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

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Abstract: In 2005, the *Federal Lands Recreation Enhancement Act* gave public land agencies discretion in the management of funds collected through recreation fees. However, this legislation is set to expire in 2015, which will lead to a reduction in available financial resources to maintain recreation services and to protect the environment. We use a unique dataset to analyze the impact of changes in fee legislation to Southwestern National Forests. Given the geographical extent of the region and the disaggregated nature of forest land, we employ a corner solution travel cost model to analyze the impact of changes in the fee legislation on *Non-Trail* and *Trail* recreationist to Southwestern National Forests and reduction in amenity service. Results show that not renewing the current legislation will have a greater impact on the welfare of *Non-trail* recreationists; an increase of $5 on current fees will have a relatively similar, but negative effect on both types of recreationists. A flat fee is expected to have little effect on *Trail* recreationists, while introducing a $5 fee on eligible sites will have a relatively larger effect on *Non-trail* recreationists.

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1 Introduction

Public land managers have been tasked with enhancing the *visitor experience* by offering recreation services, 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). For recreation demand on public lands, the cost of travel and the quality of site amenities are some of the most important determinants that a particular site will be selected over other alternatives. Public land agencies have been facing reduced budgets to manage the preservation and conservation of natural resources, the safety of users, and the provision of ecosystem services. These same agencies view recreation fees as a means of address some of this shortfall in funding (Park et al. 2010; Schroeder and Louviere 1999). At issue in this investigation are the consequences of the sunset provision of the current fee legislation, the *Federal Lands Recreation Enhancement Act* (REA), and the effect of eliminating fees.

If REA is not extended, many of the improvements and services that have enhanced the visitor experience may not be available, even with an accumulated capital reserve (DOI and USDA, 2009). The purpose of this investigation is to explore the effect on demand when recreation fees are reduced and the concomitant effect on the provision of certain recreation amenities. We test these effects on National Forests in the Southwestern region of the United States with a sample of households from Arizona and New Mexico. The empirical framework adopts a corner solution model that controls for multiple recreation sites for which no visits are stated. This approach is based on a two-stage household budgeting process: represents the decision to visit a National Forest, and the choice of a particular recreation site.

From a policy perspective, this analysis helps inform the discussion on the impact that recreation fees have on demand for public lands, and the need to keep them to provide expected amenities. 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. Flat fee structures, the second change, have been applied in other recreation contexts, e.g., 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.

Ultimately, whether or not to reauthorize the legislation 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 is expected to contribute to the upcoming discussion on extending the current recreation fee legislation, as well as provide support for changes in the current fee structure, whether it is to raise fees, charge a flat fee, or introduce fees to eligible sites. We also contribute to choice-set selection literature by developing a novel approach using geographical information systems (GIS) to spatially determine an optimal choice-set.

2 Background

The *Federal Lands Recreation Enhancement Act* (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 *enhance the visitor experience* by providing and maintaining amenities and facilities (Vincent 2010). Unlike previous legislation, the REA allows 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 their discretion.

This provision is a departure from earlier legislation that sent fees to the Federal government's general fund (Vincent 2010).[1] Maintenance needs for sites that do not charge a fee rely on the budgetary allocation and on the remaining 20% of revenues from fees.[2] Changes to recreation fees must undergo a review process that includes the input and recommendation from a Recreation Resource Advisory Committee (RRACs), which is an advisory body comprised of various stakeholder groups designated by the public land agency (Vincent 2010). Public land agencies also are required to seek 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.[3]

Supporters argue that benefits accrue to the site and that revenues are used to improve facilities and amenities of the recreation site (Bengston and Fan 2001). The resources are necessary to maintain the quality of services (Vaske et al. 1999) and act as a rationing tool to

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

[2] Recreation fees are also 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.

[3] Facilities include parking, permanent trash receptacles, permanent toilet facilities, interpretive signs, picnic tables, and security services (Vincent 2010; Federal Register 2012).

