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Assessing the Touristic Activities of Wetlands through the Travel Cost Method: A Case Study

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Abstract: Wetlands have a fundamental role in the maintenance and development of the global ecosystem and human health. Assessing the value of Ecosystem Services (ES) that wetlands provide is strictly related to environmental, economic, and social sustainability. This paper considers the Oristanese Reclamation District located in the Italian region of Sardinia, where the highest amount of water resources is used for irrigation. Moreover, the study area is characterized by the presence of numerous ponds and wetlands that are deeply interconnected with local agriculture, attracting a substantial number of tourists. This paper aims to evaluate the touristic value in the area by applying the travel cost method, a non-market evaluation method used to derive consumers' preferences. Through secondary data, we obtained a total estimate of economic benefits from the recreational uses of the site of approximately €1.25 Mln/year. The results provide support to decision-makers for improving management options while ensuring a tradeoff between the economic benefits derived from tourist activities and the conservation of the wetland area.

Keywords: wetland; travel cost method; sustainability; ecosystem services; environmental benefits

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1. Introduction

Wetlands have a fundamental role in maintaining and developing the global ecosystem and human health [1]. Wetlands include both terrestrial ecosystems, strongly influenced by water, and aquatic ecosystems with peculiar characteristics due, for instance, to proximity to the land [2]. The International Convention of Ramsar (held in Iran in February 1971), signed by 170 countries, estimates that wetlands occupy about 6 percent of the world's land surface and have strategic importance. The UNEP-World Conservation Monitoring Centre (United Nations Environment Program) suggests that about 6 percent of the earth's surface is made up of wetlands, of which 2 percent are lakes, 30 percent bogs, 26 percent ponds, 20 percent swamps, and 15 percent floodplains [3]. In particular, wetlands are ecosystems that provide numerous goods and Ecosystem Services (ES) that have an important value not only to local people but also to society in general [4]. For example, they provide sources of food, fresh water, and building materials. Moreover, wetlands are responsible for other intangible ES that generate positive externalities, such as water treatment, flood control, erosion control, biodiversity conservation, and carbon sequestration [5–7]. In addition, wetlands can also provide cultural ES, including recreation and tourism attractiveness [8,9].

The literature generally classifies ES into four main categories according to the functions they provide [10]: (i) regulatory functions, which ensure ecological processes, like the regulation of nutrient and human waste, as well as climate regulation; (ii) supporting functions, providing space for activities such as human settlement, cultivation, energy production, and habitat for animals; (iii) provisioning services, supplying crucial resources for humans, such as food and water; and (iv) cultural services, as wetlands can provide possibilities for scientific, aesthetic, spiritual, and recreational activities [11,12].

In recent years, there has been a growing interest in assessing the monetary value of EC, encouraged by European and international recommendations. For instance, in Action 5 of the EU Biodiversity Strategy, the EU commission explicitly states that Member states need "to map and assess the state of ecosystems and ES. They must also assess the economic value of such services and promote the integration of these values into accounting and reporting systems at the EU and national levels by 2020" [13]. This trend is also reflected in research, where a long-standing debate about the evaluation of ES exists, arising directly from the necessity to inform decision-makers while also reflecting the social and environmental significance of the specific ES considered [14]. For example, De Groot et al. [15] provide estimates of the value of ES in monetary terms, offering a comprehensive perspective on the economic importance of natural resources for policymakers. Despite the recognition of the importance of economic evaluation, the systematic review by Laurans et al. [16] reveals a caveat in the application of these assessments in reality. Furthermore, Costanza et al. identified many potential uses at multiple time and space scales for the evaluation of ES [17]. A variety of methods has been used in the literature to assess different types of ES. Direct evaluation through market prices is mainly used for provisioning services (e.g., crop production, livestock, and other materials), while indirect evaluation methods are more common for other categories of ES [15], given that their economic value is not directly reflected in market price (real transactions do not exist) [16]. These methods refer, for instance, to the travel cost method, benefit transfer, contingent valuation, choice experiments, hedonic pricing methods, or expert evaluation. However, as discussed in the work by Häyhä and Franzese [18], the results derived from each approach can show substantial variability, and some evaluations may even be considered biased or inadequate. The main reason lies in the complexity of the evaluation, which needs to take into account the social and political context in which ES are being assessed [19]. Finally, in relation to wetland values, Woodward and Wui [4] highlight in their meta-analysis the challenge of applying some methodologies (such as benefits transfer). The authors suggest the necessity of more site-specific studies due to the lack of uniform methodologies across existing research.

