufacturing and processing operations.	0.4515	-0.2738	0.2072	0.0759	0.0600	0.1373
8	Future generations should be as important as the current one in decisions about public lands.	0.4634	-0.3472	0.2455	0.2378	-0.0300	-0.1628
Environmental activism							
10	People should urge friends to limit their use of products made from scarce resources.	0.5969	0.0144	-0.0181	0.0084	0.0250	-0.0569
11	I am glad there are national forests even if I never get to see them.	0.4215	-0.1765	0.5181	0.1834	-0.1653	0.1180
12	People can think public lands are valuable even if they do not actually go there themselves.	0.3751	-0.1225	0.4322	0.0680	-0.1550	0.3346
13	I am willing to stop buying products from companies that pollute the environment even though it might be inconvenient.	0.6457	0.0539	0.1051	-0.0919	0.3777	0.2282
14	I am willing to make personal sacrifices for the sake of	0.4896	-0.0494	0.3907	0.1019	0.0821	-0.1102

	Public Land Value statements	Arizona CCA groups					
		1	2	3	4	5	6
	slowing down pollution.						
15	Forests have a right to exist for their own sake, regardless of human concerns and uses.	0.7028	-0.1089	0.1761	-0.0120	0.0802	-0.1606
16	Wildlife, plants, and humans have equal rights to live and grow.	0.7285	-0.2948	0.1628	-0.2240	0.0982	0.0659
Conservationist natural resource management							
18	We should actively harvest more trees to meet the needs of a much larger human population. [a]	0.5450	0.0970	0.4447	0.0615	0.1745	-0.0259
19	The most important role for public lands is providing jobs and income for local people. [a]	0.2802	0.2833	0.6333	-0.0352	0.0062	0.0317
20	The decision to develop resources should be based mostly on economic grounds. [a]	0.4113	0.2136	0.5626	0.1698	0.0760	-0.2087
21	The main reason for maintaining resources today is so we can develop them in the future if we need to. [a]	0.1793	0.4743	0.4310	0.3760	0.4140	-0.0337
23	The primary use of forests should be for products that are useful to humans. [a]	0.4562	0.1798	0.5468	0.4025	0.0908	0.0531
24	The Federal government should subsidize the development and leasing of public lands to companies. [a]	0.2004	-0.0483	0.7509	-0.0880	0.1051	-0.1041
25	The government has better places to spend money than devoting resources to a strong conservation program. [a]	0.4110	0.2460	0.5290	-0.1284	-0.1162	-0.0556

[a] Items are reverse coded to ensure that positive scores represent pro-environmental attitudes.

Table A.3 New Mexico *public land values* canonical loadings

	Public Land Value statements	New Mexico CCA groups					
		1	2	3	4	5	6
Personal conservation behavior							
1	People should be more concerned about how public lands are used.	-0.0712	-0.4014	-0.3268	-0.4320	-0.1539	0.0096
2	Natural resources must be preserved, even if some people must do without some products.	-0.4913	-0.6080	-0.1188	0.0790	-0.1133	-0.0213
3	Consumers should be interested in environmental consequences of the products they purchase.	-0.4001	-0.3990	-0.1036	-0.2182	-0.0558	-0.1314
4	I would be willing to sign a petition for an environmental cause.	-0.5904	-0.5163	0.1073	-0.0461	-0.3397	0.0929
6	If we could just get by with a little less there would be more left for future generations.	-0.3115	-0.5261	-0.2219	-0.1030	0.1953	-0.1419
7	Manufacturers should be encouraged to use recycled materials in their manufacturing and processing operations.	-0.0680	-0.4585	-0.2513	-0.3329	0.0155	-0.1468
8	Future generations should be as important as the current one in decisions about public lands.	-0.1390	-0.4702	-0.1361	-0.2858	0.1527	-0.0182
Environmental activism							
10	People should urge friends to limit their use of products made from scarce resources.	-0.2762	-0.5392	0.2314	-0.0691	-0.1997	-0.1370
11	I am glad there are national forests even if I never get to see them.	-0.0041	-0.4582	-0.3617	0.1925	0.1269	-0.1493
12	People can think public lands are valuable even if they do not actually go there themselves.	-0.0853	-0.4837	-0.4371	0.0772	0.0933	-0.0861
13	I am willing to stop buying products from companies that pollute the environment even though it might be inconvenient.	-0.2222	-0.4924	-0.1664	-0.3691	-0.1223	-0.1825
14	I am willing to make personal sacrifices for the sake of slowing down pollution.	-0.2789	-0.5033	-0.0440	-0.1690	-0.1325	-0.5012