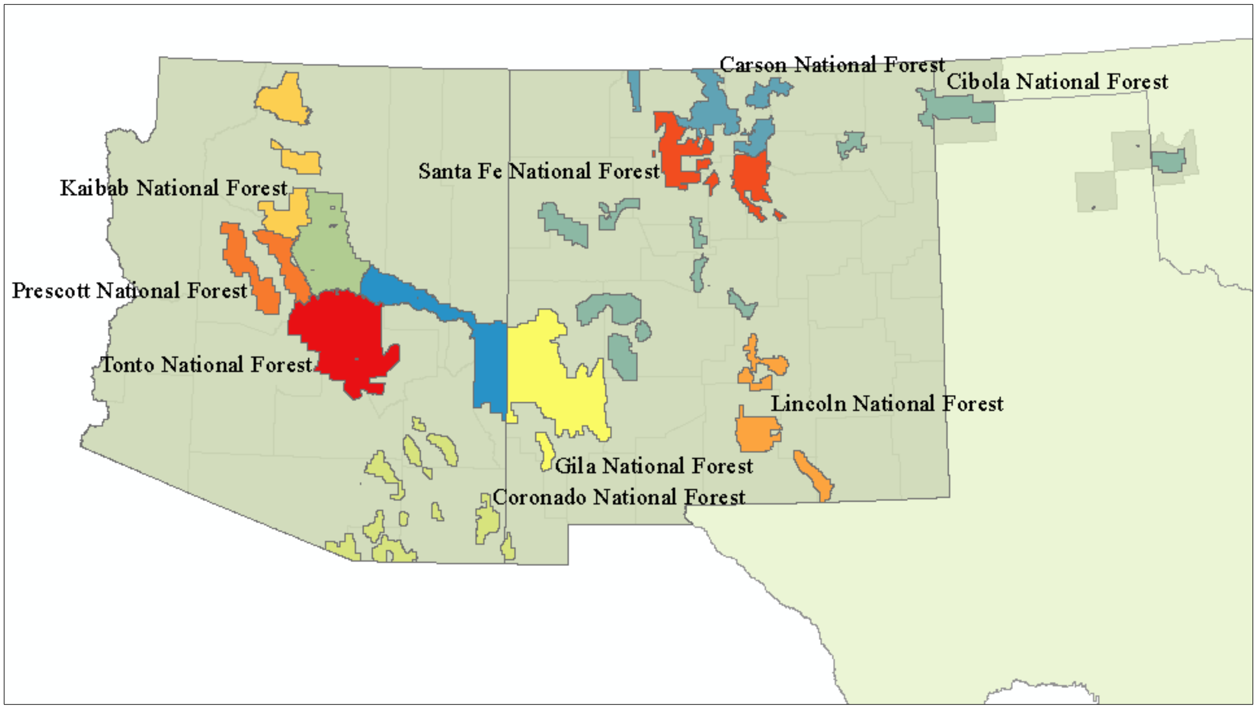
deal with congestion and resource protection (McLean and Johnson 1997). It is the ability to use recreation fee revenue to meet maintenance needs and visitor improvements that has generated the support for fees on public lands (Bowker et al. 1999; Vaske et al. 1999; Bengston and Fan 2001). Indeed, when people are asked if they would support recreation fees, most agreed to as long as funds were used to support the recreation site and to improve environmental services (e.g. Jackson 1987; Vogt and Williams 1999; 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 (Rollins and Trotter 1999; Martin 1999; Bengston and Fan 2001; Vincent 2010). Some view fees as unfair to frequent visitors (Nord et al. 1998; Schwartz and Lin 2006) and underprivileged groups, such as lower income households (Ostergren et al. 2005; Kim and Crompton 2002).

3 Empirical Approach

3.1 Corner solution travel cost model

The travel cost literature has shown the importance of considering multiple sites to generate unbiased welfare estimates (Haab and Hicks 1997). The types of activities and attributes available at each recreation site are used to characterize which sites, among all possible choices, are likely to be chosen by recreationists (McClellan and Medrich 1969; Parsons et al. 1999). 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. Thus, including all available recreation sites will result in biased estimates and lead to incorrect policy conclusions (Freeman 2003). Omitting all but a few recreation sites will also have an effect on estimations. A balance must be struck and given the expected size of the choice set, the random utility model is 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 (see Figure 1). Despite being able to consider a reduced subset, many recreation sites in the region will have zero demand, in effect leading to a corner solution (Phaneuf and Herriges 1999).[4]

Figure 1 National Forests in Arizona and New Mexico



The corner solution method evaluates the recreation decision by identifying and linking the two distinct components: number of visits and choice of the recreation site. 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 of the recreation site* and *number of visits* sequentially, while both the Kuhn-Tucker and the repeated nested logit model estimate both simultaneously. However, the Kuhn-Tucker is a non-linear model that

[4] Travel distances also lead to corner solutions, as individuals visit sites that offer the most recreation alternatives and that are the closest (Golob 2000; Phaneuf and Herriges 1999).

becomes burdensome as more alternatives are included in the process.[5] The repeated nested logit model is an attractive alternative to estimating a corner solution. The problem with this approach is that the analyst specifies the choice occasion and there is no defined criterion for establishing it. Furthermore, it assumes away past experiences, preventing the possibility of learning from past experiences, a strong assumption to make without additional attitudinal information (Herriges et al. 1999). In the face of these uncertainties and assumptions, the linked model approach is used to estimate recreation demand.