In Italy, the areas designated under the Convention of Ramsar are 57, covering a total area of 73,982 hectares, of which around 18% is agricultural area (Ministry of the Environment and Energy Security, 2020). In this study, we consider a specific wetland, namely the lagoon of 'S'Ena Arrubia, originally intended as an artificial reservoir for agricultural use, located in the Italian region of Sardinia, where the highest amount of water resources is used for irrigation [20]. The case study area includes numerous ponds and wetlands with a high touristic potential. Tourism constitutes an important source of income and employment; in 2019, before the COVID-19 pandemic, 7.4% of the total GDP of Sardinia was derived from tourism [21]. Therefore, among the ecosystem services provided by the wetland, the tourist value was chosen.

The objective of this paper is to provide an economic assessment of the tourist activity of the lagoon of 'S'Ena Arrubia, a wetland located in Sardinia. The study adopts the Travel Cost Method (TCM), a popular non-market approach used to evaluate recreational sites [22]. It is based on the estimation of the Willingness to Pay (WTP), which assesses the cost-effectiveness of doing a certain activity [23] or visiting a site. In more detail, the values can be obtained according to two main approaches: through stated preferences, in which hypothetical market scenarios are proposed to respondents, or through revealed preferences, which use information from actual participant behavior. In doing so, the paper uses secondary data derived from national databases and from the literature, as described in Section 2.2.

The structure of the paper is defined as follows. Section 2 describes the case study area and the methodology used is presented. Section 3 dwells on the results obtained through the application of the TCM. Finally, the discussion of the main insights and the conclusions are pointed out in Section 4.

2. Materials and Methods

2.1. Description of the Case Study Area

The wetland under study constitutes the relict of the Sassu Pond, which was reclaimed between 1934 and 1937, along with an additional 200 small ponds and marshes. It covers a total area of 3270 hectares (Sassu Pond). The S'Ena Arrubia pond was transformed into an independent basin fed no longer by natural tributaries (its main tributary was the Rio Mogoro, now channeled towards the Marceddì Pond) but by artificial canals. The drainage basin underlying the lagoon has an extension of about 190 km^2. It extends over an area rich in islets and reed beds, with a high ecological, faunal, and floristic value [24]. The S'Ena Arrubia Lagoon is included in the Ramsar list (code: IT016), being a Special Protection Area for Birds (SPA, code: ITB034001), a Site of Community Importance (SCI, code: ITB030016), and a 'Permanent Oasis for the Protection and Capture of Wildlife' according to the Regional Law of Sardinia (LR 29/1998) [25].The vegetation includes various salt-tolerant plants, submerged species, and emergent reeds. The wetland also hosts several species of waterfowl and supports their breeding, resting, and wintering.

The S'Ena Arrubia lagoon is classified as eutrophic and hypereutrophic and occasionally experiences dystrophic crises [26]. The lagoon's climate is Mediterranean, with a long hot summer and a short mild, rainy winter. Many activities are carried out in the area, including tourist reception activities facilitated by a campsite within the pine forest.

The area of S'Ena Arrubia encompasses a total surface of approximately 298 hectares, spanning various municipalities and composed of: (i) the Lagoon of S'Ena Arrubia, which includes the main body of water with the coastal cordon of the sea mouths, with the northern and eastern limits coinciding with the Oasis of Fauna Protection; (ii) the area of Cirras and the Pond of Zrugu Trottu—for about 1 km north of the dirt road between Case Sassu and the coastline.