Public Land Value statements		New Mexico CCA groups					
		1	2	3	4	5	6
15	Forests have a right to exist for their own sake, regardless of human concerns and uses.	-0.2025	-0.6991	-0.1242	0.0174	0.0049	-0.2036
16	Wildlife, plants, and humans have equal rights to live and grow.	-0.0571	-0.7654	0.0537	-0.2080	0.0008	0.0243
Conservationist management values							
18	We should actively harvest more trees to meet the needs of a much larger human population. [a]	-0.4773	-0.2145	-0.4215	-0.3397	-0.0506	0.3452
19	The most important role for public lands is providing jobs and income for local people. [a]	-0.4716	-0.0198	-0.5286	-0.1190	-0.2119	-0.0341
20	The decision to develop resources should be based mostly on economic grounds. [a]	-0.5111	-0.0030	-0.3524	-0.2573	0.0232	-0.2220
21	The main reason for maintaining resources today is so we can develop them in the future if we need to. [a]	-0.6995	0.1564	-0.0908	-0.3375	0.3271	0.0235
23	The primary use of forests should be for products that are useful to humans. [a]	-0.5261	-0.1093	-0.3190	-0.2670	0.1714	0.0388
24	The Federal government should subsidize the development and leasing of public lands to companies. [a]	-0.2645	-0.0473	-0.6426	-0.3978	-0.1626	-0.1408
25	The government has better places to spend money than devoting resources to a strong conservation program. [a]	-0.4115	-0.1990	-0.0958	-0.3651	-0.0598	-0.1343

[a] Items are reverse coded to ensure that positive scores represent pro-environmental attitudes.

Appendix B – Other Chapter 5 data considerations

Table B.1 shows the excluded Water and Camping recreation sites from the analysis. They are being excluded because the corresponding observations were not well behaved and consistently yielded counter-intuitive results. An additional 37 observations from Texas and Oklahoma were also dropped. I also omit the recreation sites from the National Grasslands area (located in Texas and Oklahoma) because of the considerable travel distance for Arizona and New Mexico residents and the negligible effect on the results.

Table B.1 Water recreation site categories

		Number of sites [a]	
Recreation Activity	F.S. designation	General	Total
Water	Boating	57	114
	Fishing	50	
	Swim site	7	
Camping	Camping	378	390
	Lodge	12	

[a] Excludes sites in Texas and Oklahoma

After excluding Grasslands and Water recreation sites, there are 1,283 recreation sites in the area of study, Region 3 of the US Forest Service. Approximately 36.04% charge a recreation fee, which is on average $3.92. Arizona has most of the sites that charge a fee and fees are generally higher (usually group camping sites). Of those that stated visiting a recreation site in our sample, the average fee was $2.69, with a standard deviation of $5.46 and a maximum of $60.00. About 341 sites were reported to have been visited in 2007, of which 35.48% were to sites that charged a fee.