3.1.1 Choice model

The linked corner solution model incorporates the choice of a site with how many visits to a national forest based on the two-stage household budgeting process (Hausman et al. 1995), using the assumption of weak separability in recreation goods (Phaneuf 1999). The random utility model (RUM) is used to estimate the choice of recreation sites. An implicit price for recreation is then generated by monetizing the expected maximum utility from all recreation sites, which is used as an independent variable in the visitation or recreation demand model (Hausman et al. 1995).

Given the geographical extent of the area of study (see Figure 1 above), 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.

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[5] von Haefen (2010) suggests using a traditional RUM-based model, like the Linked approach, after finding biases from significant policy changes with the Kuhn-Tucker approach.

This analysis assumes a two-level nesting structure to model site choice. In the top level, the individual decides which forest to visit, and the bottom level the individual decides which recreation site 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 alternatives for individual i in the lower level of nest k is indicated by J_k. The number of alternatives each individual faces across the region during a choice occasion is given by $\sum_{k=1}^{K} J_{ik}$.[6]

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

(1) $U_{ijk} = V_{ijk} + \varepsilon_{ijk}$

where V_{ijk} is the deterministic portion of indirect utility and ε_{ijk} are individual preferences and characteristics that are unobserved by the researcher. The individual index, i, is suppressed for the rest of this model. The deterministic portion of indirect utility is assumed to be a function of individual-specific, site- and nest-specific characteristics:

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

where y is hourly household income, p_{jk} is the travel cost of 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 occurred nearby, etc.).

[6] We generate individual specific choice sets, depending on the location of the residence. This implies $J_{ik} \neq J_{lk}$ for $i \neq l$ observations.

The random component in (1) is assumed to follow a generalized extreme value (GEV) distribution. 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. Therefore, sites in a nest are better substitutes than sites in other nests (Hausman et al. 1995). The nested logit does impose IIA within the nest. That is, 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 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:

$$(3)\ \pi_{jk} = Prob(V_{jk} + \varepsilon_{jk} > V_{lk} + \varepsilon_{lk} \forall l \neq j)$$

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

$$(4)\ Pr(j,k) = \frac{\exp\left(\frac{V_{jk}}{\theta_k}\right)\left[\sum_{l=1}^{J_k}\exp\left(\frac{V_{lk}}{\theta_k}\right)\right]^{\theta_k - 1}}{\sum_{m=1}^{K}\left[\sum_{l=1}^{J_m}\exp\left(\frac{V_{lm}}{\theta_m}\right)\right]^{\theta_m}}$$

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).[7]

The deterministic portion of the indirect utility function in (2) is linear in income and site-specific characteristics (Parsons and Hauber 2002):

$$(5)\, V_{jk} = \beta_y (y - p_{jk}) + \boldsymbol{\beta}'\mathbf{q}_{jk},$$

where $\beta_y y$ is an additive constant that will not affect the site choice probability (3) and is dropped hereafter, so that (5) becomes:

$$(6)\, V_{jk} = -\beta_y p_{jk} + \boldsymbol{\beta}'\mathbf{q}_{jk}$$

A key component of the linked model is the log of the denominator in equation (4) that links the upper and the lower level nests, representing information regarding all alternatives in the nest (Train 2009). This 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):

$$(7)\, IV = IV(y, \mathbf{p}, \mathbf{q}) = \ln\left(\sum_{m=1}^{K} \left[\sum_{l=1}^{J_m} \exp\left(\frac{-\beta_y p_{lm} + \boldsymbol{\beta}'\mathbf{q}_{lm}}{\theta_m} \right) \right]^{\theta_m} \right)$$

3.2 Visitation model

The second stage of the estimation process uses the result from equation (7) to link the site choice model to the visitation model. In the second stage, visitation is expressed as the number of reported trips to the chosen site, non-negative integers that require a count data approach (Hellerstein 1992; Hellerstein and Mendelsohn 1993; Winkelmann and Zimmermann 1995), and specifically a negative binomial model. The general form of the *visitation* model for each individual *i* is:

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[7] This assumption 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).

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

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 visitation of changes in site characteristics in a given choice occasion. The inclusive value method that is used in this analysis to link both models relies on calculating a price index ($\tilde{p}_i$), defined as the negative per trip consumer surplus (Hausman et al. 1995).[8] This method is equivalent to using the inclusive value as the linking variable in equation (8) because the price index is interpreted as the monetized utility per trip and the consumer surplus per choice occasion (Herriges et al. 1999, pg. 172):

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

Under this method, equation (8) is re-written as:

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

The consistency of the two-stage budgeting process that links the implicit price from equation (9) to the visitation model in equation (8) 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 the area under the demand curve before and after the introduction of policy:

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[8] Other suggested methods to link both models include using the inclusive value estimated in equation (17) to predict the number of trips (see Herriges et al. 1999). Welfare is 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.

