RESR Revista de Economia e Sociologia Rural
ISSN 1806-9479
ARTICLE

The value of forest recreation in Azorean public parks

O valor do recreio florestal nos parques florestais Açorianos

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How to cite: Lopes, F. & Amaral, A. (2021). The value of forest recreation in Azorean public parks. Revista de Economia e Sociologia Rural, 59(1), e238884. https://doi.org/10.1590/1806-9479.2021.238884.

Abstract: This study assesses the aggregated value of demand for forest recreation in the Azores using a regional travel cost model. Previous assessments of total economic value (TEV) of the Portuguese forest by Mendes (2005) and INCF (2006) consider both market services and non-market services. Non-timber benefits (NTB) such as recreation, carbon sequestration, protection of soil, and biodiversity were valued using value transfer methodologies. Forest recreation accounts for 0.65% of TEV using a unit transfer value of 2.75 Euros/per visit estimated by Loureiro and Albiac (1996). The present primary study assesses the value of forest recreation in the Azorean islands instead of a single site approach. A count data travel-cost model, taking into account characteristics of data from on-site face-to-face interviews, is used instead of contingent valuation.

This study uses data from a survey of visitors to public forest parks in São Miguel, Terceira, and Pico. Visits to public forest parks are a significant component of forest recreation, attracting more than 18% of residents with an average of five trips per year. The typical visitant is male, 38 years of age, and has secondary education. Those interviewed engage in physical activities, walking and running, as well as picnics, an opportunity to meet friends and family during the summer. The profile of this summer visitors changes to a more hard engagement in running and walking activities during autumn and spring. 33% of visitors are fully satisfied with their visiting experience and the quality of public forest parks. The value of a daily visit is 13.66 euros, and the total economic value exceeds 3 million euros in all Azorean parks for 275 thousand visitors. A conservative assessment of the benefit of forest recreation is higher than the total market value of wood production.

Keywords: forest recreation demand, travel cost method, forest total economic value.

Resumo: O presente estudo avalia o valor do recreio florestal com um modelo agregado regional das ilhas dos Açores. Avaliações anteriores do valor económico total (TEV) da floresta portuguesa por Mendes (2005) e INCF (2006) tiveram em consideração o valor de mercado dos serviços da floresta e o valor dos serviços não transacionados no mercado. Benefícios como o recreio florestal, o sequestro de carbono, proteção do solo e biodiversidade foram calculados usando a metodologia de transferência de valor. A componente do recreio florestal representa 0.65% do valor económico total usando o método de transferência unitária de valor com 2.75 euros/visita estimado para o Monte Brazil por Loureiro e Albiac (1996). Em vez da valorização dum único parque, usando a metodologia de valorização contingente adotada por Loureiro e Albiac (1996), adotamos um modelo com dados de contagem utilizando o método do custo de viagem com dados de entrevistas presenciais em múltiplos parques realizadas no verão de 2018. As visitas aos parques florestais das ilhas de S. Miguel, Terceira e Pico são a maior componente do recreio florestal, atraindo 18% dos residentes locais com uma média de cinco visitas anuais por residente. O visitante típico é do sexo masculino, com 38 anos de idade e escolaridade de nível secundário. Os entrevistados participam em atividades físicas, passeio e corrida, e atividades sociais como piqueniques e encontros com familiares e amigos no verão. Durante o outono e primavera, as atividades físicas como caminhada e corrida são as preferidas dos visitantes. Mais de 83% dos inquiridos estão completamente satisfeitos com a experiência da visita e a qualidade dos parques florestais públicos. O valor estimado para uma visita diária é de 13.66 euros, gerando um valor económico total de

3 milhões de euros para as 275 mil visitas anuais nos parques açorianos. O valor do recreio florestal estimado é superior ao valor de mercado da madeira de criptoméria produzida nos Açores. Esta estimativa parte dum valor conservador para o número total de visitas e o valor estimado agregado por visita, mas tem a vantagem de disponibilizar um valor agregado para uma região mais adequado à avaliação e definição de políticas regionais.

Palavras-chave: procura por recreio florestal, método do custo de viagem, valor económico total.