Appendix C – Facility categories and descriptions

Table C.1 Description of on-site facilities used in the analysis

Category	**Facility**/ Description
Parking	**Developed** – *Wheel Stop*: A precast concrete or plastic barrier used to define the perimeter of a parking area and to protect from vehicle encroachment. **Undeveloped** – *Parking Barrier*: A structure designed to prevent vehicular travel beyond a designated point.
Site Access	**Stairway**: A set of joined steps that provides easier access up or down a slope. **Pathway**: A route within the recreation site boundary designated for the movement of pedestrians and non-motorized vehicles, does not include National Forest System Trails. **Pathway Bridge**: A structure designed to carry pedestrian traffic over a gap or obstacle. **Accessible/Social Impact Area**: An area with a hardened surface to prevent resource damage or to be ADA accessible.
Site Information	**AV System Hardware**: An integrated, permanent system of audio and video/DVD equipment, electrical wiring, circuitry for lighting, playback, accessibility (audio and captioning systems), and public address system designed for use in a theater or similar stand-alone setting or capacity. **AV System Program**: The integrated development, fabrication, and installation of professional stand-alone digital, audio, film, or video/DVD presentations and the physical or electronic media with which they are delivered. **Exhibit Interactive**: A series of comprehensive, integrated permanent exhibits with moving parts that may also use computer or audio-visual hardware and software. **Exhibit Static**: A series of comprehensive, integrated permanent exhibits with text and images but no moving parts includes but not limited to: flat panel, two dimensional or 3-D such as dioramas. **Guide**: Signs that direct users to and from recreation destinations as well as direct users from the site entrance to facilities and activities within the site. **Poster**: Temporary signs used to meet a specific, short-term need. **Travel Management**: Regulatory signs that inform users of applicable traffic laws, regulations, and other legal requirements or warning signs that are needed to alert users to conditions not readily apparent or normally associated with typical site use. **Visitor Information**: Signs that engage, appeal to different learning styles, use interpretive techniques, and have a central theme that links that site's resources to intangible, universal concepts. **Information Kiosk**: A multi-paneled sign that dispenses information in the form of maps, pamphlets, and other literature.
Table	**Bench**: An elevated sitting surface upon which more than one person may rest.

Category	**Facility**/ Description
	Picnic Table: A piece of outdoor furniture with a smooth flat top and affixed benches and legs. **Serving Table**: A piece of outdoor furniture with a smooth flat top; has no benches attached.
Water Recreation Amenity	**Riprap**: Rock used to armor shorelines and streambeds against water erosion. **Retaining Wall**: A structure that prevents down slope movement, or erosion, of soil or rock and provides support to constructed features from above or below. **Beach**: Area of sand along the edge of a body of water managed for recreational use. **Buoy, Regulatory**: A floating device attached to the sea/lake bottom with chains and anchors, used to warn boaters of hazards, restricted areas, speed limits, etc. **Depth Marker**: A measuring device found in water to indicated the distance from the floor to the surface.
Sanitation/Garbage	**Dumpster, Large**: Large (6-8 cubic yards) steel waste receptacle designed to be emptied into garbage trucks. **Dumpster, Small**: Small (2-5 cubic yards) steel waste receptacle designed to be emptied into garbage trucks. **Garbage Bin**: Metal receptacle used to temporarily store waste, smaller than a dumpster and larger than a garbage can. **Garbage Can**: A container for temporarily storing water usually made out of metal or plastic. **Garbage Can Anchor Post**: Wood/metal post anchored in concrete to which a garbage can may be secured. **Garbage Can, Accessible**: A garbage can that meets ADA guidelines. **Sanitary Pit**: An open hole into which human waste is disposed (associated with wilderness toilets). **Subsurface Can**: Garbage can that has been installed in ground with a concrete pad and access point at the surface. **Toilet, Mobile**: Portable structure designed to contain human excrement.
Social Amenity	**Ball Field**: A level field maintained for use of a baseball diamond. **Bike Rack**: Solid, anchored object to which a bicycle is secured while owner is away. **Horseshoe Pit**: Two metal stakes planted in the ground approximately 40 feet apart. **Playground**: An area designed for children to play, often includes equipment like swings, slides, monkey bars, etc. **Tennis Court**: A firm rectangular surface with a low net stretched across the center. **Volleyball Court**: A firm rectangular surface with a high net stretched across the center.

Category	**Facility**/ Description
Water Recreation Access	**Dock, Floating**: A platform to provide access to boats that is supported by pontoons so that it raises and lowers with the water level. **Dock, Stationary**: A platform extending from the shore into the waterway that does not raise and lower with the water level. **Dump Station, Floating**: Place to bring boats to empty their holding tanks of gray water and sewage and to refill with fresh water. **Fishing Platform**: A stationary structure extending from the shore into a waterway, bordered with a railing, and used for fishing rather than boat access. **Ramp**: A hardened, inclined travel way used for trailered watercraft to gain access to a body of water.

Source: US Forest Service Infra Recreation Sites Minor Constructed Features, September 2010.