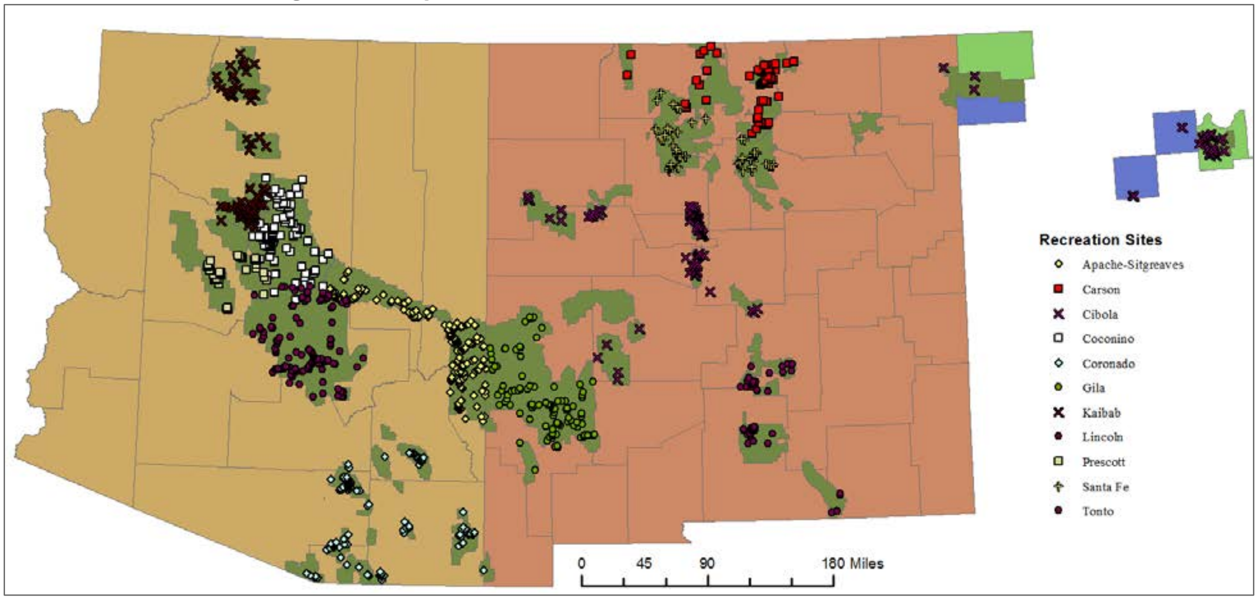
$$(11)\, W_i = \int_{\tilde{p}^1}^{\tilde{p}^0} \hat{h}_i(\tilde{p}_i, \mathbf{Z}_i)dp$$

3.3 Choice Set Definition

An important aspect of the analysis is the set of alternative sites an individual faces when selection a recreation site that are spatially disaggregated, as is the case of sites in National Forests in region (Crawford 2006) (see Figure 2). For 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 to its proximity to sites in the same vicinity, (e.g., on a High 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.

For the nested logit model, the composition of the *choice set* will have a direct impact on the inclusive value; an index of the quality of recreation opportunities that is determined by all substitute sites in the nest (Carson et al. 1989). The transportation literature was one of the first to consider 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 requirements, 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 the remaining sites have a low probability of selection.

Figure 2 Region 3 National Forests and Recreation Sites



As an alternative to probability models to define choice sets, other researchers have used distance (e.g. Parsons and Kealy 1992; Thill 1992; Haab and Hicks 1999; Parsons et al. 2000; Whitehead and Haab 1999). These *choice sets* are generated such that irrelevant alternatives are not included because there is no gain in the efficiency of welfare estimates and may lead to biased welfare estimates (Parsons and Kealy 1992).

Despite this research, there is little guidance with respect to the 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.

For this analysis, choice sets are generated using distance from the residence; however, some individuals visited sites well outside the buffer resulting in no alternatives around the site. This led to counter intuitive results for the visitation model; the sign on the coefficient for the implicit price for recreation in equation (10) was unexpectedly positive. The problem was the size of the estimated inclusive value from equation (7) that affected the implicit price in equation(9). 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 generated choice sets for each observation by first identifying one site in each National Forest and applying a buffer to each, using the identified site as the origin.

The identified sites are either the nearest recreation site or the site that the individual visited. A buffer is then placed around the identified site, outside which sites in the forest were excluded. To explore the empirical consequences of different buffer distances, multiple buffers are created by varying the distance away from the identified sites. Each buffer was then tested by estimating the *visitation* model from equation (10) 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 was 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 buffer has a 210 mile diameter, or a 3.5 hour driving time from the identified site to any other site within the buffer.

