Economic Value of Taylor Mountain Regional Park and Open Space Preserve

Merlin Hanauer
John Reid
Aja Heisler
Felipe Vasquez

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Acknowledgements

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Summary

The Taylor Mountain Regional Park and Open Space Preserve represents a large investment in land conservation near the urban core of Santa Rosa. Between 1995 and 2011, the Sonoma County Agricultural Preservation and Open Space District invested $26 million to acquire the 1,100 acres of land. This study examines the economic values generated by the protection of this publicly accessible urban park. A team from Sonoma State University and Conservation Strategy Fund analyzed recreation, climate stability and water supply benefits from the protected area.

On average people visited Taylor Mountain 33 times a year. By using "non-market valuation" methods, economists are able to assign dollar values to activities that benefit people, even if the activity in question is not directly paid for by the user. The annual value of the park to each user was $631.70. Adding up all users, the total benefits are between $1.35 - $1.84 million per year, with a midpoint estimate of $1.56 million. This number represents how much the creation of the Taylor Mountain park adds to people's wellbeing by providing recreation opportunities.

Projecting these values over perpetuity, the total recreation value would be $45 - $61 million dollars with a midpoint estimate of $52 million. If more people use the park in the future, which seems likely because it is relatively new, the values will be even greater. The park is valuable to the community because it is close by and is suited to a diverse set of users, including runners, hikers, walkers, picnickers and disc golfers. Park users are diverse in socio-economic terms as well, matching the income distribution and ethnic composition of the county.

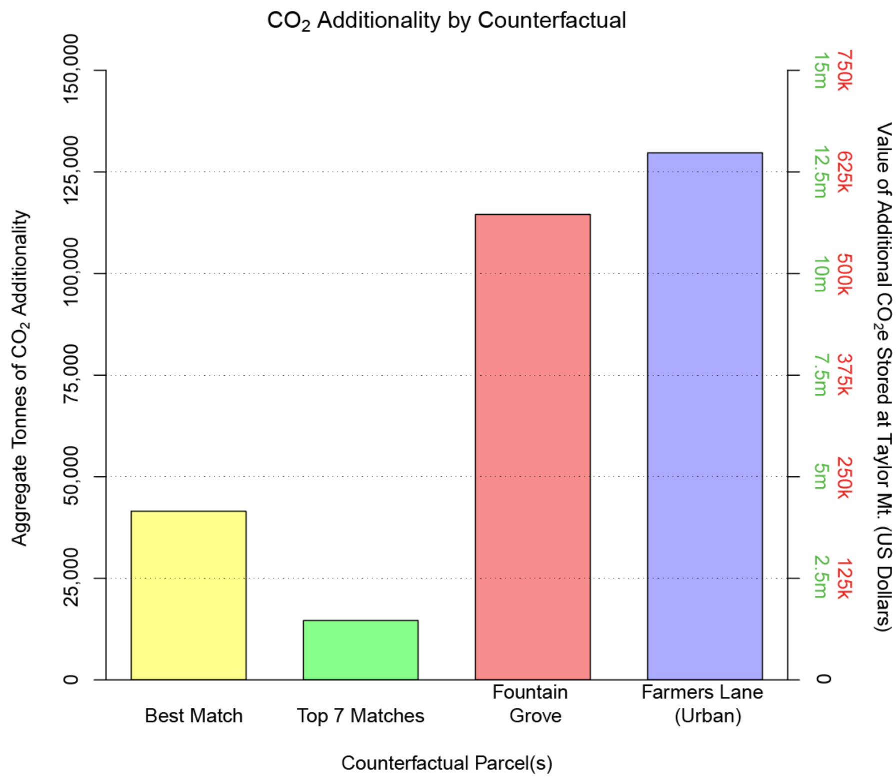
Table i - Recreation benefits of Taylor Mountain

Value per visit	$14.39
Value per visitor per year	$631.70
Total annual value	$1.56 million
Total value over time	$51.85 million

The park helps mitigate climate change by maintaining undisturbed carbon stocks contained in natural vegetation and its associated soils, resulting in a benefit of up to $12.5 million. The minimum value for this benefit is $328,000. The wide variation in figures depends on the price attributed to avoided greenhouse gas emissions; we tested prices between $5 and $100/ton (shown on the right-hand axis in red and green, respectively), a range that reflects the ongoing debate over the value of reducing greenhouse gas emissions.

We used statistical methods to identify unprotected parcels most similar to Taylor Mountain and compared carbon storage on those plots to that stored within the park's boundaries. Taylor Mountain stores 41,548 tons more carbon than the most similar parcel. If we take an average of the seven most similar parcels, Taylor

Mountain's advantage is 14,620 tons. If Taylor Mountain had been developed in a pattern similar to the adjacent urban development on Farmers Lane, the resulting carbon loss would be 129,705 tons. The loss would be 114,527 tons if Taylor Mountain had been developed in a pattern similar to the Fountain Grove area of northeast Santa Rosa. The carbon benefits of preserving Taylor Mountain are likely even greater if we project into the future and account for further carbon stock losses from our comparison parcels.



We also examined water benefits in terms of groundwater recharge due to the protection of the Taylor Mountain landscape. With available data is was impossible to conclusively determine the change in recharge that would occur if Taylor Mountain were developed rather than conserved. We did calculate the cost of replicating the entirety of Taylor Mountain's on-site groundwater contribution with an artificial storm water recharge project. Measured this way, the maximum water benefit was around $500,000, a tiny fraction of the recreation and most estimates of the climate benefits.

This economic analysis examined benefits generated by the protection of Taylor Mountain, finding that they far outstrip the $26 million initial investment. The lowest value we calculated, for recreation alone, was $27 million and our mid-point estimate was $52 million for recreation. Add to that the carbon storage benefits, and ecosystem values not quantified in this paper – things like scenic beauty and wildlife habitat – and it's clear that Taylor Mountain is providing a generous return on investment to the people of Sonoma County.

Introduction

Conservation of large natural areas in close proximity to cities can provide a compelling value proposition when compared to either small urban parks or large remote ones. They make a wide variety of recreation, including forms like hiking and cycling that require large areas, easily accessible to large numbers of people. And they provide values associated with large, intact landscapes, such as scenic views, biodiversity conservation, protection of watersheds and climate stabilization.

The Taylor Mountain Regional Park and Open Space Preserve is an example of this category of park. At 1,100 acres, it is one of the larger public open spaces in the area and is a defining feature of Santa Rosa's landscape. Acquired with major support from the Sonoma County Agricultural Preservation and Open Space District (SCAPOSD) over the period between 1995-2011, it is popular among hikers, runners, disc golfers and equestrians, and holds potential for a variety of other recreational activities, including mountain biking. Access was recently improved and further upgrades and a quadrupling of trail miles will open the area to greater recreational use in the future. It supplies water to the Santa Rosa plain aquifer and has important scenic impacts across the city. The area is also situated such that it provides open space benefits to a relatively low-income region of Santa Rosa.

This study estimates the economic value of protecting and providing public access to Taylor Mountain. The branch of economics dedicated to the measurement of the value of the environment and its "ecosystem services" uses a variety of techniques to figure out the monetary value of good and services that aren't fully reflected in market transactions. In other words, things that are not directly bought and sold – like an ecosystem's contribution to water quality, air quality, recreational enjoyment or the aesthetic character of a place, to name a few. By understanding these values, we can better gauge the return on investments in land conservation.

The methods and data available are inadequate to truly represent the total value of any natural area, so environmental economists ideally focus on those values that are most relevant to the park's constituency and that can be measured with the greatest degree of confidence. As noted above, Taylor Mountain provides a wide variety of different values. Our study focuses on three that we determined to be both measureable and significant to the users and neighbors of Taylor Mountain. These are recreation, water supply and climate stabilization via carbon storage.

Recreation was chosen because of the rapidly increasing use of the area by a range of people from Santa Rosa and surrounding areas. Water is included in the study because of the critical importance of this resource to agriculture, domestic supply and ecosystems. Carbon storage is a global, rather than a strictly local benefit, but we consider it here because Sonoma County has committed to act on climate as demonstrated by the establishment of the Regional Climate Protection Authority and its Climate Action 2020 plan.[1]

Recreation Analysis

The objective of the recreation analysis is to estimate the economic benefit that Taylor Mountain visitors accrue from recreational activities. In traditional market settings, existing data and economic models of demand allow economists to estimate the benefits above and beyond costs that consumers accrue from participating in the markets. This benefit is referred to as ***consumer surplus***, or ***access value*** in the recreation valuation literature. The fact that recreational visits to Taylor Mountain are not allocated in a traditional market setting means that the data with which one could estimate the demand for recreation at Taylor Mountain—and thus the access value associated with recreation—do not exist.

Travel Cost Method

The travel cost method (TCM) is founded on the assumption that the economic benefits individuals accrue from recreational activities is inextricably linked to the costs incurred to engage in the activities. According to economic theory, every consumptive choice that an individual makes is based on a comparison of the benefits and costs associated with that choice. Thus, a rational individual will only choose to engage in a transaction or activity if the benefits of that choice at least outweigh the costs. In the recreational setting, individuals face costs that include: travel expenses (direct costs associated with mode of transportation), access fees, equipment costs and indirect costs (e.g., foregone wages). The sum of these costs are referred to as ***travel costs***, and if recreation behaves like other market goods then it should follow the law of demand: there should be an inverse relationship between travel costs and recreational visitation. According to this theory, if one can obtain data on individuals' visitation patterns and travel costs (along with other information related to the individuals), one can reasonably model demand and thus make calculations of the access value for recreational activities.