Table C.2 Additional facilities available in the data but not used in the analysis

Category	**Facility**/ Description
Recreation Vehicle Amenity	**Dump Station, Trailer**: Place to bring travel trailers, RVs, etc. to empty their holding tanks of gray water and sewage and to refill with fresh water. **Loading/Unloading Ramp, ATV**: Ramp designed to ease transfer of ATV to or from a truck or trailer. **Trailer/RV Hookup**: Electrical and/or water connection provided at a unit for visitors' use.
Camping Amenity	**Host Site**: Overnight unit designed to be utilized by a long-term occupant. Typically includes water, electricity and holding tank or septic system. **Security Light**: A freestanding light installed to illuminate potential hazards. **Bear Box**: Metal Box used to store food and other attachments to prevent consumption by bears. **Lantern Post**: A metal pole with a hook from which a lantern is hung. **Sun/Wind Shelter**: An open structure that covers or provides protection from sun, wind, or rain. **Tent Pad**: Area leveled, hardened and delineated with a border for the pitching of tents.
Horse Recreation Amenity	**Corral**: An enclosure for confining livestock. **Hitching Post**: Anchored posts between which rope is strung. Horse leads are hung from rope in order to contain and/or feed horses. **Hitching Rack**: Horizontal bar attached to vertical posts used to tie off horses. **Manger**: A container from which horses or pack stock feed. **Loading/Unloading Ramp, Animal**: Ramp designed to ease transfer of animal to or from a truck or trailer. **Stock Stall**: A compartment where a single animal is confined and fed. **Water Trough**: A container with an open top, used to provide water to stock animals.
Fire/Grill	**Combination Fire Ring Grill**: A device with an attached cooking surface used to contain campfires and prevent them from spreading. **Fire Ring**: A device used to contain campfires and prevent them from spreading, may be constructed of metal or concrete. **Fireplace**: A structure, usually of stone or brick, for holding an outdoor fire. **Grill Stand**: An elevated metal surface designed to hold portable grills. **Pedestal Grill, Large**: Elevated, metal cooking device on which food is cooked on a rack and over an open flame. **Pedestal Grill, Small**: Elevated, metal cooking device on which food is cooked on a rack and over an open flame.

Source: US Forest Service Infra Recreation Sites Minor Constructed Features, September 2010.

Appendix D – Spatial Amenity Definitions

Inventoried Roadless Area

An area that provides opportunities for disperses outdoor recreation, such as hiking, camping, picnicking, wildlife viewing, hunting, fishing, cross-country skiing, and canoeing. Mountain biking and other mechanized means of travel are also allowed, but road construction, road reconstruction, and timber harvesting are prohibited.

Source: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5050459.pdf Federal Register, Vol. 66, No. 9, January 2001. 36 CFR Part 294; *Special Areas Roadless Area Conservation; Final Rule.*

Wildland Urban Interface (WUI) Areas

Areas where homes are built near or among lands prone to wildland fire (see: http://wildlandfirersg.org/Learn/content.cfm?ItemNumber=646&navItemNumber=505), a zone where natural areas and development meet (see: http://www.fws.gov/fire/living_with_fire/wildland_urban_interface.shtml.)

Wilderness Area

Established in the Wilderness Act of 1964, it is an area of undeveloped Federal land retaining its primeval character and influences, without permanent improvements or human habitation, protected and managed so as to preserve its natural conditions. No commercial enterprise and no permanent or temporary roads are allowed. Motorized recreation of any type are not also not allowed, including the use of motor vehicles, motorized equipment or motorboats, landing or aircraft, or other form of mechanical transport.

Source: http://www.wilderness.net/NWPS/documents//publiclaws/PDF/16_USC_1131-1136.pdf Public Law 88-577 (16 U.S. C. 1131-1136), September 1964.

Appendix E – Survey questionnaire

Managing National Forests and Grasslands in the Southwest:

What Do You Think?

The Southwestern Region of the Forest Service, which is made up of Arizona, New Mexico, and small parts of Oklahoma and Texas, is about to begin the process of revising the forest plans for all the forests and grasslands in the region.

To make good decisions about how to use and care for the National Forests and Grasslands in the Southwest, the Forest Service needs to hear what people think about those lands. It doesn't matter whether you use those lands a lot or never set foot on them, they need to know what you think.