1. INTRODUCTION

The forestry sector is a small part of the Azorean economy generating less than 1% of gross value added. However, it provides non-market services that are relevant to the development of nature tourism, from the unique natural woodlands of Laurisilva and exotic forests of cryptomeria japonica. Natural Laurisilva woodlands are also habitats for most of the endemic flora and fauna supporting island biodiversity (Gaspar et al., 2011). All types of forest, exotic, and Laurisilva woodlands are essential for carbon retention and soil conservation (Vergílio et al., 2016).

Outdoor recreation in small islands is limited inland to forestry parks (Lopes & Gomes, 2015), nature trails (Queiroz et al., 2014) and volcanic hot springs and in the frontier with the ocean a broader supply of marine wildlife tourism (Bentz et al., 2016), surfing activities and beach recreation (Morais, 2015). Recreation demand is growing driven by the expansion of nature tourism and increasing demand from residents due to changes in lifestyle and recently the promotion of nature trail events (Scarpa et al., 2000).

Regional or national level policies and regulations require information affecting larger geographical areas that cannot be adequately addressed by using single-site information and needs to be addressed by an aggregate value for a specific region.

From a policy perspective, current single site estimates of the value of forest recreation are not adequate to make informed environmental and forestry policy decisions and managing access to more extensive geographic areas. The accuracy of single-site estimates is limited when substitution and complementary effects are not taken into account, leading to upward biased or downward biased estimates of value, respectively (Caulkins et al., 1985). Regional aggregate demand models also account for a broader range of origins for users contributing to a more considerable variation in travel times and travel costs. An essential question in an aggregated model is the number of sites to be considered (Lutz et al., 2000), and as there is no method to identify the optimal number of places the criteria used is to guarantee a more extensive spatial representation of the region.

These questions are addressed for the case of public forest recreation using a count data aggregated model for forestry parks in the Azores region. This paper estimates the value of daily visits to public parks in São Miguel using the travel cost method. A network of 27 forest public parks with a total area of 570 hectares provides recreation facilities in suburban contexts, e.g., Pinhal da Paz and Monte Brazil, and in less developed rural environments in eight Azorean islands. In small and remote island environments, these parks are sometimes the only public facilities for recreation. Travel cost, travel time, socioeconomic variables, and substitute site variables are considered as main variables to explain daily visits to public forest parks. Instead of physical characteristics variables that do not have a significant variance, we used the perceptions of visitors on the importance of some characteristics. Previous literature for Azorean forestry parks was limited to single-site assessments and used the contingent valuation method (Gomes, 2013; Loureiro & Albiac, 1996).

This paper contributes to characterize forestry recreation and to the travel cost literature providing the first assessment of the value of daily visits at an aggregated regional level in the Azores. As a sizeable primary study, the main contributions are:

i) Creation of a data set for recreational demand in Azores forest parks;

ii) Characterization of residents demand and satisfaction levels with existing park facilities;

iii) First regional aggregate travel cost model and valuation of recreational forest use;

2. METHODOLOGY AND DATA

2.1 Travel cost methodology

Within an increasingly urbanized society, the rural world and forests, in particular, contribute in new ways to human wellbeing. Woodlands and forests contribution to improved air and water quality, carbon sequestration, biodiversity enhancement, and recreation supersede traditional roles as food and fiber producers. Non-timber benefits are a generally accepted designation for this type of contribution to human wellbeing that is either public or free access goods (Lindhjem, 2007). A wider literature focuses on land-based activities such as fishing (Grilli et al., 2018), hunting (Knoche & Lupi, 2007), hiking, and camping (Brox & Kumar, 1997) and the comparison of non-timber benefits with timber production revenue. Managed forest and farmland can also provide a variety of non-consumptive services, such as landscape and wildlife viewing, as well as traditional consumptive services such as hunting.

In Europe, a large literature addresses access to forest recreation (Elsasser et al., 2009; Zandersen & Tol, 2009) showing that visits to forests are positively affected by distance traveled, the opportunity cost of time and travel cost per kilometer. The assessed value of benefits using the travel cost method shows a median value of $4.90 and a maximum value of $122 per trip.