The area represents a quite complex eco-hydrological system. It is delimited by and interacts with a system of lagoons and coastal ponds, relevant from an environmental point of view for the richness of fauna and flora. Most of them are classified as Sites of Community Importance (SCIs) under the Natura 2000 network and are specifically regulated as a Special Area of Conservation (SAC) under the Habitats Directive (see Figure 1).

The Regional Agency of the River Basin District of Sardinia classifies the area under study as part of the Plioquaternary alluvial detrital water body of Arborea of the Campidano Hydrogeological Complex. Numerous hydrogeological studies conducted in the area have identified the presence of two aquifers, one superficial and one deep. The superficial aquifer is made up of alternating sandy-clayey and clayey levels, varying in strength from 10 to 20 m. It is a phreatic aquifer, which is locally confined at the roof by clayey levels and/or banks and at the bed by a continuous clayey level with a power varying between 5 m and 15 m, which is found everywhere in the plain at altitudes varying between 10 m and 15 m below sea level in the surveys. The deep aquifer is also set on loose alluvial sediments, consisting of alternating sandy-clayey and silty-sandy levels and is confined to the roof by the clayey level that forms the bed of the surface water table. The deep-water table finds its natural supply to the east of the Sassu depression in the filtration waters coming from the slopes of Monte Arci. Moreover, the groundwater undergoes monitoring activity as part of the Action Program for the Nitrate Vulnerable Zone Arborea. Besides the water contamination, the intensive agricultural activity in the area poses a number of challenges; these also relate to the over-exploitation of water resources. The most severe impacts of water scarcity are experienced during the summer, exacerbated by increased water demand from the agricultural and tourism sectors. In terms of cultivated crops, arable crops have the highest water requirement, and a significant part of Utilized Agricultural Area (UAA) is dedicated to such crops. The pumping activity, both for irrigation and for the maintenance of the land following extensive transformations since the early 20th century, has reduced the piezometer of the aquifers, thus eroding groundwater water availability. Furthermore, in coastal agricultural areas, water scarcity may lead to the phenomenon of saline water intrusion. Not limited to this, the complex interaction between the two aquifers can also lead to salinity contamination in non-coastal areas through the groundwater. Indeed, there is also a hypothesis suggesting that the transfer of pollutants have been facilitated through the interactions of the two aquifers (Contract of the marine coastal wetlands of the Oristano area: cognitive analysis, https://www.maristanis.org/index.php/en/resources/projects/the-oristano-coastal-wetlands-contract.html (accessed on 5 May 2023). Furthermore, the wetland under study is closely connected with irrigation, as it is fed by the "Canale delle Acque Medie" and is an adductor canal for irrigation use [24].

Figure 1. Territorial limits of the special protected area, S'ena Arrubia. Source: Piano Di Gestione Della Zps Stagno Di S'Ena Arrubia.

The lagoon's climate is Mediterranean, with a long hot summer and a short mild, rainy winter. Numerous activities take place in the area, including hosting tourists thanks to a campground within the pine forest; in addition, the Sant'Andrea Fishing Cooperative and six farms operate in the area to raise cattle for milk production and grow (mainly) corn. The area has around 71 M tourist presences per year [24]. As highlighted in the introduction, given the fact that tourism constitutes an important source of income, in this study, it was decided to limit the economic evaluation only to the tourist activity among the existing recreational services.

2.2. Methodology

This paper applies the travel cost method, which is further discussed in the following section, to the case study area of S'Ena Arrubia. In particular, the study adopts the zonal method starting from secondary data. According to the literature, this approach is more suitable and should be preferred when only secondary data are available. Data from the year 2021 were used. The choice is justified by the fact that it was the most recent available dataset, and thus, the number of visitors is similar compared to other years.