Demand for visits, r, to a specific site is modeled generally as

$$r = f(tc_r, tc_s, y, z), \qquad (1)$$

where tc_r are travel costs to the site, tc_s are travel costs to substitute sites, y is income, and z are other demographic and individual characteristics that affect recreational demand (Champ, Boyle & Brown, 2003). With such data in-hand and the assumption of a linear form to equation (1), demand would take on a graphical form similar to that depicted in Figure 1. The linear demand function (D) in Figure 1 represents the willingness to pay (WTP) for recreational trips to a specific site. In this model, an individual who faces travel costs tc_s^1 will make r^1 visits to the site in a given period of time. Total WTP for all r^1 visits is represented by the area **a** + **b**

[1] http://www.sctainfo.org/climate_action_2020.htm

under the demand curve (i.e., total benefit). Because the individual incurs costs of tc_s^1 for each trip, the area **b** represents the total travel costs incurred for r^1 trips. Therefore, area **a** represents the access value associated with recreational visits for this individual: the benefits above and beyond costs. The ultimate goal of the TCM is to estimate the functional form of the demand curve in Figure 1 which allows for the calculation of area **a** for each individual, which in turn allows for the calculation of total recreational access value.

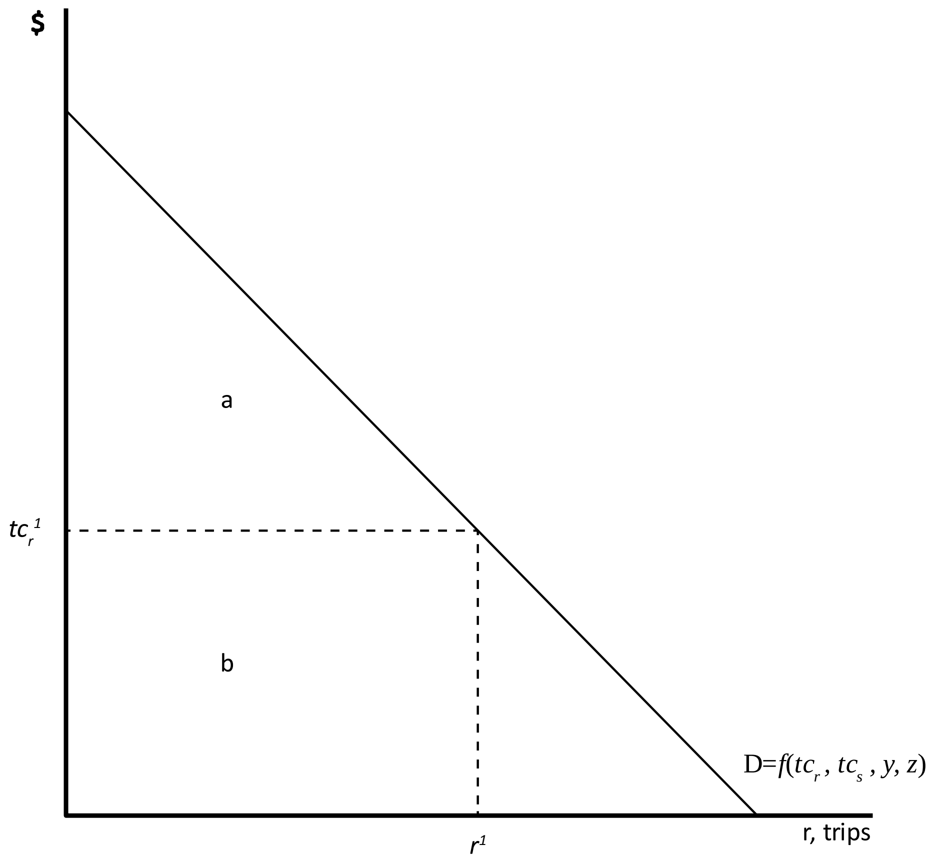


Figure 1. Calculating access value (area a) for recreation at a specific site. Figure adapted from (Champ et al., 2003).

Application of the TCM to Taylor Mountain

The primary goal of our recreational analysis is to measure the economic benefits visitors to Taylor Mountain accrue in a given year. We use data from on-site surveys administered by undergraduate research assistants from Sonoma State University and a number of econometric specifications to estimate the functional form of equation (1) and to estimate various measures of access value.

Survey

Survey Design

The purpose of our survey was to gather the data necessary to estimate equation (1) in a form that is representative of all Taylor Mountain visitors. Because we are interested in the recreational value for actual Taylor Mountain visitors, we designed an on-site survey to be administered in-person by research assistants,[2] all of whom received detailed training on enumeration techniques. The survey was comprised of three sections: **Section A** elicited information on number of visits in the past year, primary recreational activities, attitudinal information regarding park amenities, mode of transportation, access fees and household location; **Section B** elicited information on visitor perception of Taylor Mountain's potential impacts on environmental services in addition to awareness of SCAPOSD and; **Section C** elicited demographic information. The final survey was the product of numerous iterations of piloting and focus group testing.

One of the primary components of travel costs are the implicit time costs associated with travel to and from Taylor Mountain. *A priori* we expected proximity to Taylor Mountain would be a primary draw for users, which could make it difficult to capture enough variation in travel costs in order to precisely estimate a demand equation. Thus we were particularly interested in capturing as much variation in travel distances as possible. To achieve this goal, in Section A users were asked to provide, at least, information on the closest intersection to their house or, at best, their actual street address.[3] Also integral to the calculation of travel cost is information on income. Section C contained numerous sensitive demographic questions regarding race, age, employment, income and political affiliation. In order ensure accuracy of response to these questions, research assistants asked users to fill out Section C on their own.

Survey Implementation

Surveying was conducted across four weeks in October of 2015. During that period, research assistants were on site in five hour shifts between 7am and 5pm. Surveys were collected every other weekday, so that each day of the work week was sampled twice, and during three full weekends for a total of 16 collection days. During all survey sessions, groups of research assistants were located at the two entrances to Taylor Mountain: Kawana Springs (KS, the primary entrance) and Petaluma Hill Road (PH). In addition to collecting surveys, research assistants kept record of total survey time and number of visitors in each party for all visitation occurrences.[4] Based on volume of visitors, and to facilitate these two tasks, two research assistants were positioned at the KS entrance during the week and three on the weekends, while one research assistant was positioned at PH during all sessions. Visitors were approached as they entered the park and each survey generally took less than five minutes to complete. Prior to administering the survey, visitors received a brief description of the study and were provided information regarding confidentiality. Visitors who declined to respond were offered a mail-in survey.

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[2] The survey was written in a manner that would also allow for individuals to respond by mail if they did not have time to respond on-site.

[3] Of the 470 valid addresses we received during the survey process, 229 users provided specific street addresses.

[4] During our survey period there were 2,136 visitation events, of which 1,831 events occurred at the Kawana Springs entrance.

Data

We collected a total of 510 surveys, of which, 381 were collected from KS (6 of those were mail-in surveys) and 129 were collected from PH. Our final sample for analysis comprises 439 visitor observations. Observations were dropped for the following reasons: 38 visitors provided unusable information on residential location or transportation method; 23 visitors did not provide sufficient information on income;[5] nine visitors' one-way travel time was greater than one hour and thus were considered outliers in our sample and; one observation was dropped due to a recording error in which number of visits was omitted from the record on a survey.

Travel Costs

Per-trip travel cost (tc_i) for each visitor i is calculated as the sum of foregone wage costs (wc_i), vehicle operation costs (oc_i), and parking costs (pc_i)

$$tc_i = wc_i + oc_i + pc_i. \tag{2}$$

Per-trip wage costs are calculated by multiplying a fraction (30% in this case)[6] of estimated hourly income by the round trip travel time

$$wc_i = \left(0.3 \cdot \frac{y_i}{2000}\right)\left(2 \cdot \frac{time_i}{60}\right), \tag{3}$$

where y_i is annual household income as reported by visitors and $time_i$ is the one-way travel time, in minutes, from residence to Taylor Mountain as measured by Google Maps.

Per-trip vehicle operation costs are based on travel distance to Taylor Mountain ($miles_i$) and current per-mile operating cost (vc_j) estimates provided by the Automobile Association of America (AAA) for various types of vehicles (indexed by type, j)

$$oc_i = vc_j * miles_i, \tag{4}$$

where operating costs depend on vehicle type (j)

[5] Visitors provided information on household income based on various income brackets. Final household income is measured as the average income within each bracket. In the full sample, 80 visitors did not provide information on household income. For 57 of those 80 observations we were able to impute household income using a regression-based wage equation (see below). The other visitors did not provide sufficient information for us to impute wages, thus those observations were dropped from the final sample.
[6] The weight on incomes is somewhat arbitrary. However, using a weight of approximately one-third is relatively common (e.g., (Champ et al., 2003; Peter E.T. Edwards & Myers, 2011))

$$
vc_j = \begin{cases} 0.464 & if\ j = small\ sedan \\ 0.61 & if\ j = medium\ sedan \\ 0.75 & if\ j = large\ sedan \\ 0.773 & if\ j = SUV \\ 0.653 & if\ j = minivan \\ 0.681 & if\ j = other. \end{cases} \quad (5)
$$

Per-trip parking costs (pc_i) depend in part on whether or not the visitor chooses to park in Taylor Mountain lots. On the KS side there are a number of free parking spaces that lie just outside of park boundaries. Further, for visitors that choose to park in designated areas within the park, parking costs depend on whether the visitor has a regional park pass or pays the daily parking fee. Final per-trip parking costs are calculated as

$$
pc_i = \begin{cases} 0 & if\ don't\ pay \\ \$7 & if\ day\ pass \\ \dfrac{\$69}{\#\ of\ visits} & if\ regional\ pass. \end{cases} \quad (6)
$$

Visitor Profile

Tables A1-A3 provide summary statistics for all variables collected during the survey period. Table 1 provides a summary of some of the more pertinent variables.