In Portugal, a small corpus of non-published grey literature, thesis, and reports, has addressed the valuation of non-timber benefits for specific sites. Loureiro & Albiac (1996) were the first to use contingent valuation to estimate the access value of Monte Brasil Forest Park, on Terceira Island. With this study, they obtained a consumer surplus-value of 2.75 euros. Years later, Pacheco (2011) estimated the economic value of the Pinhal da Paz Forest Park, using both the contingent valuation method and the zonal travel cost method. The estimated value of the consumer surplus was 5.78 euros per visitor, according to the first approach, and 4.38 euros per visitor, according to the latter. A more statistically efficient and robust value of 3.99 Euros per daily/visits to Pinhal da Paz was obtained by Gomes (2013) using the double bounded contingent valuation method after controlling for starting bias and framing effects. The first published travel cost study of recreation demand for Geres National Park explored the use of the number of days per visit as an independent variable, accounting for the fast decay of the number of trips per visitor (Mendes & Proença, 2011). The average value of 193 Euros per day/visit is not very precise and, according to the authors, not comparable with previous values due to the unusual travel cost approach used to deal with the data specific characteristics. However, the number of primary studies in Portugal is still insufficient, with most secondary studies (Lopes, 2018) relying on the original values from Loureiro & Albiac (1996).

Recreation, in its multiple aspects, has been the subject of in-depth analysis, and the travel cost methodology has become a stable and robust tool providing valuable information (Smith & Kaoru, 1990). The literature using the travel cost method evolved from the first-generation zonal travel cost models to second-generation travel cost models with microdata and, more recently, the integration of revealed and stated preferences data (Phaneuf & Smith, 2005). From a policy decision making perspective, single-site valuations have been used in secondary studies and policy evaluation using benefit transfer methodologies; however, several authors argue that aggregated regional values are more accurate (Bertram & Larondelle, 2017; Bujosa & Riera, 2010). The demand for forest recreation is driven by factors such as the characteristics of the forest, the access to forests in urban or rural locations, the access to substitute sites, the availability of facilities such as parking space, picnic areas (Scarpa, 2003; Termansen et al., 2013). Changes in access to forest recreation sites depend on the distance to population centers as well as distances to substitute sites. In an island space where distances of forest parks to major population centers are smaller than 50 km, daily return trips do not exceed 100 km and contribute to a more regular pattern of visits all year round. Woodlands of cryptomeria japonica are dominant in the island ecosystems so variation in the characteristics of forest sites is limited to some mixed woodlands of non-endemic species and very small patches of laurisilva. In the aggregate trip generating function individual socio-demographic characteristics such as

age, gender, and income are considered as the main demand shifters. The model also takes into account changes in the quality of services provided by the different sites as perceived by each visitor.

The trip generating function analyses the relationship between travel cost (price) and the number of annual visits per individual, showing that with increasing travel costs, the number of visits decreases. The travel cost includes the cost of traveling; the opportunity cost of time spent valued as one-third of hourly wages; and assumes there is a perfect substitution between working time and recreation time (Cesario, 1976). The dependent variable is always an integer, non-negative, and greater than zero characteristics of count data truncated in zero. In this study, because data was collected using on-site surveys, it has the characteristics of count data, and the Kolmogorov-Smirnoff test results reject the null hypothesis of a normal distribution. The expected number of visits is modeled using a Zero Truncated Negative Binomial (ZTNB) function written as:

$$Exp\left(y|\ x\right) = Exp\left(\beta_i X_i\right) = Exp\left(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_n x_n\right)$$

The function using a binomial distribution is more adequate than a Poisson distribution function. It takes account of the integer positive nature of the dependent variable and does not assume that the conditional mean and the conditional variance are equal, taking into account unobserved heterogeneity (Englin et al., 2003). Sociodemographic dependent variables include gender, age, employment, and the monthly income declared by the visitors. The effects of the substitute site are accounted as the distance to the best alternative stated by the interviewees (Caulkins et al., 1985). It is assumed that forest parks in the Azores are homogeneous, offering essential services, walking trails, picnic areas, children playgrounds, with main differences in area size and the level of wilderness. Integrating the estimated demand curve, it is possible to obtain the consumer surplus of a day trip which is given by the inverse negative of the cost coefficient (Hellerstein & Mendelsohn, 1993)

2.2 Survey and data analysis

We surveyed 323 visitors to three forest parks during the summer of 2018 with the cooperation of the Azores Forestry Services and their socio-demographic characteristics are reported in Table 1. Adult interviewees were intercepted at the main entrances on alternate days of the week, either in the morning or in the afternoon, and were asked to fill the questionnaire. In some cases where there was a difficulty, the interviewer filled the inquiry as an interview. Of the 323 visitors interviewed, 90% declared that the visited park was their first choice and less than 10% reported that either Pinhal da Paz or Chã da Macela were considered as a substitute as they are, both located near the three main towns in the center of the island(see Figure 1).