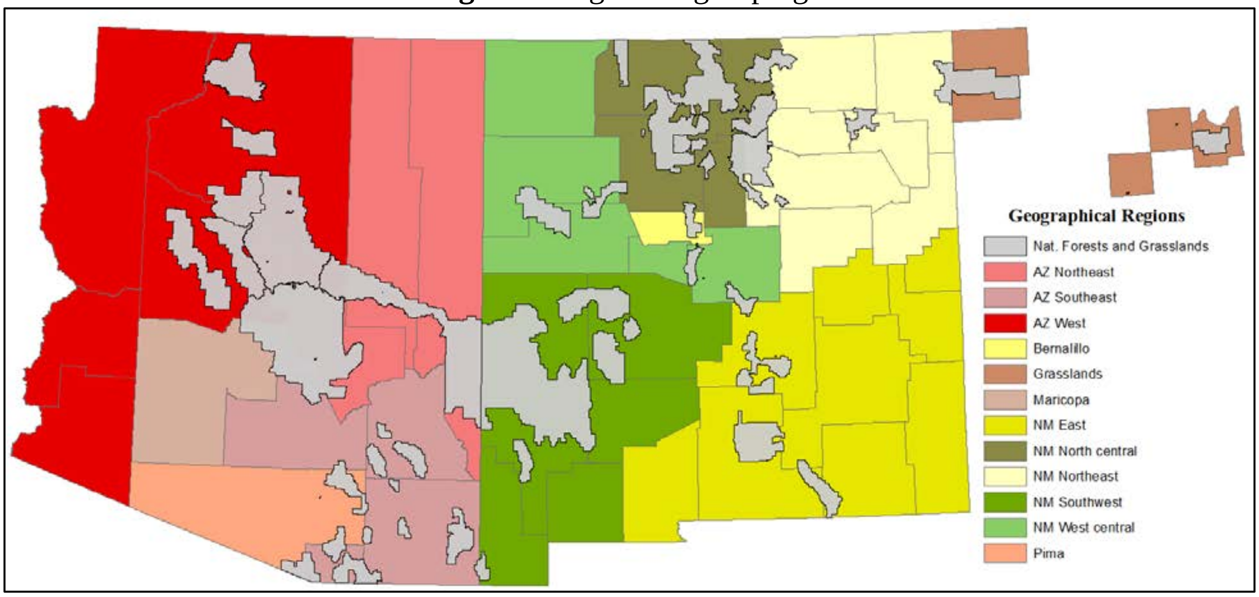
4 Data

4.1 Overview of the data

Data comes 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 US Forest Service. The sample frame are households in the Southwestern region of the Forest Service (Region 3), comprised of the states of Arizona, New Mexico, three western counties in Oklahoma, and two western counties in Texas. Data was gathered over a three month period in 2007, from June to September, using a mail and internet, multiple languages (English and Spanish), survey instrument.

A two-stage stratification sampling process was implemented. In the first stage, the region was divided into geographical regions, each containing at least one county and a National Forest or Grassland. A total of twelve regions were created (see Figure 3). Three of the regions are comprised of the counties that contain the main urban centers of Phoenix, AZ (Maricopa County), Tucson, AZ (Pima County), and Albuquerque, AZ (Bernalillo County). One region is comprised of the Texas and Oklahoma counties where the Regions' National Grasslands are located. All remaining counties were grouped such that they are next to each other and there is at least one National Forest within the group boundary. In the second stage, a random sample was generated based on the number of household in each county to the total number of household in the geographical region. Additional households were included in rural counties to ensure the minimum sample of responses was received. The random sample for each group was generated to ensure the required minimum sample for statistical validity of 384 responses, assuming a 5% sampling error.

Figure 3 Region 12 groupings



Based on this sampling strategy, a sample of 39,200 addresses was purchased from a commercial vendor. This initial sample was subsequently reduced to 37,804 after removing wrong addresses and deceased from the database prior to mailing the first contact.[9] Of the 37,804 households that were contacted, an additional 2,390 were dropped from the database due to undeliverable wrong addressed and more recently deceased contacts. This resulted in a usable sample of 35,414 households. Given budgetary constraints, the survey did achieve the minimum sample requirement in all but one group: the Texas and Oklahoma group received only 358

[9] Survey administration followed Dillman's total design method of five mailings. See McCollum et al. (2008) for a full description of the sample and descriptive statistics.

responses. A total of 7,628 responses were received, resulting in a response rate of 21.54%. The response rate 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 response rate for general population surveys (Connelly et al. 2003).

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: Non-Trail and Trail.[10] This categorization is based on how the recreation site is described according to an inventory provided by the Southwestern Regional office of U.S. Forest Service. Trail is comprised of sites designated as trail heads, snow sites, and horse trails. Non-Trail sites include observation sites, picnic sites, day areas, and information sites/fee stations.

A necessary condition for the 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 sampled recreation location. However, for our sampling method, the individual must not only recall the National Forest or Grassland, but also the site that was visited at some point in time. Given the distances involved and the dispersion of recreation alternatives on public lands, identifying a specific site is necessary for a reliable estimate of travel cost. Due to this important requirement, this analysis uses a subset of the data: respondents living in Arizona and New Mexico that identified a specific recreation site in a National Forest.