- The average **number of visits** in the past year reported by respondents was 32.6. Figure 2 illustrates that 50% of respondents visited Taylor Mountain 10 or fewer times in the past year and 90% of respondents visited 100 or fewer times in the past year. Taylor Mountain visitors also visited Annadel and Crane Creek parks, which we consider to be the two most likely substitute parks, on average 13.5 and 4.2 times in the past year, respectively.
- On average, visitors **live within** 7 miles of Taylor Mt and 50% of visitors live within ~5 miles of the park. These numbers reflect the fact that **proximity** was the most commonly cited attribute (29%) that drew visitors to Taylor Mountain. A more detailed spatial distribution of visitors' household location can be seen in Figure 3.
- The two most popular **visitation activities are:** running/walking/hiking = 76.3%; and disc golf = 20.1%.
- The average per-trip **travel cost** for visitors was \$23.89. Figure 4 illustrates that, similar to the distribution on visitation, travel costs are highly right-skewed. 50% of visitors incur per-trip travels costs that are less than ~\$17 and 90% of visitors incur per-trip travels costs less than ~\$47.
- The average **age** of visitors was 40.15 and 41% of visitors were **female**.
- The two most common categories of **race** reported were white (71.9%) and Hispanic (16.9%).

Table ii. Summary statistics for select variables. See Tables A1-A3 for complete summary statistics tables.

Variable	N	Mean	Median	St. Dev.	Min	Max
Visitation						
Visits to TM in past year	446	32.603	10	52.413	1	365
Visits to Crane Creek	430	4.207	0	13.025	0	150
Visits to Annadel	435	13.471	2	28.518	0	200
Primary Activity						
Visit for Disc Golf	442	0.201	0	0.401	0	1
Visit for Running	442	0.077	0	0.267	0	1
Visit for Walk/Hike	442	0.686	1	0.465	0	1
Primary Reason for Choosing TM						
Preference for Trail Quality	442	0.113	0	0.317	0	1
Preference for Disc Golf	442	0.188	0	0.391	0	1
Preference for Vistas	442	0.172	0	0.378	0	1
Preference for Proximity	442	0.29	0	0.454	0	1
Household Location						
Miles to TM	446	7	5.268	7.33	0.67	79.433
Minutes to TM	446	19.756	14.833	22.005	3.367	315.867
Travel Cost to TM	446	23.893	16.332	24.007	1.044	160.957
Transportation						
Travel by Car	446	0.872	1	0.334	0	1
Typical Number in Party	441	2.34	2	1.896	1	20
Demographics						
Female	446	0.41	0	0.492	0	1
Age	412	40.515	39	15.028	14	88
Hispanic	445	0.169	0	0.375	0	1
White	445	0.719	1	0.45	0	1
Married	446	0.48	0	0.5	0	1
Number of Children	397	1.181	1	1.327	0	6
Household Income	446	$79.4k	$62.5k	$52.1k	$3.8k	$200k
Democrat	445	0.494	0	0.501	0	1
Independent	445	0.106	0	0.308	0	1
Republican	445	0.083	0	0.276	0	1

- Average and median **household income** were reported as $79.4k and $62.5k, respectively. The median household income in Sonoma County, as reported by the US Census Bureau,[7] is ~$63k. This is encouraging in that it suggests that our sample exhibits similar characteristics to the population and that over or under reporting was not likely an issue in our survey.

[7] http://quickfacts.census.gov/qfd/states/06/06097.html

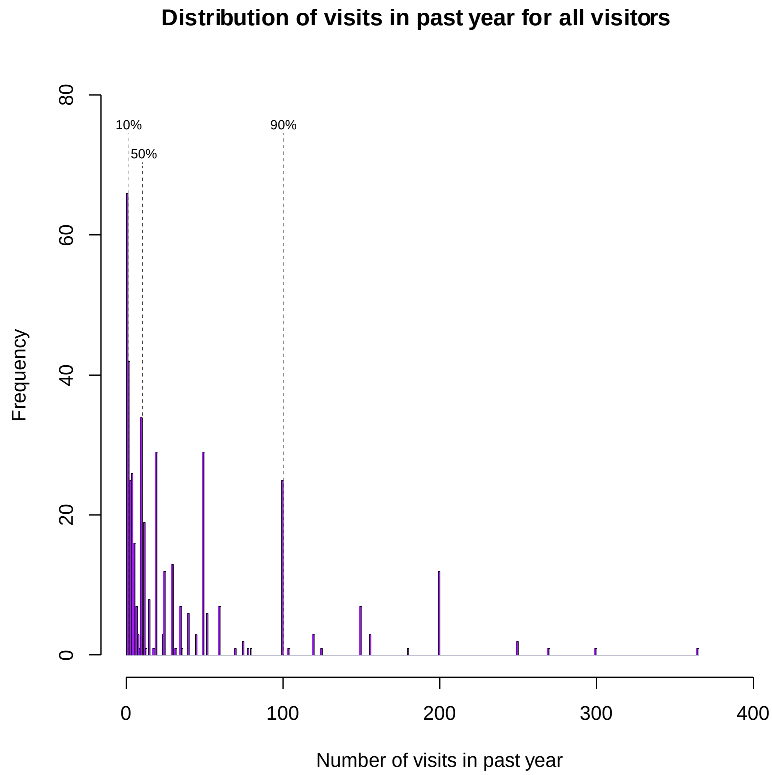

Figure 2. Histogram of reported visits over the past year. Dashed lines represent percentiles of the distribution, as labeled.

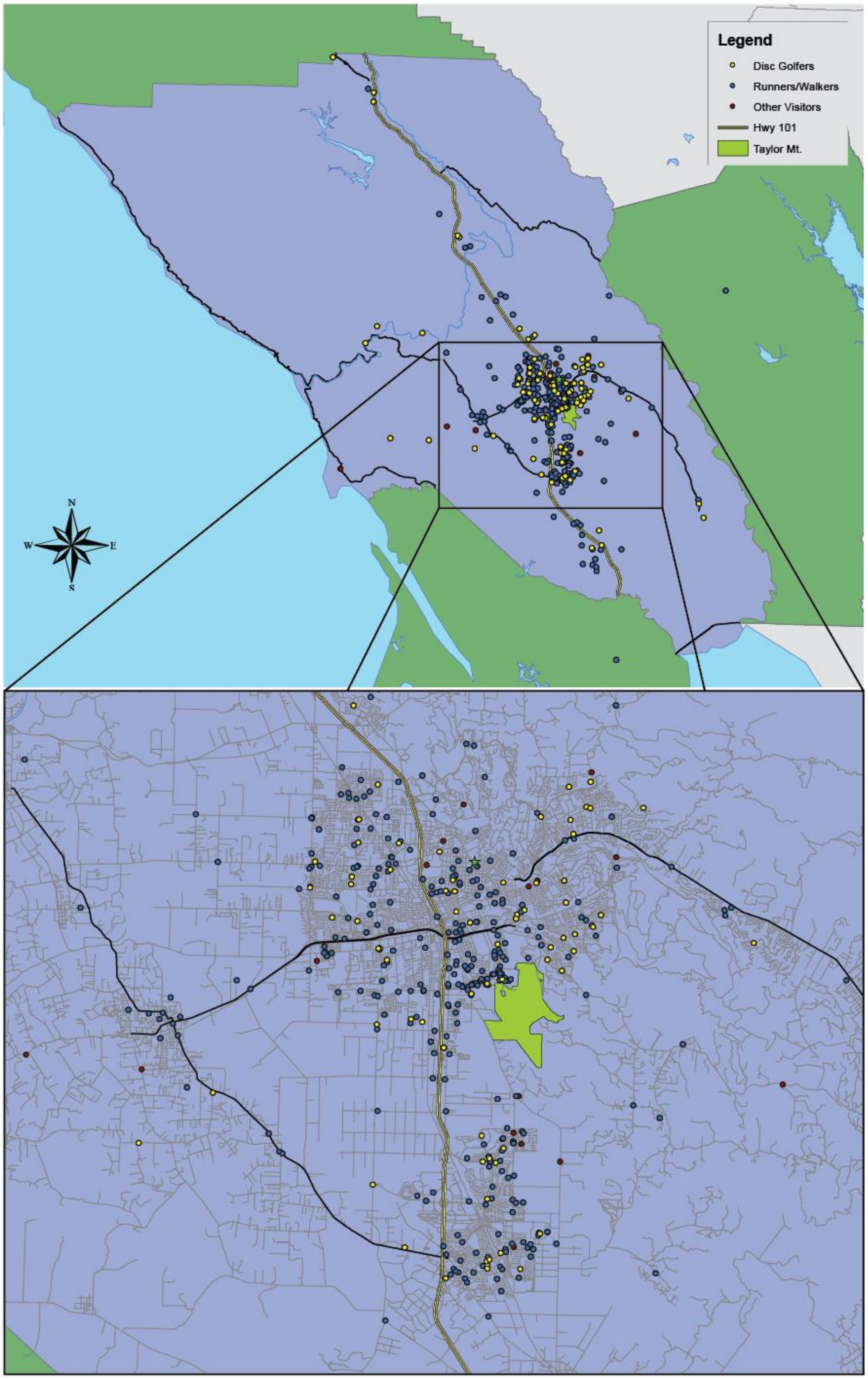

Figure 3. Map depicting spatial distribution of Taylor Mountain visitors.