Only 11.5% of visitors were not residents of the island, 48.6% of respondents had a secondary education, there was a small majority of females, and 79% were employed. Visitors traveled an average of 30 kilometers to Nordeste Park, 8.4 kilometers to Macela, and 6.6 kilometers to Pinhal da Paz.

The perceptions and level of satisfaction with services provided are analyzed; using a list of 15 attributes, as reported in Figure 2, defined in cooperation with the park management services. The most popular activities during summer are picnics, being with friends and family, and enjoying the landscape. During spring and autumn regular visitors, they prefer walking (40%), relaxing in the park (38%), and running (12%), showing a more active profile and preferring individual instead of group activities. On average, the number of visits was five per annum with 8% of the interviewed visiting the parks more than ten times.

Table 1. Socio-demographic characterization of visitors

Variable		Value
Age (average)		38,15
Gender	Female	52,8%
	Male	47,2%
Residence	Island	88,5%
	Out of Island	11,5%
Education level	Basic education	15,9%
	Secondary education	48,6%
	Tertiary education	35,5%
Activity class	Student	8,0%
	Unemployed	5,3%
	Employed	67,5%
	Self-employed	11,8%
	Retired	3,4%
	Domestic	1,5%
Monthly Income	Up to 500 euros	9,0%
	From 500 to 750 euros	35,7%
	From 750 to 1000 euros	22,0%
	From 1000 to 1500 euros	21,2%
	Greater than 1500 euros	12,2%