[10] Two additional recreation activities were considered: Camping and Water. The sample for both activities was not well behaved, consistently yielding counter-intuitive results. In addition, we omit 37 observations from Texas and Oklahoma for the same reason.

Of the 6,847 respondents that provided information on number of trips taken, only 910 offered enough information to identify a specific recreation activity. Of these 910 observations, the usable sample consists of 566 observations: 291 Trail recreation observations and 275 Non-Trail recreation observations. Being able to only use a subset of the sample is a frequent issue with this type of analysis. For example, Whitehead and Haab (1999) use a sub-set of 1,914 anglers, out of a sample of 8,865, drawn from the Southeastern regional sample of the Marine Recreation Fishery Statistics Survey. This sub-set (32%) represented only small game fishing and private/rental boat users and is used to avoid complications with nesting structures. A travel cost analysis of anglers in Tennessee by Jakus et al. (1997) uses 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 small sub-set of the respondents (12.4%) were able to recall a specific site.

4.2 Demographic characteristics

The literature on the travel cost model suggests including personal characteristics that are likely to shift recreation demand (Haab and McConnell 1996; Fletcher et al. 1990): age, gender, household size, and income. Employment and membership to natural resource group are also included and provide evidence that additional personal characteristics are helpful in generating travel cost estimates (see Table 1). For example, membership to a natural resource group can be an important determinant of acceptability of new or higher recreation fees and is likely to be associated with recreation demand.

According to the 2000 US Census, Hispanics represent 30% of the population in the Region. Hispanics are under-represented in both the Trail recreation sample (13%) and the Non-Trail 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 sample is also older than the population, whose average age in the Region is around 39 years.

Table 1. Demographic characteristics

Characteristic	Trail		Non-Trail	
	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: Activity-specific characteristics are shaded in grey. SD: Standard deviation.

A solution to this under- and over-representation would be to use survey weights. Despite the availability of survey weights (see McCollum et al. 2008 for a description of the survey and weights), it would be problematic to include them with a 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. The information on the type of recreation activity may in fact not be representative of the demand in the population. Although survey weights may be included in the analysis, it is likely to lead to incorrect population-level inferences. It can also be shown that not using survey weights does not pose a problem for bias, see Deaton (1997). Thus, the discussions and conclusions are limited to the usable sub-sample and not the general population.[11]

[11] Despite this, our data is consistent with demographic data from the National Visitor Use Monitoring Program (Round 2 and Round 3) of the USDA Forest Service.

Some characteristics in Table 1, 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 activity recreation models. The survey questionnaire has a question regarding membership to a natural resource group (sportsperson group, producer group, off-highway-vehicle user group). 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 (Trail) and environmental group (Non-Trail).

4.3 Recreation site attributes

Additional information used in this analysis is the site-specific attributes presented in Table 2. The first set of characteristics is on-site facilities, coded as binary variables. Information on the availability and location of these facilities was provided by Southwestern region (Region 3) of the U.S. Forest Service. 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 recreation amenities are facilities used only for the Trail 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 Non-Trail. 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 2. Site-specific attributes

Attribute	Trail		Non-Trail	
	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 other set of characteristics in Table 2 are four spatial amenities: Wildand Urban Interface, Fire damage, Inventoried Roadless area, and Wilderness area; created using GIS information available in the Southwestern regional website of the U.S. Forest Service.[12] 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). Such variables add a spatial heterogeneity dimension that is not readily available with the information on facilities and other recreation amenities. 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 limit the types of recreation activities that can performed at each recreation site. For example, no

[12] See http://www.fs.usda.gov/detail/r3/landmanagement/gis/?cid=stelprdb5201889.

mechanized recreation is allowed on a Wilderness area, while it is allowed on a limited basis on an Inventoried Roadless area. 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).

5 Empirical Results

5.1 Optimal choice model

As a first step in the analysis, the sensitivity of the *choice model* for each recreation activity is verified by systematically adding facility and spatial variables (Model 1 to 3). Model 1 estimates the *choice model* only with the facilities. Spatial amenities alone are estimated in Model 2, and the final model used to generate the link variable for the second stage model is Model 3.

Table 3 presents the results for Trail recreation. Facilities change 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.

Table 3. Testing Trail *choice model* sensitivity (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 4. Testing Non-Trail *choice model* sensitivity (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.

Results for Non-Trail recreation presented in Table 4 show that 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 Non-Trail recreation. The only spatial amenity that is statistically significant in all models is Fire damage within 2 miles (Fire 2), indicating that Non-Trail recreationist prefer a site that is fairly well developed and not too remote from human development.