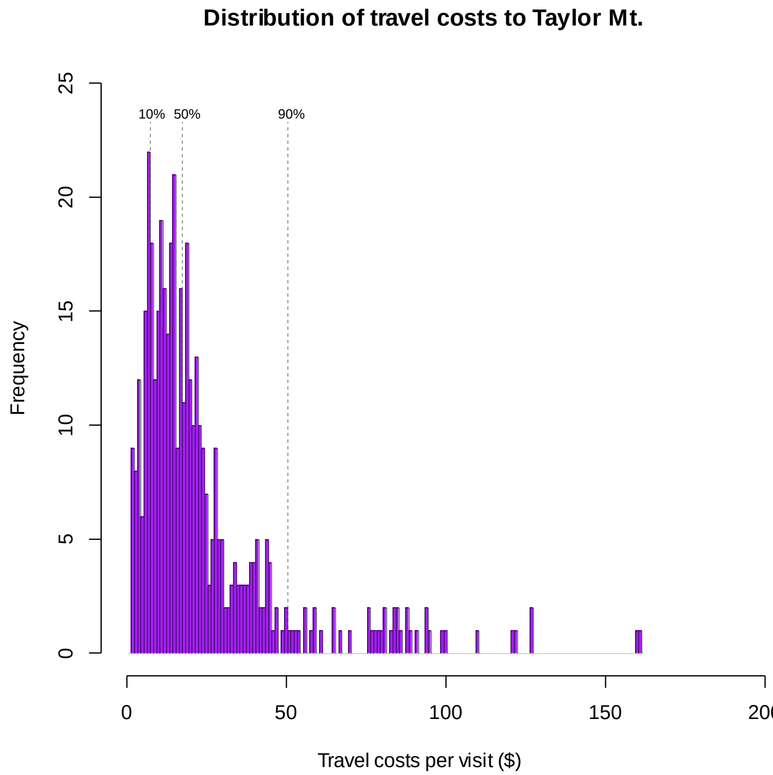

Figure 4. Histogram of travel costs. Dashed lines represent percentiles of the distribution, as labeled

Results

All survey data were recorded in Excel and analyzed in **R** v3.2.0. We specify three different forms of demand equations

$$r_i = f(tc_{i,tm}) \tag{7}$$

$$r_i = f(tc_{i,tm}, tc_{i,ann}, tc_{i,cc}, y_i) \tag{8}$$

$$r_i = f(tc_{i,tm}, tc_{i,ann}, tc_{i,cc}, y_i, z_i), \tag{9}$$

where $tc_{i,tm}$, $tc_{i,ann}$ and $tc_{i,cc}$ represent travel costs to Taylor Mountain, Annadel and Crane Creek parks, respectively, y_i represents income and z_i represents a vector of control variables. In our final specifications, z_i contains attitudinal variables that capture the primary attribute that drew visitors to Taylor Mountain.[8]

Regression Results

For each of these general demand equations we run four different regression analyses: linear ordinary least squares (OLS), log-log OLS, poisson count model, and negative binomial count model. Results from all regressions are reported in Table A4. Table 2 presents results from our primary specification, which is a negative binomial model that accounts for on-site sampling and endogenous stratification

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[8] Numerous specifications of z_i were considered. Our final z_i was chosen based on model fit and the fact that some controls (e.g., age) contained numerous missing values because respondents failed to provide the information. See Table A4 for full regression results.

(the fact that we likely over-sampled frequent visitors during our survey period)(Englin & Shonkwiler, 1995).

Table iii. Selected results from primary negative binomial specification. See Table A4 for full results from all specifications.

Dependent Variable: # Visits in past year	
Variable	Coefficients
Travel Cost TM	-0.070***
	(0.005)
Travel Cost Annadel	0.046***
	(0.008)
Travel Cost Crane Creek	0.005
	(0.004)
Income	0.001
	(0.002)
Trail Quality	0.829**
	(0.327)
Disc Golf	0.925***
	(0.297)
Constant	2.977***
	(0.277)
Observations	442
Log Likelihood	-1,843.11
Alpha	1.34***
AIC	3,708.23

Notes: *p<0.1; **p<0.05; ***p<0.01
(Standard Errors)

Table 2 highlights the strong negative relationship between visitation and travel costs to Taylor Mountain, meaning that we have estimated a downward sloping demand curve as expected. The coefficients on the variables for substitute sites are both positive, indicating that visitation to Taylor Mountain increases as travel costs to Annadel and Crane Creek increase, which is expected with substitute goods. The coefficient on income is positive, as expected, but not significant. The coefficients on the trail quality and disk golf attributes are positive and significant (reported in Table 2), all other attribute coefficients were insignificant (reported in Table A4).[9]

Access Value

The regression results from Table 2 allow us to calculate various measures of access value for visitors to Taylor Mountain. Each calculation is based on the coefficient on *Travel Cost TM* in Table 2 and the estimated access values are presented in Table 3.

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[9] The attribute variables capture the visitors' stated primary attribute that draws them to Taylor Mountain We omit the "other" attribute from our regressions.

Table iv. Estimates of access value (consumer surplus, CS_i) based on results from primary regression specification (Table 2).

	Point Estimate	95% Confidence Interval Lower	Upper
Mean CS_i/year	$631.70	$547.50	$746.50
Mean CS_i/visit	$14.39	$12.47	$17.00
Total CS/year	$1,555,361.98	$1,347,836.27	$1,837,467.24
Discount Rate	Present Value of Future Benefits		
1%	$155,536,197.71	$134,783,626.51	$183,746,724.19
3%	$51,845,399.24	$44,927,875.50	$61,248,908.06
5%	$31,107,239.54	$26,956,725.30	$36,749,344.84

Estimates in Table 3 indicate that the average visitor to Taylor Mountain accrued access value equal to $631.39 over the past year. We estimate the per-trip access value to be $14.39. Again, this implies that, on average, visitors to Taylor Mountain accrued per-trip benefits of $14.39 above and beyond visitation costs incurred. Based on the per-trip estimate and information on aggregate visitation, we can estimate the total access value attributable to recreation at Taylor Mountain. Sonoma County Regional Parks reported 6,117 day passes purchased at Taylor Mountain in the past year (July 1, 2014 through June 30, 2015). Based on our survey we know that only 15.1% of visitors that drive to Taylor Mountain purchase a day pass. From this we can infer that the total number of vehicles that traveled to Taylor Mountain in the past year was 40,406 (43.7% used a season pass and 29.4% parked outside the park entrance). Visitors who traveled to Taylor Mountain in a vehicle reported, on average, a total of 2.29 individuals in their party. Thus, we estimate that 92,531 visitors arrived by car in the past year. Using similar methods, we estimate that 3,096 visitors arrived by bike and 4,433 arrived on foot, which implies that total visitation to Taylor Mountain in the past year was 108,086.

Combining this estimate on total visitation with the estimate of per-trip individual access value we estimate the total access value at $1,555,362 with lower and upper bounds of $1,347,836 and $1,837,467, based on uncertainty in the regression model. Finally, Table 3 includes present value calculations of the future stream of benefits from recreation at Taylor Mountain over perpetuity given various discount rates.[10] These calculations should be viewed as very conservative lower bound estimates because they are made under the assumption of constant future recreational demand at Taylor Mountain; the area has only been made fully accessible in the last three years and visitation may well be on an upward trend.

[10] The discount rate determines the value attributed to future benefits and costs. A higher discount rate calculates lower values for future benefits and costs, while a lower discount rate calculates higher values.

Climate and Water Analyses

Conserving Taylor Mountain means that the land will remain in its near-natural state in perpetuity. This also means that existing provisioning ecosystem services (ES), such as carbon storage and ground water recharge, will continue to function similarly to current conditions.

The value of conserving these ES is a function of existing services and what services would exist in the absence of a conservation intervention. In other words there is very little value in conserving even the most biodiverse or ecosystem-rich areas if there is no pressure of conversion even in the absence of conservation. Therefore, in order to estimate the value of conservation provided by Taylor Mountain (in terms of carbon storage and water services) we must estimate what the **counterfactual** levels of these services would be in the absence of the protection of Taylor Mountain. We focus on carbon and water because of available data and their relevance to the region.

The potential release of CO_2 stored in biomass on natural landscapes poses a threat as a contributor to global climate change. Great attention is being paid at local (see California's AB 32 and Sonoma County's Climate Action 2020 plan) and global (see variations of the UN-REDD program) levels as to how conservation can be used to help mitigate climate change. We measure the carbon benefits associated with the protection of Taylor Mountain by estimating how much CO_2 would be released in the absence of this protection, and then monetizing these emissions using calculations on the social cost of carbon.

Water supply is a leading concern in Sonoma County generally. In the vicinity of Taylor Mountain, the most notable water-related concern is the management of groundwater in the Santa Rosa Plain. We choose to focus on the benefit provided by the protection of Taylor Mountain in terms of infiltration of precipitation into aquifers. We also examine the avoided cost of additional water consumption that would have taken place if the area had been developed according to typical patterns for similar unprotected land in the county.

Data and Methods

To estimate counterfactual values of these two ES for Taylor Mountain we employ several different strategies, all of which involve selection of sites that are of similar size to Taylor Mountain but have experienced various levels of development over the years. Our **counterfactual scenarios** ask what development on the Taylor Mountain site might look like if instead of being protected it had been developed in a similar manner to other comparable sites in the area.

Spatial data on carbon (**CO_2 equivalent**, or **CO_2e**), legal parcels, and park boundaries were provided by the SCAPOSD. Digital elevation models (used for slope, aspect and elevation) were obtained from U.S. Geological Survey. Geographic information system (GIS) processing was conducted in ArcMap 10.3.