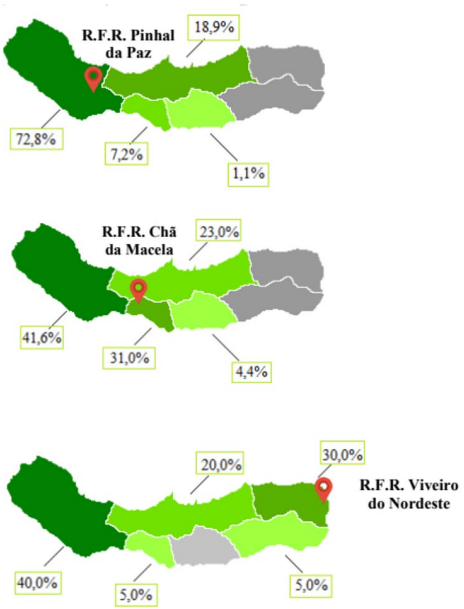

Figure 1. Catching area of Pinhal da Paz, Chã da Macela and Viveiro do Nordeste

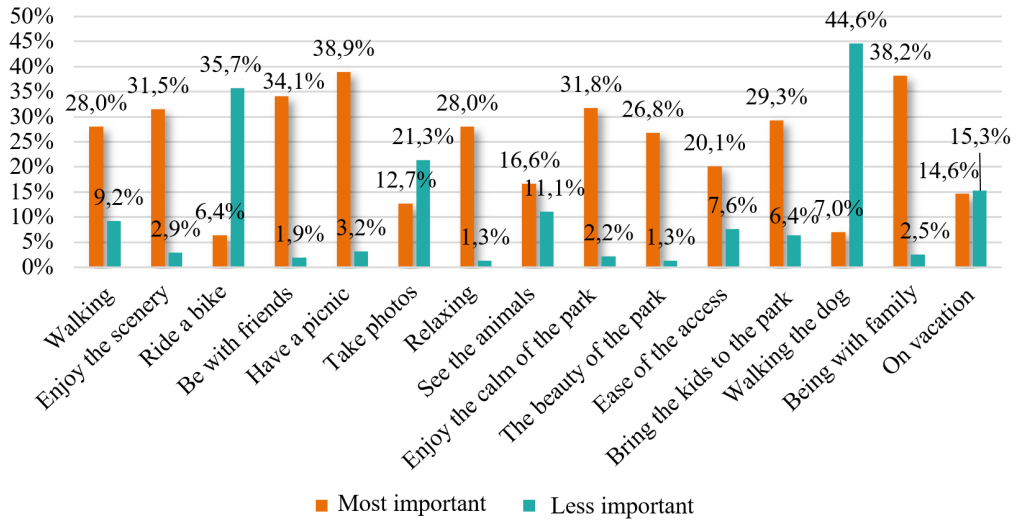

Figure 2. Most important/less important activities

3. RESULTS AND CONSUMER SURPLUS ESTIMATION

The maximum likelihood estimation of the model in Stata generated the coefficients in Table 2 and the variance parameter alpha. All parameters are significantly different from zero, and the likelihood ratio test rejects the hypothesis that α=0 and this overdispersion parameter is equal to 0.93.

Table 2. Zero Truncated Quadratic Negative Binomial Model results

	Coefficient	Z	P>|z|
Travel cost	-.0868834	-5.71	0.000
Substitute	.0135524	3.19	0.001
Income	.0009155	5.47	0.000
Gender	-.3411981	-2.18	0.029
Landscape	-.8097064	-3.16	0.002
Picnic	-.4254102	-2.00	0.045
Acess	.9223902	2.91	0.004
Constant	1.750563	8.27	0.000
/lnalpha	-.0619761	---	---
Alpha	.9399053	---	---

LR test of alpha=0: $X^2(01) = 1673.72$ Prob >= $X^2 = 0.000$

As expected, the number of annual trips decreases as travel cost increases. Table 2 shows the variables that have a negative effect on the number of visits:

a) Travel cost, which includes the opportunity cost of time spent in the park and account for distance traveled, is significant at the 1% level

b) Gender, is interpreted as men visiting less often than women do;

c) The employment situation, which is interpreted as fewer visits for those in employment;

d) Landscape, which measures the effect of the landscape attribute on the number of visits.

The variables with a positive impact on the number of trips are access, income, and substitutes. The number of visits increases the larger the number of visits to substitute sites. Two of the variables that account for the perception of characteristics of the park, landscape, and picnics have negative coefficients, which are difficult to interpret. From descriptive statistics, we know that visitors with an above-average number of visits are engaged in more

hard activities relating to exercise, walking, running, and biking. While those that have as a primary motive for the trip, picnics, and socializing activities are mainly summer visitors with a smaller number of annual visits, which might explain the negative sign for the picnic variable. Travel costs, substitutes, and income have the expected sign and are statistically significant.

Calculating the consumer surplus as the negative of the inverse of the sum of travel cost coefficient plus the substitutes travel cost coefficient, we obtain an average of 13.66 euros per trip. Not accounting for the substitution effects would undervalue the Consumer surplus per trip by 15% at 11.50 Euros. Checking the variability of the consumer surplus per trip using the confidence interval of the travel cost coefficient (-0.11672,-0.05704). The range of variation of the consumer surplus per trip has a lower bound of 8.56 Euros and an upper bound of 17.53 Euros. The average economic value per hectare is six thousand Euros. The total economic value of park recreation in the Azores is 3.7 million Euros for an estimated 275 thousand annual trips with parks in Sao Miguel contributing with 1.5 Million Euros in 2018.

4. DISCUSSION AND CONCLUSION

A visitor survey has been delivered across three islands, creating a first regional database on forest recreation, delivering better information for forest managers and policymakers. The survey was developed with the cooperation of Azores Forestry Services, creating the opportunity for regular updates in the future and the introduction of an automated visitor monitoring program. A detailed profile of visitors, which are mainly young, 38 years old on average, with secondary education and income levels below the regional average, allows for a better targeting of activities and improved facilities (Amaral, 2019). Residents travel an average of 8.8 kilometers, which is below the average of 32 kilometers for a country such as Italy (Bertram & Larondelle, 2017). Generally, visitors revealed a high level of satisfaction, and information and walking trails were identified as critical areas. The variation in environmental attributes is small regarding tree species and biodiversity, with a high number of invasive species as reported in the forest inventory.