5.1.1 Choice model discussion

For both Trail and Non-Trail, 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 final 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. The dissimilarity coefficient must be within 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 3 and 4, 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).[13]

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 Trail recreation only. Site access, such as ramps for disabled people, increases the likelihood of site choice, but as with parking facilities, it is only statistically different from zero for Trail recreation. Site information reduces the likelihood of site selection for Trail recreation, while for Non-Trail, it increases the likelihood. The availability of Tables works in the opposite direction, increasing the likelihood for Trail recreation and reducing it Non-Trail recreation.

Model diagnostics revealed a set of facility variables unique to each recreation activity in explaining site choice. For Trail 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 Non-Trail 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, a Trail 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, recreation sites exhibiting fire damage within 1 to 2 miles is less likely to be selected. The only statistically significant spatial amenity for Non-Trail recreation is

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

a site that is 1 to 2 miles from a recent forest fire (Fire 2), which increases the likelihood of the site being selected. Looking at the coefficients for the other spatial amenities that are not statistically different from zero, Non-Trail recreationists prefer to visit sites that are well managed and protected from development, but not distant to their residence (a negative coefficient on the WUI). Unlike Trail recreationists, Non-Trail recreationists don't mind visiting a site that has experienced a recent forest fire nearby. Both types of recreationists prefer a site that is on a designated Wilderness area, which prohibits any type changes or mechanized recreation and leaves the area as primitive as possible.

Based on these site characteristics, Trail recreationists prefer 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. Non-trail recreationists likely prefer sites that provide amenities for social gatherings and access to water and appear to dislike having tables on the site.

5.2 Visitation model robustness test

Similar to the *choice model,* three *visitation* models are estimated for each recreation activity. Demographic characteristics are grouped into two categories: (i) core, and, (ii) supplemental. *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 and having children 13 to 17 was a better fit for the model than household size.

Supplemental include additional variables that are found to be important determinants in the *visitation* model. Visited a site over 100 miles from the residence is the only other 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 distance travelled to a recreation site was revealed when the choice sets for the *choice model* were being defined. Membership to a natural resource group is another shared demographic feature, with Hiker/Biker group for Trail recreation and Environmentalist group for Non-trail recreation. Finally, Hispanic is an important determinant for Non-Trail recreation only, which is consistent with findings from National Forests near urban centers in California (Chavez 2001).

Table 5. Testing Trail *visitation model* sensitivity (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
Hiker or biker group			0.562*	0.288	0.549*	0.281
Environmental group			-0.151	0.207		
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. In Model 2, the supplemental characteristics for both recreation activities are included, and in Model 3, only the core and the supplemental characteristics specific to the recreation activity are used. Table 5 presents the results for Trail recreation. It is interesting to note that the coefficient on Price (the linking variable between the *choice* and *visitation* models) is not statistically different from zero in the model with only the core characteristics. As the supplemental characteristics are added (Model 2 and 3), it becomes statistically different from zero. Of the four core characteristics, only Male (gender) is statistically different from zero. All the supplemental characteristics for Non-Trail recreation are not statistically different from zero, while membership to a Hiker or Biker group and visited a distance site are. The results also show the coefficients to be relatively similar across the three models, with no changes in the sign of the coefficients.

Table 6. Non-Trail recreation *visitation 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
Hiker or biker group			0.588**	0.282		
Environmental group			0.391	0.252	0.615***	0.229
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)

Results for Non-Trail recreation presented in Table 6 show the coefficient for Price for recreation become statistically different from zero once the *supplemental* features are included. Unlike Trail recreation, both Age and Male are statistically different from zero. Membership to an Environmentalist group and Hispanic are the only two *supplemental* features that are statistically different from zero, and both are specific to Non-Trail recreation. A likelihood ratio test indicates that Model 3 is statistically different from Model 2, $(\chi^2 = 6.74,\ p-value: 0.034$, d.f.=2). Improvement in the fit for model 3 is verified by a lower Bayesian Information Criterion (Model 2:1915.1 vs. Model 3:1910.6). Therefore, Model 3 is used in the final specification of the *visitation* model for Non-Trail recreation.

5.2.1 Visitation model discussion

As expected, the coefficient on the implicit price for recreation has the correct sign and is similar in magnitude across Trail and Non-Trail 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 Trail 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 Non-Trail recreation sites. Non-Trail 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 a Trail site, while lower income households are more likely to visit a Non-Trail site. Unemployed respondents are more likely to visit a Non-Trail site than a Trail 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 is expected to have a positive effect on welfare.

This change in fees is expected to benefit Non-Trail 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 Non-Trail recreationists' more than Trail 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.