Units of Analysis

Taylor Mountain comprises 1,082 acres of land. In order to formulate different counterfactual scenarios of development and ES, we begin by creating a grid of 2,100m parcels (approximately 1,090 acres) throughout Sonoma County. After clipping the grid using the Sonoma County boundary, we are left with 833 parcels that are of similar size to Taylor Mountain. Due to the differences in biophysical characteristics between the western and eastern portion of the county, we further parse the sample by dropping all grid parcels that lie west of highway 101, which leaves us with 367 parcels. Figure 5 provides a map of all grid parcels used in the analyses and their location relative to Taylor Mountain and Santa Rosa.

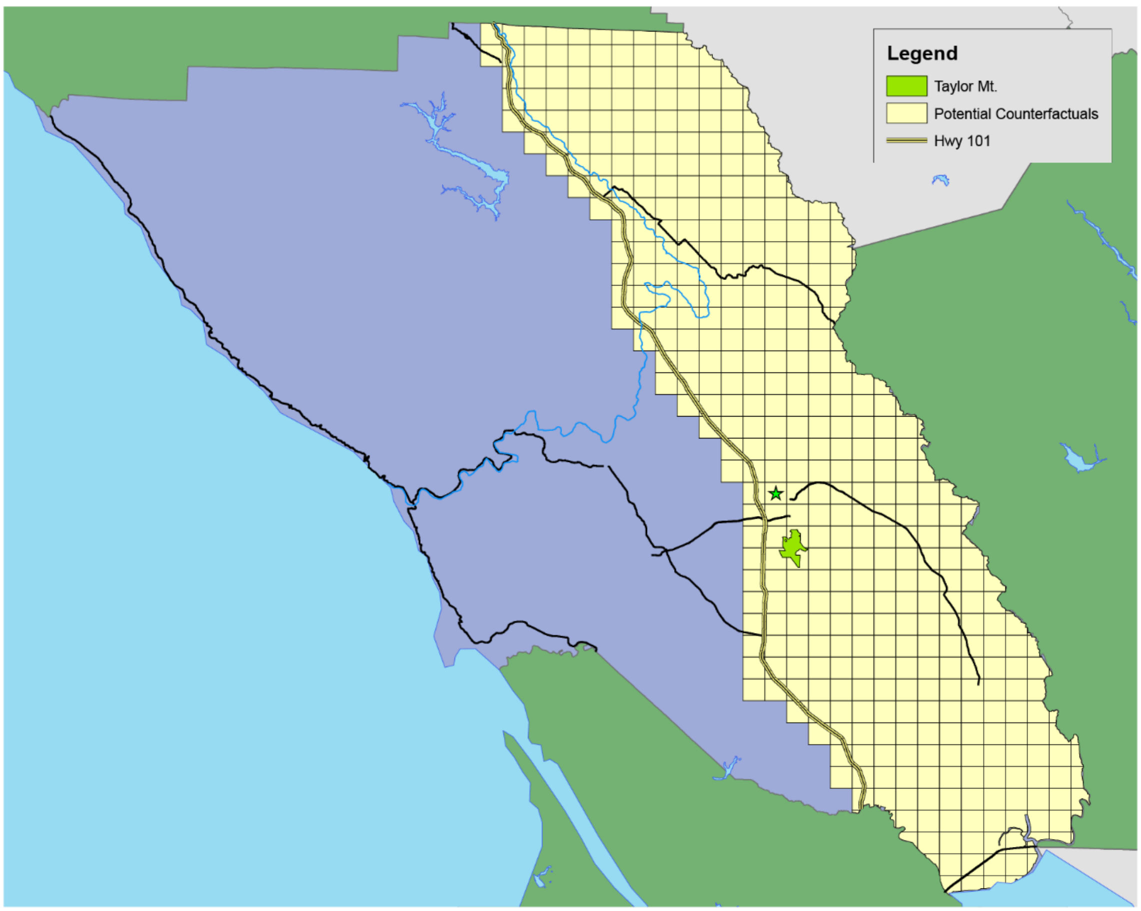

Figure 5. Study area and potential counterfactual grid parcels.

Outcomes

Carbon

For the carbon analysis we measure the aggregate and mean tons of CO_2e stored in above ground biomass. Using GIS, we overlay the parcel layer with the carbon raster and calculate zonal statistics to obtain measures of aggregate and mean CO_2e for each grid parcel and Taylor Mountain. We compare the carbon stocks of Taylor Mountain and the alternative parcels as of 2010, the most recent assessment available. It should be noted that our comparison does not take into account future changes in carbon stocks. Stocks may decrease on some comparison parcels if they are further developed. Tree planning could increase stocks on comparison parcels with no potential for further development. Overall we expect Taylor Mountain's protection of carbon stocks in comparison to the other sites to increase over time, so our calculation of the park's climate benefits is likely an underestimate.

Water

We focused on the value of groundwater recharge as the Taylor Mountain water value of most immediate interest to planners. Recharge was estimated by the Sonoma County Water Agency (SCWA) using the groundwater flow model grid of the Santa Rosa Plain Model developed by the USGS (Woolfenden and Nishikawa, 2014). The Taylor Mountain area GIS shapefile was overlaid on the groundwater flow model grid, which determines various outputs relating to groundwater recharge for given areas in the Santa Rosa Plain.

To assess the value of additional infiltration, we used the replacement cost method. This method estimates the least-cost realistic option for replacing a foregone environmental service. In this case, the measure selected was a groundwater recharge project that could be implemented in the environs of Taylor Mountain. In a scenario where Taylor Mountain became developed with residential homes, a system of stormwater capture and recharge by infiltration basins would be the most viable method to replace the foregone natural groundwater recharge provided by the open space. As the area became developed (and permeable soil was covered with building and pavement), the previous level of recharge would no longer be possible.

Our investigation of this issue revealed a great deal of uncertainty in comparing the groundwater dynamics of the parcels considered for this study, to the point that we cannot reliably forecast the difference in recharge in scenarios of preservation and development for Taylor Mountain. As a result we simply report a rough estimate of the total – rather than the additional – on-site groundwater recharge and the cost of accomplishing a similar figure by artificial means.

Counterfactual Scenarios

We take four different approaches to estimating counterfactual ES. For the first two scenarios we use statistical matching to find grid parcels, from the pool of 367 that are similar to Taylor Mountain in terms of the variables that determine development patterns and ES levels. In the second two scenarios we select grid parcels that are indicative of medium and high-density residential development in the Santa Rosa area.

Matching Scenarios

Matching is a quasi-experimental method that uses weight matrices to determine the similarity among different units across (potentially) multiple dimensions of characteristics. Matching is commonly used for policy evaluation and has become increasingly popular in the conservation literature (see (P.J. Ferraro & Hanauer, 2014)). Matching has nice large-sample properties and, under the correct specification, can be used to mimic experimental conditions (hence the term, quasi-experiment). For our purposes we use matching to aid in the selection of parcels that are similar to Taylor Mountain, ignoring uncertainty.[11] In the first scenario we use the single best match (the grid parcel selected because it is most like Taylor Mountain), and in the second scenario we use the average of the best seven matches.[12]

Matching Covariates

The covariates included in a matching algorithm should jointly capture the selection process that determines which units are exposed to a program or policy, and the outcome of interest. For our analyses we choose time-invariant covariates that are believed to influence development and our ES outcomes. The covariates that we include in our matching algorithm are: mean aspect, mean elevation, mean slope, and distance to downtown Santa Rosa from the center of the parcel.

One test of the validity for a set of covariates is based on a regression of the outcome on the selected covariates. A good set of covariates should predict the outcome well. To provide evidence on the validity of our covariates we run two separate regressions: in the first we regress mean CO_2e on all aforementioned covariates and in the second we regress a log transformed measure of development on all aforementioned covariates. To capture development within each grid parcel we use GIS to calculate the number of legal parcels that lie within each grid parcel.[13] Grid parcels that contain many legal parcels are considered, on average, more developed than those with few legal parcels within their boundaries. Results from the regressions are presented in Table 4. Both regressions exhibit high degrees of joint significance according to the F statistics and in both models the covariates explain over 50% on the variation in the respective outcomes. These results provide

[11] Typically matching, as a statistical estimator, is used with large samples of treated (exposed to program or policy) and untreated (not exposed to program or policy) units. In this study we have a single treated unit (Taylor Mountain), thus estimates of uncertainty are not applicable for our approach. There are methods for comparative case studies with a single treated unit which allow for measures of uncertainty (synthetic controls; see (Abadie, Diamond, & Hainmueller, 2010; Ferraro & Hanauer, 2014). However, these methods require time series data on outcomes (which we do not have) and do not provide an actual, policy relevant, counterfactual unit (which is something that we want).

[12] The algorithm was designed to choose the top 10 matches. However, three of the matched parcels overlapped with Taylor Mountain (a sign that the matching algorithm is doing what we want it to) so those parcels were dropped from the analysis.

[13] Specifically, we use GIS to define the centroid of each legal parcel and then overlay the 2,100m grid parcels to determine the number of centroids within each. The mean, minimum and maximum number of centroids within the grid parcels are 351.9, 0, and 4051, respectively. We use a log transformation of our development variable due to its highly skewed distribution.

evidence that the matching covariates we chose are appropriate for the matching analyses.

Table v. Regression results from models intended to test the quality of matching covariates.