This paper uses a regional travel cost model to estimate the value of forest recreation in the Azores. We developed a flexible count data model that accounts for truncation at zero and overdispersion characteristics of the survey data. The regional model overcomes some of the limitations of previous primary valuation for small single-site studies of the Portuguese forest. Comparing the results obtained with those from previous studies is possible but should be interpreted with caution due to differences in methodology.

The contingent valuation estimates used in previous secondary studies comparing the value of the Portuguese pine and eucalyptus forest (Lopes, 2018) and for the Mediterranean Portuguese forest (Mendes, 2005) are from the Monte Brasil park in the Azores. Later tests of the methodology using a double biding method, instead of the simple referendum used by Loureiro & Albiac (1996) improved the efficiency and accuracy of the estimates and confirmed that both referendum and double biding results are in the same interval of confidence (2.69; 4.81) with an average value of 3,75 euros (Gomes, 2013).

Even adjusting for inflation, those results are much smaller than the 13.66 euros per day visit of the count data aggregate model of this paper. The previous estimates of an average 3.75 Euros consumer surplus per trip are outside the interval of the variability of the consumer surplus, (8.56Euros-17.53) obtained with the regional travel cost model. Furthermore, from the statistical point of view, the present results are more stable and more accurate. A comparable aggregate value for the forests of Mallorca using discrete-count data travel models values daily visits at 68.8 Euros (Bujosa & Riera, 2010). A contingent valuation model of 27 Irish forests accounting for forest attributes influence on consumer surplus generates values in the 66 euros to 220 euros range (Scarpa et al., 2000). Both the Irish and Mallorcan studies use larger samples, 8000 and 4000 visitors surveyed respectively, and use contingent discrete choice and travel cost methods, respectively. In the Azorean case, a larger off-site survey, including zero visits or a larger sample integrating visits to nature reserves, might allow to include the choice of parks but would imply more human resources and a larger budget. Aware of this study limitation the results obtained as expected are not much different from those obtained in similar European studies (Zandersen & Tol, 2009)

The results show an economic value of recreation of more than 3 million euros, which is greater than the 1.8 million euros market value of timber produced in Azorean forests (Governo dos Açores, 2014). For managers and decision-makers, this information might be relevant to the ranking of investment projects and planning decisions in multi-use forests. The expected dynamics of the price of cryptomeria, which has decreased from an average of 30 euros/m^3 to 15 euros/m^3, and an increasing number of visitors as well as more recreation opportunities, will contribute to an expected and sustainable growth in the total value of recreation. Focusing on visits to forestry parks, instead of particular activities such as biking and running, the estimates of value are less susceptible to a smaller number of sports practitioners and addresses a wider demand of the resident population. The amenity value of forest parks will also likely increase with further investment in new facilities such as camping and mountain biking routes in more rural environments making a valuable and cost-effective contribution to rural development. The results obtained suggest that the development of public forests must take into account the amenity component and the contribution to carbon sequestration and biodiversity (Amaral, 2019). Better data on public forests could contribute to an economic assessment of contributions to nature conservation that are often overlooked in regional environmental assessments.

This paper dealt only with park recreation, but recent increases in tourist demand for hiking, the expansion of trail run events, and greater participation of residents in these activities need a dedicated study. The total value of recreation, which is already greater than timber production, is also growing faster if we take into account recent trends in nature tourism. Just as a comparison, two nature private sites that associate nature with hot springs, Parque Terra Nostra and Caldeira Velha, generated over 2 million euros each in 2018. The iconic value of natural landscapes in promoting nature tourists in the Azores should also be considered in future assessments of forests' total economic value.

The design of environmental and forest policies at the regional level needs economic information on the market, and non-market factors that affect soil use patterns and ecosystem services and benefits must be accounted. In this context, value information from regional aggregated demand models is a better alternative than estimates obtained from single-site models used for either the National Forest Strategy or the Regional Forest Strategy.

Aknowledgmentss

The authors would like to thank the financial support of project Forest-ECO-Towards an ecological and economic valorization of the Azorean flora, under the Açores-01-0145-FEDER-00014 supported by FEDER (85%) and ORAA(15%)

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Submetido em: 18/Out/2019
Aceito em: 19/Maio/2020
Classificação: JEL Q26, Q51