Uses of National Forests and Grasslands

Many people participate in outdoor activities. Sometimes those activities are done in a national or state forest or park; sometimes they are done on private land. This first section asks about outdoor activities you do and where you do them.

Q1. What outdoor activities have you participated in during the last twelve months? *Circle the number for all that apply*.

1	Camping in developed areas	18	Fishing
2	Camping in undeveloped areas	19	Hunting or trapping
3	Backpacking	20	Viewing/photographing wildlife
4	Staying at cabins, camps, etc.	21	Viewing/photographing birds
5	Picnicking and group or family day gatherings at developed sites	22	Viewing/photographing natural features such as scenery, flowers, etc.
6	Visiting historic or prehistoric sites	23	Horseback riding
7	Visiting a nature center, nature trail or visitor information services	24	Hiking or walking on trails
8	Nature study	25	Hiking or walking off trails
9	Driving for pleasure on roads	26	Bicycling
10	Off-highway vehicle driving (jeep, ATV, dirt bike, etc.)	27	Mountain biking
11	Snowmobiling	28	Other non-motorized activities (swimming, games and sports, etc.)
12	Downhill skiing or snowboarding	29	Gathering special products, such as piñons, berries, Christmas trees, etc.
13	Cross-country skiing or snowshoeing	30	Personal-use fuelwood cutting
14	Motorized water travel (boats, jet skis, etc)	31	Logging or commercial fuelwood cutting
15	Non-motorized water travel (canoe, raft, etc.)	32	Ranching
16	Guiding	33	Mining or cutting stone
17	Rock climbing or caving	34	Other. Please specify: _____

The **Southwestern Region** of the Forest Service is made up of all the National Forests and Grasslands in Arizona and New Mexico, plus National Grasslands in Texas and Oklahoma. Those areas are shown on the enclosed map.

In this survey, we will refer to those areas collectively as the "Southwestern Region." **Whenever you see the phrase Southwestern Region, think of that whole group of National Forests and Grasslands.**

Q2. During the last twelve months, how many trips for recreation have you made (in total) to any National Forest or Grassland in the Southwestern Region?

_____ trips ***(If you said zero, please skip to question Q6 starting on page 4.)***

Q3. Which Southwestern Region National Forest or Grassland, shown on the enclosed map, did you visit most frequently for recreation in the past 12 months? *Circle the number next to the forest or grassland you visited most frequently.*

1	Apache-Sitgreaves National Forest (in AZ or NM)	7	Kaibab National Forest (in AZ)
2	Carson National Forest (in NM)	8	Lincoln National Forest (in NM)
3	Cibola National Forest (in NM)	9	Prescott National Forest (in AZ)
4	Coconino National Forest (in AZ)	10	Santa Fe National Forest (in NM)
5	Coronado National Forest (in AZ)	11	Tonto National Forest (in AZ)
6	Gila National Forest (in NM)	12	Cibola National Grasslands (in NM, OK, or TX)

Q4. Can you identify the name of the site you visited most frequently at the forest or grassland you circled in Q3? *Write in the name of the trailhead, campsite, or other site, or briefly describe where it is.*

Most frequently visited trailhead, campsite, or other site: _____

_____

_____

Q5. What recreation activity did you do most frequently at the forest/grassland you circled in Q3? *Write the activity you did most often or use the activity number from Q1 (on page 2).*

Most frequent recreation activity: _____

Management of National Forests and Grasslands

In this section we will ask about your views and opinions regarding National Forests and Grasslands and how they might be managed. There are no right or wrong answers; the best response is the one that most closely matches what you think.

Q6. Indicate your level of agreement with each of the following statements by circling the appropriate number for each statement.