	Dependent Variable:	
	Carbon	log(Development)
Elevation	0.029***	0.0001
	(0.007)	(0.0002)
Slope	3.793***	-0.080***
	(0.305)	(0.009)
Dist. SR	-0.002***	-0.0001***
	(0.0002)	(0.00001)
Aspect	-0.382***	0.003
	(0.07)	(0.002)
Constant	126.301***	7.041***
	(11.84)	(0.346)
Observations	370	366
R2	0.645	0.532
Adjusted R2	0.641	0.526
Residual Std. Error (df = 365)	47.802	1.393
F Statistic (df = 4; 365)	165.789***	102.420***

Note:*p<0.1; **p<0.05; ***p<0.01

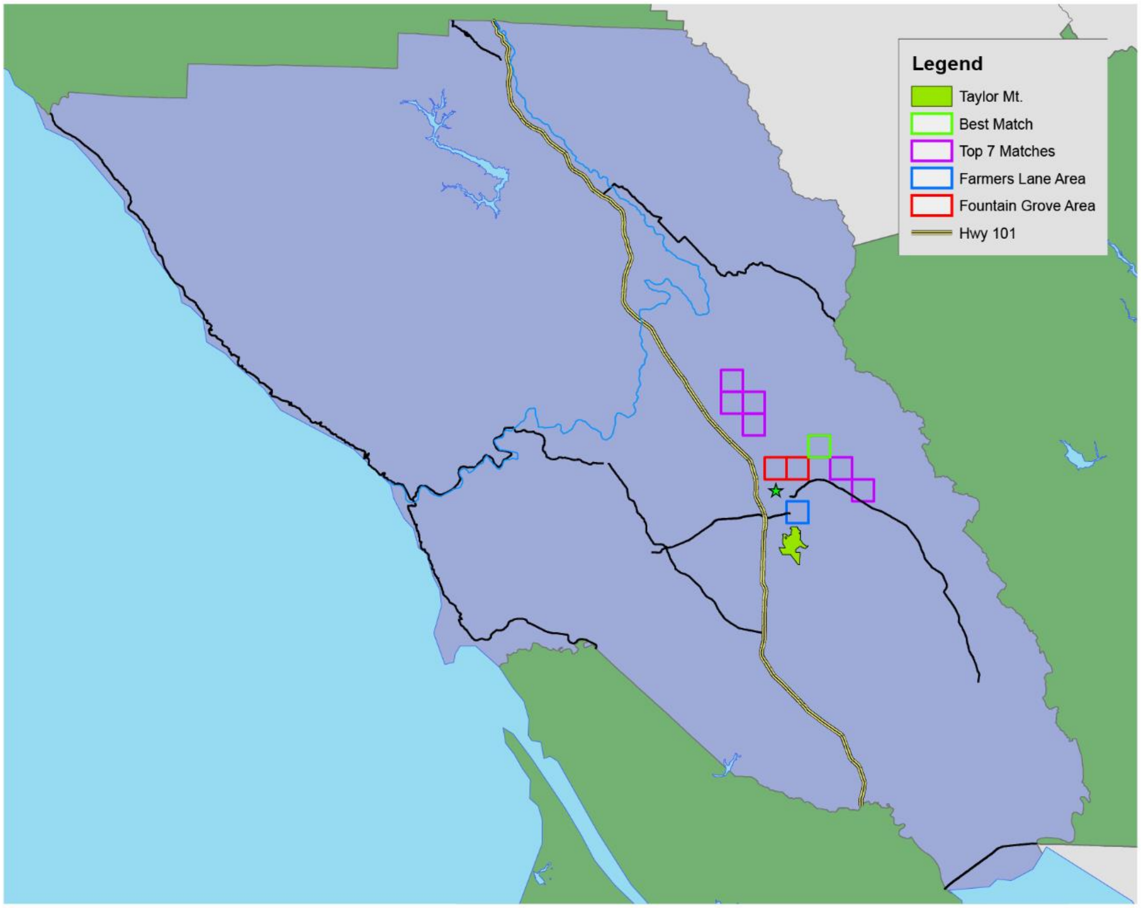

Figure 6. Map of study area and grid parcels selected for the four counterfactual scenarios.

Medium Development Scenario

To estimate what ES outcomes would be under a scenario of medium residential development, we chose two grid parcels that encompass the Fountain Grove area. Fountain Grove is a highly residential area with biophysical characteristics that are roughly similar to Taylor Mountain. Thus we think that these grid parcels provide an interesting and plausible counterfactual scenario for Taylor Mountain.

Urban Development Scenario

To estimate what ES outcomes would be under a scenario of urban residential development (relative to Santa Rosa standards of development) we chose a parcel that encompasses the Farmers Lane area, which is the nearest gird parcel with relatively high density residential development.

Table vi. Summary of covariate and CO_2e (metric tons) values for Taylor Mountain and the grid parcels used to construct the counterfactual scenarios.

Area	Average Aspect	Average Elev. (ft)	Average Slope (d)	Distance to SR (m)	Average CO2e/acre	Aggregate CO2e
Taylor Mt.	225.59	597.75	34.97	5362.60	167.40	181,131
Best Match	201.94	697.56	33.54	5939.70	128.09	139,583
Top 7 Matches	206.18	432.43	33.52	11971.84	131.23	143,010
	210.90	374.24	33.06	9391.49	153.92	167,727
	201.94	697.56	33.54	5939.70	128.09	139,583
	201.32	621.38	33.23	8400.00	156.16	170,168
	209.24	780.39	36.55	6640.78	179.27	195,361
	183.00	368.28	31.58	6640.78	160.13	174,495
	191.10	529.90	33.52	8658.52	160.81	175,237
Mean	200.53	543.46	33.57	8234.73	152.80	166,512
Fountain Grove 1	189.38	338.93	21.82	3320.39	56.04	61,066
Fountain Grove 2	158.37	349.64	14.32	5353.97	66.20	72,143
Mean	173.87	344.29	18.07	4337.18	61.12	66,605
Farmers Lane	162.19	218.07	9.68	7424.62	47.19	51,426
Full Sample Mean	165.69	654.60	25.37	22974.00	136.25	148,476

Results: Carbon

Figure 6 provides a map of the selected grid parcels for each of the counterfactual scenarios, and Table 5 provides information on covariate and CO_2e values for those parcels and Taylor Mountain. The final row in Table 5 presents the mean values of covariates for all 367 parcels in the sample. It is clear that the covariate values for the best match and the average covariate values for the top seven matches resemble those of Taylor Mountain much more closely than does the full sample. This provides evidence that the matching procedure succeeded in finding quality counterfactual parcels for Taylor Mountain.

To measure the impact of Taylor Mountain on CO_2e we compare existing levels of CO_2e within Taylor Mountain to those that would be observed under our various counterfactual scenarios; Table 6 presents these results.

Table vii. Estimated counterfactual CO_2e and impact for each scenario (tons).

Aggregate CO2e within Taylor Mountain = 181,131		
Area	Counterfactual Aggregate CO_2e	CO_2e Additionality
Best Match	139,583	41,548
Top 7 Matches*	166,512	14,620
Fountain Grove*	66,605	114,527
Farmers Lane	51,426	129,705

Note: *Aggregate is an average across selected parcels

We measure the impact of Taylor Mountain on CO_2e in terms of **CO_2e additionality**. In other words we take the difference between existing CO_2e within Taylor Mountain and the counterfactual values of CO_2e under each counterfactual scenario. This is the additional CO_2e that can be attributed to the fact that Taylor Mountain remains conserved, as opposed to undergoing development similar to that observed in each of the counterfactual scenarios.

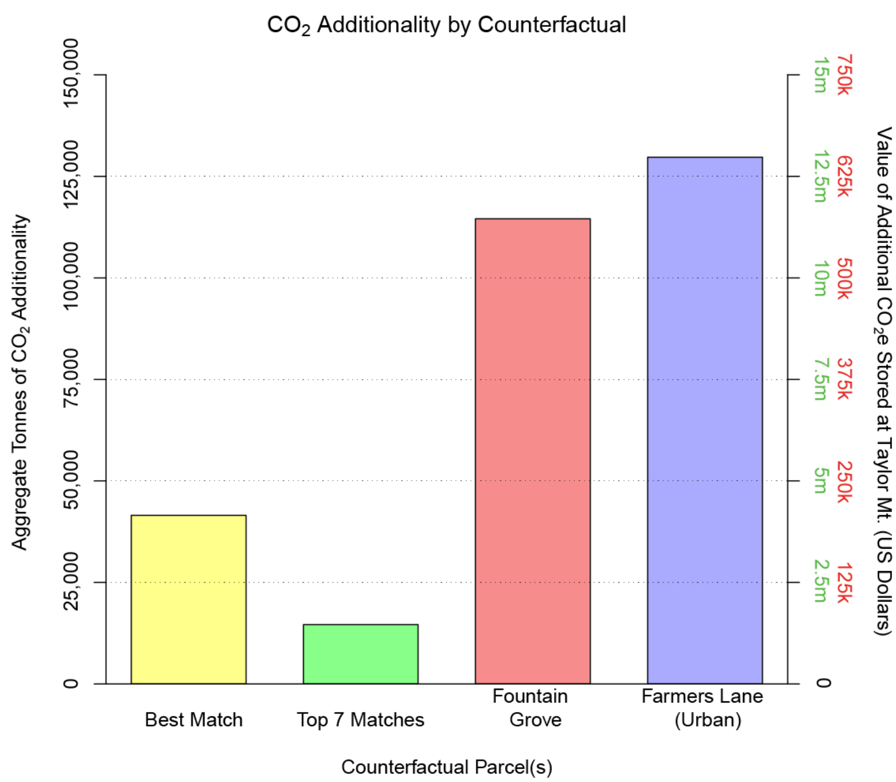

Figure 7. Results for each counterfactual scenario in terms of CO_2e additionality (left-hand y-axis) and the value of the CO_2e additionality (right-hand y-axis), as measured by two different values of the social cost of carbon.