6 Welfare Results of Fee Policy Scenarios

The empirical model combines number of trips taken and site selection using the inclusive value, the expected maximum utility an individual receives given the alternatives in the nest for a given choice. This behavioral link helps predict the change in the number of trips from changes in prices, and possible concomitant changes in site amenity availability, to changes in welfare following Hausman et al. (1995):

$$(12) \quad W_i = \int_{\tilde{p}^1}^{\tilde{p}^0} \hat{h}_i(\tilde{p}_i, \mathbf{Z}_i)dp$$

Where the linking variable between both models, $\tilde{p}_i$, is the monetized value of utility, the implicit price for recreation. The resulting measure is a reduction in welfare based on the difference between the predicted number of trips before and after a change in fee policy.

Table 7 presents the point estimates for four changes in the current fee policy, along with the lower and upper bound 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, with *Non-Trail* recreationists can expect to receive greater increases in welfare. This result is not unexpected, as 40% of *Non-Trail* 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 *Trail* recreationists. Around 23% of *Trail* 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 7. Change in welfare per person per year (in US $)

Change in fee policy	Trail			Non-Trail		
	Mean	95% C.I.		Mean	95% C.I.	
		Lower	Upper		Lower	Upper
Dropping all fees: not reauthorizing fee legislation	18.92	21.86	15.98	23.00	26.31	19.70
Charge a $5 flat fee at sites currently charging a fee	0.11	0.95	(0.74)	3.19	5.16	1.21
A $5 increase to current recreation fees	(18.65)	(15.76)	(21.54)	(19.74)	(17.38)	(22.09)
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 *Non-Trail* and *Trail* sites, and the mean fee is less than $3 for *Non-Trail* site and $1 for *Trail* 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 *Non-Trail* recreation. This last result is explained by the 16% of observations that visited a fee-eligible *Non-Trail* site, compared to 1% of *Trail* observations that visited a similar type of site. Considering the number of recreation sites in the Region for both types of recreation activities, 530 Trail and 364 *Non-Trail*, 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 fees or charging a flat fee improves welfare. For all policies, the effect is greatest for *Non-Trail* recreation. If the legislation is renewed and the Forest Service required additional funds, introducing fees to eligible Trail sites would have a lower effect on welfare than doing so on *Non-Trail* sites. A flat fee has a marginal effect on *Trail* recreationists and in fact increases welfare for *Non-Trail* recreationists. This information may be useful for the Forest Service for considering changes to fee structures and weighing the considerations of multiple stakeholders (McCarville and Crompton 1987).

7 Conclusions

This investigation contributes to the travel cost literature that employs corner solution models to estimate recreation demand. 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. Observations are grouped into two recreation activities: Non-trail and Non-Trail. These recreation activities were generated based on the site descriptions provided by the Southwestern office of the U.S. Forest Service.

For the Forest Service to consider changes in recreation fees this possibility, consultation with stakeholder groups and the public would be necessary to reduce any controversies. The use of such 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 that use the National Forests the most (Martin 1999) and are there to maintain the quality of services, facilities and amenities (Bengston and Fan 2001; Vaske et al. 1999). Furthermore, as policymakers consider changes in recreation fees, thought must be given on how the ability to provide recreation facilities will be impacted. A reduction or elimination of fees will also have a long-term impact in how public land agencies are able to protect ecosystems services in the face of reduced budget appropriations.

Sensitivity testing confirmed the need to group the observations into these recreation activity categories, as the types of activities available at each site define which sites are the most likely to be chosen by recreationists (McClellan and Medrich 1969; Parsons et al. 1999). The multiplicity of recreation sites, the geographical extent of the area of study, and the disaggregated nature of National Forests leads to a presence of corner solutions in recreation demand; visiting one or two sites amongst the full choice set available to each recreationists. To control for the presence of multiple recreation sites with zero demand, recreation demand is estimated using a linked corner solution travel cost model (Herriges et al. 1999).

By using a unique data set of households in Arizona and New Mexico, this investigation controls for a set of demographic characteristics traditionally used in in travel cost analysis: age, gender, household size, and income (e.g., Jakus et al. 1997; Hesseln et al. 2003; Loomis et al. 2001) and a set of variables, such as membership to a natural resource group, that have traditionally not been used. The inclusion of these other variables helps explain differences in behavior and characteristics of the two recreation activity groups. Further, this analysis takes advantage of a geocoded inventory of recreation sites and geographical information system (GIS) data from the regional office of the US Forest Service to generate a set of spatial amenity variables. Given the geographical extent and multiplicity of recreation sites, we use this data and geocoded information on residential location, to develop a method to generate observation-specific optimal choice sets.

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

We add an important caveat to these conclusions. The usable sample is a reduced sub-set of an original sample with over 5000 observations. During the course of data preparation, we 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 and using at the very least the ranger district to segment the area would help individuals recall, at least, a recreation area they had recently visited. A set of questions or statements could also be included that would elicit information on preferred recreation activities, helping generate a recreation profile, which could then be matched with recreation site information to predict a specific recreation site.

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