	Strongly disagree	*Somewhat disagree*	*Neutral*	*Somewhat agree*	*Strongly agree*	*Don't know*
People should be more concerned about how our public lands are used.	1	2	3	4	5	9
Natural resources must be preserved even if people must do without some products.	1	2	3	4	5	9
Consumers should be interested in the environmental consequences of the products they purchase.	1	2	3	4	5	9
I would be willing to sign a petition for an environmental cause.	1	2	3	4	5	9
The whole pollution issue has never upset me too much since I feel it's somewhat overrated.	1	2	3	4	5	9
If we could just get by with a little less there would be more left for future generations.	1	2	3	4	5	9
Manufacturers should be encouraged to use recycled materials in their manufacturing and processing operations.	1	2	3	4	5	9
Future generations should be as important as the current one in decisions about public lands.	1	2	3	4	5	9
I would be willing to pay five dollars more each time I use public lands for recreational purposes, for example, hiking, camping, and hunting.	1	2	3	4	5	9
People should urge their friends to limit their use of products made from scarce resources.	1	2	3	4	5	9
I am glad there are national forests even if I never get to see them.	1	2	3	4	5	9
People can think public lands are valuable even if they do not actually go there themselves.	1	2	3	4	5	9
I am willing to stop buying products from companies that pollute the environment even though it might be inconvenient.	1	2	3	4	5	9

	Strongly disagree	*Somewhat disagree*	*Neutral*	*Somewhat agree*	*Strongly agree*	*Don't know*
I am willing to make personal sacrifices for the sake of slowing down pollution.	1	2	3	4	5	9
Forests have a right to exist for their own sake, regardless of human concerns and uses.	1	2	3	4	5	9
Wildlife, plants, and humans have equal rights to live and grow.	1	2	3	4	5	9
Donating time or money to worthy causes is important to me.	1	2	3	4	5	9
We should actively harvest more trees to meet the needs of a much larger human population.	1	2	3	4	5	9
The most important role for the public lands is providing jobs and income for local people.	1	2	3	4	5	9
The decision to develop resources should be based mostly on economic grounds.	1	2	3	4	5	9
The main reason for maintaining resources today is so we can develop them in the future if we need to.	1	2	3	4	5	9
I think public land managers are doing an adequate job of protecting natural resources from being overused.	1	2	3	4	5	9
The primary use of forests should be for products that are useful to humans.	1	2	3	4	5	9
The Federal government should subsidize the development and leasing of public lands to companies.	1	2	3	4	5	9
The government has better places to spend money than devoting resources to a strong conservation program.	1	2	3	4	5	9

Q7. Each of the following statements is a possible objective for managing National Forests and Grasslands in the Southwestern Region. *Indicate how important you think each of the objectives is by circling the appropriate number for each statement.*

	Not at all important	*Not very important*	*Neutral*	*Somewhat important*	*Very important*	*Don't know*
Developing and maintaining continuous trail systems that cross both public and private land for motorized vehicles such as snowmobiles or ATVs.	1	2	3	4	5	9
Developing and maintaining continuous trail systems that cross both public and private land for non-motorized recreation such as hiking or cross-country skiing.	1	2	3	4	5	9
Designating some existing recreation trails for specific use, for example, creating separate trails for snowmobiling and cross-country skiing, or for mountain biking and horseback riding.	1	2	3	4	5	9
Developing new paved roads on forests and grasslands for access for cars and recreational vehicles.	1	2	3	4	5	9
Designating more wilderness areas on public land that stops access for development and motorized uses.	1	2	3	4	5	9
Conserving and protecting forests and grasslands that are the source of our water resources, such as streams, lakes, and watershed areas.	1	2	3	4	5	9
Preserving the natural resources of forests and grasslands through such policies as no timber harvesting or no mining.	1	2	3	4	5	9
Protecting ecosystems and wildlife habitats.	1	2	3	4	5	9
Preserving the ability to have a "wilderness" experience on forests and grasslands.	1	2	3	4	5	9
Preserving Native Americans' and Native Hispanics' cultural uses of forest and grasslands such as fire wood gathering, herb/berry/plant gathering, and ceremonial access.	1	2	3	4	5	9
Providing natural resources from forests and grasslands to support communities dependent on grazing, mining or timber harvesting.	1	2	3	4	5	9
Restricting mining, oil drilling, and other mineral removals on forests and grasslands.	1	2	3	4	5	9
Expanding access for motorized off-highway vehicles on forests and grasslands, for example, snowmobile or 4-wheel driving.	1	2	3	4	5	9
Restricting timber harvesting and grazing on forests and grasslands.	1	2	3	4	5	9