Value of CO_2e Additionality

Greenhouse gas emissions impose a cost on society, commonly called the social cost of carbon (SCC). Estimates of the SCC strive to measure the societal impacts of an additional ton of CO_2e in the atmosphere. According to the United States

Environmental Protection Agency (EPA)[14], the SCC is designed to be a "comprehensive estimate of climate change damages and includes changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs." The EPA and other government agencies note that given current modeling and data limitations, the SCC estimates do not include all important damages. According to the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, SCC estimates omit important "physical, ecological, and economic impacts of climate change recognized in the climate change literature because of a lack of precise information on the nature of damages and because the science incorporated into these models naturally lags behind the most recent research."[14] Some estimates are higher than the US EPA estimate, such as the $220 per ton determined by scientists at Stanford's School of Earth Sciences (Moore & Diaz, 2015) and the Organisation for Economic Cooperation and Development's (OECD) estimate of $125 per ton in 2016 (Watkiss, 2006).

According to the EPA, average 2015 value estimates of the SCC over the next ~300 years for a ton of CO_2e emitted in 2015 range from $11 (discount rate of 5%) to $56 (discount rate of 2.5%). At each discount rate there is a range of estimates based on uncertainty and model calibration. The EPA reports that the 95th percentile value on the SCC for a ton of CO_2 emitted in 2015 is $105 (discount rate of 3%). The EPA gets its figures from the Interagency Working Group on the Social Cost of Carbon (2013).

Figure 7 presents the results for each counterfactual scenario in terms of CO_2e additionality (listed in Table 6) and the value of the CO_2e additionality when SCC is set to $5/ton (red) and $100/ton (green) (similar calculations were employed by (Paul J. Ferraro et al., 2015)). These calculations are founded on the assumption that under the counterfactual scenarios, all biomass removed from Taylor Mountain would be released into the atmosphere as CO_2. This assumption simplifies calculations and has been used in the literature (see (Paul J. Ferraro et al., 2015) for an example and references to other studies). According to our results the minimum present value of conserving carbon on Taylor Mountain is $73,100 (under the best 7 matches scenario and SCC = $5/ton), whereas the maximum value is $12,970,500 (under the Farmers Lane scenario and SCC = $100/ton).

Results: Water

The volume of infiltration within Taylor Mountain's boundaries is approximately 3,540,688 cubic feet of water (about 81 acre-feet) annually. An engineering project to replace the entirety of this value would cost approximately $200,000 - $400,000 to design and construct[15]. In addition, the system would require operation and maintenance costs of about $5,000 per year. This system would consist of about 20 small storm water capture and infiltration structures covering approximately a

[14] http://www3.epa.gov/climatechange/EPAactivities/economics/scc.html

[15] This calculation considers estimates and assumptions provided by the Sonoma County Water Agency.

quarter to half acre each to replicate the amount of infiltration and aquifer recharge that occurs naturally (a system like this captures and recharges 20-120 acre-feet per year v. the estimated ~80 acre-feet of Taylor Mountain recharge).

As Taylor Mountain is not currently part of Santa Rosa's Urban Growth Boundary, in a development scenario the city would not supply water to the area under Santa Rosa's Urban Water Management Plan. If development were constructed, consequently, residences would need to be on a well system or the Urban Growth Boundary would need to be expanded. If the boundary were expanded to include residential development on the mountain, the developer would be required to extend and pay for all necessary water supply infrastructure for the development. Infrastructure costs for both water and sewer will be a function of the size of the development, which would vary under each counterfactual scenario, since the development would need larger diameter pipes to serve larger populations. This information was determined based on interviews with City of Santa Rosa water officials.

According to existing agreements between the City of Santa Rosa and the Sonoma County Water Agency (SCWA), the city currently pays SCWA $761.05 per acre-foot of water (and rates are expected to rise at five percent per year over the next five fiscal years). With households in Santa Rosa using an average of approximately 100,000 gallons of water per year, under a housing density similar to Fountain Grove, development of Taylor Mountain would increase wholesale water costs to Santa Rosa Water approximately $200,000.[16]

Conclusion

Investing in the conservation of Taylor Mountain is bringing substantial benefits to the people of Sonoma County in the form of recreation. The park also avoids substantial greenhouse gas emissions, a benefit of up to $58 million shared globally. Information on water was inconclusive as to the scale of benefits the park brings in terms of groundwater recharge. Other important benefits, such as scenic beauty and wildlife conservation are likely to be important but were not quantified in this study.

We find that the recreation benefits alone are $54 million over time, over double the original $26 million investment in creating the park. This estimate is likely to rise as the park's popularity grows, more trails are built and infrastructure is improved. The composition of park visitors mirrors the economic diversity of the county as well as its balance of white, Hispanic and other ethnicities. While many of Sonoma

[16] There are approximately 1,500 households in the Fountain Grove Ranch area, which is approximately 2,000 acres; consequently, at a level of development similar to this region there would be 825 homes on Taylor Mountain's 1,090 acres that would require water supply infrastructure.

County's parks draw large numbers of tourists, Taylor Mountain is fundamentally a local park. The vast majority of visitors are from within the county and 50 percent travel less than five miles to get there.

The interest in Taylor Mountain for recreation demonstrates an ongoing demand for such opportunities in Sonoma County. And the numerous other ecosystem services co-produced along with these recreation benefits further underscores the economic rationale for identifying and protecting strategically chosen areas that will satisfy the needs of county residents and businesses over the long term. Studies like the one performed for Taylor Mountain can show the size of ecosystem service values and identify who benefits from them and therefore help guide future investments and management of open space.

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Annex 1

Variable	N	Mean	Median	St. Dev.	Min	Max
Visitation						
Visits to TM in past year	446	32.603	10	52.413	1	365
Visits to Crane Creek	430	4.207	0	13.025	0	150
Visits to Annadel	435	13.471	2	28.518	0	200
Primary Activity						
Visit for Disc Golf	442	0.201	0	0.401	0	1
Visit for MTB	442	0.018	0	0.133	0	1
Visit for Running	442	0.077	0	0.267	0	1
Visit for Walk/Hike	442	0.686	1	0.465	0	1
Visit for Horseback Riding	442	0.002	0	0.048	0	1
Visit for Birdwatching	442	0	0	0	0	0
Visit for Picnic	442	0.007	0	0.082	0	1
Visit for Other Activity	442	0.009	0	0.095	0	1
Primary Reason for Choosing TM						
Preference for Trail Length	442	0.086	0	0.281	0	1
Preference for Trail Quality	442	0.113	0	0.317	0	1
Preference for Disc Golf	442	0.188	0	0.391	0	1
Preference for Vistas	442	0.172	0	0.378	0	1
Preference for Proximity	442	0.29	0	0.454	0	1
Preference for Nature	442	0.05	0	0.218	0	1
Preference for Solitude	442	0.018	0	0.133	0	1
Preference for Lack of Congestion	442	0.007	0	0.082	0	1
Preference for Other Attrib.	442	0.075	0	0.263	0	1
Household Location						
Miles to TM	446	7	5.268	7.33	0.67	79.433
Minutes to TM	446	19.756	14.833	22.005	3.367	315.867
Miles to Annadel	446	10.493	8.535	7.669	1.043	84.993
Minutes to Annadel	446	33.056	22.342	34.95	4.9	408
Miles to Crane Creek	446	11.753	10.169	7.069	1.849	72.893
Minutes to Crane Creek	446	38.534	22.067	51.986	3.883	258.45
Travel Cost to TM	446	23.893	16.332	24.007	1.044	160.957
Travel Cost to Annadel	446	25.12	18.759	21.025	1.821	170.497
Travel Cost to Crane Creek	446	28.464	20.375	27.11	3.588	189.35
Transportation						
Travel by Car	446	0.872	1	0.334	0	1
Travel by Bicycle	446	0.029	0	0.168	0	1
Travel by Foot	445	0.099	0	0.299	0	1
Drive Small Sedan	446	0.352	0	0.478	0	1
Drive Medium Sedan	446	0.152	0	0.36	0	1
Drive Large Sedan	446	0.027	0	0.162	0	1
Drive SUV	446	0.276	0	0.447	0	1
Drive Minivan	446	0.034	0	0.18	0	1
Drive Other Vehicle	446	0.034	0	0.18	0	1
Pay for Parking	446	0.152	0	0.36	0	1
Park But Don't Pay	446	0.294	0	0.456	0	1
Regional Pass	446	0.439	0	0.497	0	1
Typical Number in Party	441	2.34	2	1.896	1	20

Table A1. Summary statistics from Section C of the survey.

Variable	N	Mean	Median	St. Dev.	Min	Max
Demographics						
Female	446	0.41	0	0.492	0	1
Male	446	0.583	1	0.494	0	1
Age	412	40.515	39	15.028	14	88
Hispanic	445	0.169	0	0.375	0	1
Native American	445	0.018	0	0.133	0	1
Asian	445	0.031	0	0.175	0	1
Black or African American	445	0.016	0	0.125	0	1
Native Hawaiian (Islander)	445	0.004	0	0.067	0	1
White	445	0.719	1	0.45	0	1
Other	445	0.031	0	0.175	0	1
Married	446	0.48	0	0.5	0	1
Single	446	0.489	0	0.5	0	1
Number of Children	397	1.181	1	1.327	0	6
Education						
No High School	446	0.007	0	0.082	0	1
Some High School	446	0.045	0	0.207	0	1
High School Degree	446	0.085	0	0.279	0	1
Some College	446	0.256	0	0.437	0	1
Associates Degree	446	0.112	0	0.316	0	1
Bachelor Degree	446	0.314	0	0.465	0	1
Some Graduate School	446	0.027	0	0.162	0	1
Master's Degree	446	0.114	0	0.319	0	1
PhD or Equivalent	446	0.038	0	0.192	0	1
Employment						
Employed Less than 20hr/week	445	0.07	0	0.255	0	1
Employed 20-39hrs/week	445	0.189	0	0.392	0	1
Employed >=40hrs/week	445	0.573	1	0.495	0	1
Unemployed	445	0.022	0	0.148	0	1
Unemployed not Looking	445	0.02	0	0.141	0	1
Disabled	445	0.002	0	0.047	0	1
Retired	445	0.094	0	0.293	0	1
Household Income						
Less than $20,000	439	0.089	0	0.285	0	1
$20,000-$34,999	439	0.118	0	0.324	0	1
$35,000-$49,999	439	0.105	0	0.307	0	1
$50,000-$74,999	439	0.182	0	0.386	0	1
$75,000-$99,999	439	0.121	0	0.326	0	1
$100,000-$149,999	439	0.157	0	0.364	0	1
$150,000-$199,999	439	0.075	0	0.264	0	1
$200,000 or more	439	0.039	0	0.193	0	1
Decline	439	0.114	0	0.318	0	1
Household Income	446	79,442.77	62,500.00	52,061.65	3,873.79	200,000.00
Voting						
Vote Regularly	446	0.72	1	0.45	0	1
Don't Vote Regularly	446	0.28	0	0.45	0	1
Democrat	445	0.494	0	0.501	0	1
Green	445	0.04	0	0.197	0	1
Independent	445	0.106	0	0.308	0	1
Republican	445	0.083	0	0.276	0	1
Tea Party	445	0.009	0	0.094	0	1
Party, Other	445	0.065	0	0.247	0	1
Party, Decline	445	0.198	0	0.399	0	1

Variable	N	Mean	Median	St. Dev.	Min	Max
Demographics						
Female	446	0.41	0	0.492	0	1
Male	446	0.583	1	0.494	0	1

Age	412	40.515	39	15.028	14	88
Hispanic	445	0.169	0	0.375	0	1
Native American	445	0.018	0	0.133	0	1
Asian	445	0.031	0	0.175	0	1
Black or African American	445	0.016	0	0.125	0	1
Native Hawaiian (Islander)	445	0.004	0	0.067	0	1
White	445	0.719	1	0.45	0	1
Other	445	0.031	0	0.175	0	1
Married	446	0.48	0	0.5	0	1
Single	446	0.489	0	0.5	0	1
Number of Children	397	1.181	1	1.327	0	6
Education						
No High School	446	0.007	0	0.082	0	1
Some High School	446	0.045	0	0.207	0	1
High School Degree	446	0.085	0	0.279	0	1
Some College	446	0.256	0	0.437	0	1
Associates Degree	446	0.112	0	0.316	0	1
Bachelor Degree	446	0.314	0	0.465	0	1
Some Graduate School	446	0.027	0	0.162	0	1
Master's Degree	446	0.114	0	0.319	0	1
PhD or Equivalent	446	0.038	0	0.192	0	1
Employment						
Employed Less than 20hr/week	445	0.07	0	0.255	0	1
Employed 20-39hrs/week	445	0.189	0	0.392	0	1
Employed >=40hrs/week	445	0.573	1	0.495	0	1
Unemployed	445	0.022	0	0.148	0	1
Unemployed not Looking	445	0.02	0	0.141	0	1
Disabled	445	0.002	0	0.047	0	1
Retired	445	0.094	0	0.293	0	1
Household Income						
Less than $20,000	439	0.089	0	0.285	0	1
$20,000-$34,999	439	0.118	0	0.324	0	1
$35,000-$49,999	439	0.105	0	0.307	0	1
$50,000-$74,999	439	0.182	0	0.386	0	1
$75,000-$99,999	439	0.121	0	0.326	0	1
$100,000-$149,999	439	0.157	0	0.364	0	1
$150,000-$199,999	439	0.075	0	0.264	0	1
$200,000 or more	439	0.039	0	0.193	0	1
Decline	439	0.114	0	0.318	0	1
Household Income	446	79,442.77	62,500.00	52,061.65	3,873.79	200,000.00
Voting						
Vote Regularly	446	0.72	1	0.45	0	1
Don't Vote Regularly	446	0.28	0	0.45	0	1
Democrat	445	0.494	0	0.501	0	1
Green	445	0.04	0	0.197	0	1
Independent	445	0.106	0	0.308	0	1
Republican	445	0.083	0	0.276	0	1
Tea Party	445	0.009	0	0.094	0	1
Party, Other	445	0.065	0	0.247	0	1
Party, Decline	445	0.198	0	0.399	0	1

Response	N	Mean	Median	St. Dev.	Min	Max
How does TM affect clean air?						
No Impact	385	0.078	0	0.268	0	1
Helps	385	0.738	1	0.44	0	1
Don't Know	385	0.169	0	0.375	0	1
How does TM affect global climate?						
No Impact	385	0.114	0	0.319	0	1
Helps	385	0.673	1	0.47	0	1
Don't Know	385	0.197	0	0.399	0	1
How does TM affect clean water?						
No Impact	384	0.107	0	0.309	0	1
Helps	384	0.562	1	0.497	0	1
Don't Know	384	0.315	0	0.465	0	1
How does TM affect groundwater recharge?						
No Impact	384	0.065	0	0.247	0	1
Helps	383	0.546	1	0.499	0	1
Don't Know	384	0.372	0	0.484	0	1
How does TM affect soil erosion control?						
No Impact	381	0.121	0	0.326	0	1
Helps	382	0.592	1	0.492	0	1
Don't Know	382	0.27	0	0.444	0	1
How does TM affect plant and animal diversity?						
No Impact	384	0.073	0	0.26	0	1
Helps	384	0.81	1	0.393	0	1
Don't Know	384	0.096	0	0.295	0	1
How does TM affect diversity in the community?						
No Impact	384	0.042	0	0.2	0	1
Helps	384	0.857	1	0.351	0	1
Don't Know	384	0.086	0	0.281	0	1
How does your view of TM from outside the park affect your well-being?						
No Impact	387	0.096	0	0.294	0	1
Positive Impact	387	0.773	1	0.42	0	1
Don't See It	387	0.116	0	0.321	0	1
Are you aware of who purchased TM?						
Yes	384	0.185	0	0.389	0	1
No	384	0.799	1	0.401	0	1
Are you aware of who owns and operates TM?						
Yes	385	0.46	0	0.499	0	1
No	385	0.525	1	0.5	0	1
How aware are you of SCAPOSD?						
Heard of them	377	0.265	0	0.442	0	1
Heard of and know what they do	377	0.207	0	0.406	0	1
Not	377	0.512	1	0.501	0	1
Do investments of SCAPOSD have net positive or negative impact?						
Positive Impact	196	0.949	1	0.221	0	1
Negative Impact	196	0.015	0	0.123	0	1

	Dependent Variable: Number of Visits in Past Year								
	OLS			Elasticities (OLS)			Poisson		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
TC.TM	-0.555***	-0.787***	-0.755***	-0.590***	-0.973***	-0.950***	-0.033***	-0.063***	-0.061***
	(0.111)	(0.128)	(0.133)	(0.083)	(0.098)	(0.097)	(0.001)	(0.001)	(0.001)
TC.Ann		0.261	0.171		0.452***	0.436***		0.021***	0.017***
		(0.251)	(0.254)		(0.151)	(0.147)		(0.001)	(0.001)
TC.Crane		0.242	0.293*		0.375***	0.393***		-0.001	0.002***
		(0.156)	(0.158)		(0.124)	(0.120)		(0.001)	(0.001)
Income		0.062	0.050		0.210**	0.186*		0.005***	0.004***
		(0.055)	(0.055)		(0.105)	(0.102)		(0.0002)	(0.0002)
Trail Length			6.637			0.259			0.306***
			(11.933)			(0.333)			(0.055)
Trail Quality			30.358***			0.830***			0.937***
			(11.275)			(0.314)			(0.049)
Disc Golf			12.221			1.205***			0.612***
			(10.347)			(0.285)			(0.048)
Vistas			-1.814			-0.020			-0.023
			(10.416)			(0.290)			(0.052)
Proximity			7.495			0.277			0.316***
			(9.874)			(0.273)			(0.048)
Nature			13.258			0.129			0.487***
			(14.022)			(0.390)			(0.057)
Solitude			3.776			0.075			0.233***
			(20.733)			(0.578)			(0.090)
Lack of Congestion			-15.169			-0.669			-1.964***
			(30.197)			(0.838)			(0.411)
Constant	45.579***	32.951***	25.169***	3.977***	0.240	0.014	4.049***	3.661***	3.280***
	-3.547	-4.689	-9.633	(0.240)	(0.960)	(0.962)	(0.014)	(0.017)	(0.047)
Observations	446	446	442	446	446	442	446	446	442
R2	0.052	0.102	0.113	0.104	0.197	0.28	Mean CS_i/year	Mean CS_i/year	Mean CS_i/yea
Adjusted R2	0.05	0.093	0.092	0.101	0.19	0.263	$965.40	$507.50	$532.50
Residual Std. Error	51.087 (df = 444)	49.903 (df = 441)	50.116 (df = 431)	1.523 (df = 444)	1.446 (df = 441)	1.384 (df = 431)	Total CS	Total CS	Total CS
F Statistic	24.405***	12.473***	5.467***	51.266***	27.023***	16.752***	$3,275,342.68	$1,715,655.69	$1,771,906.6
Log Likelihood							-12,130.51	-11,202.79	-10,856.43
theta									
Akaike Inf. Crit.							24,265.01	22,415.59	21,734.86

Notes: *p<0.1; **p<0.05; ***p<0.01

Variables of highlighted coefficients enter the regression in natural log form

Table A4. Full regression results from all specifications.