	Not at all important	*Not very important*	*Neutral*	*Somewhat important*	*Very important*	*Don't know*
Making it easier to get permits for some established uses of forests and grasslands such as grazing, logging, mining, and commercial recreation.	1	2	3	4	5	9
Developing a national policy that guides natural resource development of all kinds, for example, the amount of timber cut or barrels of oil pumped, and the regulation of environmental impacts.	1	2	3	4	5	9
Expanding commercial recreation on forests and grasslands, for example, ski areas, guide services, or outfitters.	1	2	3	4	5	9
Developing volunteer programs to improve forests and grasslands, for example, planting trees, or improving water quality.	1	2	3	4	5	9
Developing volunteer programs to maintain trails and facilities on forests and grasslands, for example, trail maintenance, or campground maintenance.	1	2	3	4	5	9
Informing the public about recreation concerns on forests and grasslands such as safety, trail etiquette, and respect for wildlife.	1	2	3	4	5	9
Informing the public on the potential environmental impacts of all uses associated with forests and grasslands.	1	2	3	4	5	9
Informing the public on the economic value received by developing our natural resources.	1	2	3	4	5	9
Encouraging collaboration between groups in order to share information concerning uses of forests and grasslands.	1	2	3	4	5	9
Using public advisory committees to advise on public land management issues.	1	2	3	4	5	9
Allowing for diverse uses of forests and grasslands such as grazing, recreation, and wildlife habitat.	1	2	3	4	5	9
Making management decisions concerning the use of forests and grasslands at the local level rather than at the national level.	1	2	3	4	5	9
Increasing the total number of acres in the public land system.	1	2	3	4	5	9
Introducing a recreation fee that goes to support public land.	1	2	3	4	5	9
Increasing law enforcement efforts by public land agencies on public lands.	1	2	3	4	5	9
Allowing public land managers to trade public lands for private lands, for example, to eliminate private property within public land boundaries, or to acquire unique areas of land.	1	2	3	4	5	9

Relationships between People and Forest/Grassland Managers

Recently there has been a lot of discussion over issues like the role of public input and increasing public participation in the management of National Forests and Grasslands

Q8. How informed do you feel about the issues affecting National Forest and Grassland management? *Circle the appropriate number.*

Well informed	*Somewhat well informed*	*Somewhat uninformed*	*Uninformed*
1	2	3	4

Q9. How much do you agree or disagree with each of the following statements related to managing National Forests and Grasslands? *Circle the appropriate number for each statement.*

	Strongly disagree	*Somewhat disagree*	*Neutral*	*Somewhat agree*	*Strongly agree*	*Don't know*
Public participation is of great value even if it adds to the cost of government.	1	2	3	4	5	9
Public concerns are rarely or never considered by the Forest Service.	1	2	3	4	5	9
Highest priority should be given to local community concerns.	1	2	3	4	5	9

Q10. In your opinion, which is the most appropriate role for the public in National Forest and Grassland management? *Circle one number.*

1 None, let natural resource professionals make the decisions.

2 Provide input and suggestions for decision makers to consider.

3 Serve on advisory boards that only review and comment on decisions.

4 Serve on advisory boards that help develop management proposals.

5 Act as a full and equal partner in making management decisions.

6 The public should make the decisions and natural resource professionals should carry them out.

Q11. In your opinion, does the Forest Service give too much weight to the opinions and viewpoints of any particular group(s)?

1 No

2 Yes If yes, which one(s)? _____

Wildland Fire

Q12. Have you ever been affected by a wildland fire? *Circle all that apply*.

1 I have smelled smoke from a wildland fire.

2 I have seen a wildland fire.

3 I was told to be ready to evacuate my home.

4 I was evacuated from my home as a result of a wildland fire.

5 I suffered property loss or damage from a wildland fire.

6 I know someone who was evacuated or suffered property loss or damage from a wildland fire.

7 I have never been affected by a wildland fire.

Background Characteristics

Questions in this final section help us better understand peoples' views and opinions and check whether our survey is representative. All responses are anonymous; results will only be reported as group averages.

Q13. Are you: Female _____ Male _____

Q14. What year were you born? **19**_____

Q15. How long have you lived in the county where you currently live? _____ years

Q16. How many people are in your household? _____ people

Q17. How many people in your household are age 12 or younger? _____ 12 or younger

Q18. How many people in your household are age 13 to 17? _____ 13 to 17

Q19. What is your employment status? *Circle all that apply.*

1	Work full-time	6	Part-time student
2	Work part-time	7	Active duty U.S. Armed Forces
3	Retired	8	Military Reserve or National Guard
4	Homemaker	9	Unemployed – looking for a job
5	Full-time student	10	Unemployed – not looking for a job

Q20. Do you make your living (or did you if you are now retired) from a job that depends directly on natural resources, such as ranching, mining, guiding hunters or recreation users, working in a saw mill, or others?

1 No

2 Yes. Please specify: _____

Q21. Are you a member of any organized group with an interest in natural resources or outdoor activities? *Circle all that apply.*

1	No.	5	Producer's group
2	Sportsman's group	6	Hiking or biking group
3	Conservation group	7	Off-highway vehicle user group
4	Environmental group	8	Other. Please specify: _____

Q22. Are you Hispanic or Latino(a)?

1 No
2 Yes

Q23. With which racial group(s) do you most closely identify? *Please select one or more*.

1 American Indian/Alaska Native
2 Asian
3 Black/African American
4 Native Hawaiian or other Pacific Islander
5 White

Q24. Is any language other than English regularly spoken in your home?

1 No
2 Yes. Which language? _____

Q25. What is the highest level of schooling you have completed? *Circle one category.*

1 Fourth grade or less
2 Fifth through eighth grades
3 Ninth through eleventh grades
4 Twelfth grade, no diploma
5 High school graduate (including GED)
6 Some college
7 Associate's degree
8 Bachelor's degree
9 Graduate or professional degree

Q26. What was your total household income in 2006, before taxes? *Circle one category*.

1 Less than $20,000
2 $20,000 to $39,999
3 $40,000 to $59,999
4 $60,000 to $79,999
5 $80,000 to $99,999
6 $100,000 to $119,999
7 $120,000 to $139,999
8 $140,000 to $159,999
9 $160,000 to $179,999
10 $180,000 to $199,999
11 $200,000 to $219,999
12 $220,000 or more

Q27. How many weeks did you work at a job or business in 2006? *Include paid vacation, paid sick leave, and military service.*

_____ weeks

Q28. For the weeks worked in 2006 from *Q27*, how many hours did you usually work each week?

_____ hours

Q29. Approximately what percent of your total household income in 2006 was derived from **your** personal employment?

_____ %

Q30. Some participants in this survey were randomly given the opportunity to complete the survey using the internet. Were you given this opportunity?

1 Yes **(go on to *Q31*)**

2 No **(skip to *Q32*)**

3 Don't know **(skip to *Q32*)**

Q31. If you chose Yes on *Q30*, why did you choose to fill out the paper survey? *Circle all that apply.*

1 I do not have internet access.

2 I have internet access but I do not like to use it.

3 I usually have internet access, but it wasn't working (because of problems with the internet or my computer).

4 I tried to complete the survey using the internet, but had difficulty with the survey website.

5 I do not feel comfortable using computers.

6 It was just easier to fill out the paper survey.

7 I was concerned about the security of internet surveys.

8 Other. Please tell us why:

_____

Q32. If you chose No or Don't Know on *Q30*, would you have completed the survey using the internet had you been given the opportunity to do so?

1 Does not apply, I chose Yes on *Q30*.

2 Yes

3 No

4 Don't know

Do you have any additional comments about the survey or about Forest and Grassland planning or management in the Southwestern Region?

Thank you for your help.

The Forest and Grassland Management Plans in the Southwestern Region will be better as a result of your input.

OMB 0596-0202; Expires 03/31/2010

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* * *

National Forest managers will use this information to serve the public. Response to this request is voluntary. No action may be taken against you for refusing to supply the information requested. When analysis of the questionnaire is completed, all names and address files will be destroyed. Thus, the permanent data will be anonymous. Please do not put your name or that of any member of your household on the questionnaire. Data collected through surveys may be disclosed to the Department of Justice when relevant to litigation or anticipated litigation, or to appropriate Federal, State, local or foreign agencies responsible for investigating or prosecuting a violation of the law.

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