In particular, the methodology adopted in the study includes five steps in order to estimate the value of the recreational service:

- Identification of the zones for the zonal approach. It was decided to use 5 areas based on geographical considerations. The GIS data source used is Google Maps;
- Collection of data about visitors. The data are retrieved from official source, which is the Tourism Observatory of Sardinia (http://osservatorio.sardegnaturismo.it/, accessed on 5 May 2023);
- Calculation of the rate of visitors by zone. This was done by using population data from the official statistics institution (ISTAT for Italy https://www.istat.it/en/ (accessed on 5 May 2023), EUROSTAT for Europe https://ec.europa.eu/eurostat (accessed on 5 May 2023) and Worldmeter for the remaining countries https://www.worldometers.info/ (accessed on 5 May 2023));
- Calculation of travel cost;
- Estimation of the cost function. It was done by regression analysis.

2.3. The Travel Cost Method (TCM)

The TCM is an approach originally proposed by Harold Hotelling in 1947. The TCM approach is rooted in demand analysis: it assumes that the recreational value of a specific site reflects the costs paid to visit that site. In other words, the economic value associated with the visit is usually estimated based on the visitor's willingness to pay to access that specific site. In particular, the values are derived from all the costs incurred by the visitors, such as travel costs and entrance fees, which represent the demand to "consume" the recreational activity. In doing so, this method establishes a clear approach to derive the willingness to pay of participants for the access to the recreational experience. However, it is important to note that the model has an important assumption: if the costs incurred increase, the frequency of visits to the site is expected to decrease [27].

A large number of reviews and studies on TCM emerge from the scientific literature starting from the first methodological advances by Trice and Wood [4] and Clawson [28] to more recent evaluations [29]. Nowadays, the TCM is a well-established methodology that has been widely applied to assess different recreational activities in natural and rural environment. More in detail, there is also a great deal of studies that specifically focus on wetlands, as in Fleming and Cook [30] for Lake McKenzie (Fraser Island), or on lakes, as in Wubalem et al. [31] for Lake Tana situated in the northwest region of Ethiopia or in Tienhaara et al. [32] for Lake Puruvesi in Finland. In general, the results of these studies suggest to decision-makers what the overall economic gains derived from the touristic and recreational activities are while preserving the natural resources.

There are two main approaches in the TCM literature: individual (ITCM) and zonal (ZTCM). The former considers the number of trips per year or per season by a single user. while the latter relies on the number of trips taken to the site or zone by a group of people. It derives that the individual approach is more suitable to study more frequented sites, while the zonal is better to assess more remote sites that are typically frequented by people from afar [28]. The main differences between the two approaches are briefly presented in the Table 1 derived from Skarakis et al. [33].

Table 1. Comparison of Individual and Zonal TCM from Skarakis et al [33].

ITMC (Individual)	ZTCM (Zonal)
Specifies individual's traits	Uses average data per zone
Produces more accurate demand function	Avoids outliers
Requires significant sample	Deals with lack of data
Assumes that an individual's characteristics affect travelling decisions	Considers certain socioeconomic variables statistically insignificant
Robust estimations require variation in visitation rate	Robust estimations require an adequate number of zones

The zonal approach seems more suitable for assessing the recreation-related use value in this specific case study, given the purpose of this research.

Finally, the advantage of applying the TCM lies in its feasibility: survey costs are generally reasonable, and the estimation proceeding is not as complicated compared to other techniques. However, TCM presents some methodological limitations: (i) it cannot be generalized to estimate other services rather than the recreational ones and (ii) it assumes single visits rather than multi visits.

3. Results

3.1. Application of Travel Cost Method

3.1.1. Identification of Zones for the Zonal Approach

The first step in the application of the Travel Cost Method is to identify areas from which visitors come based on available data. These areas are weighted based on the distance of visitors from the place of interest, as in [34–36]. The zones were identified on the basis of visitor attendance data published by the Sardinian Tourism Observatory. In this paper, five different areas of interest are considered:

- Area 1: Visitors from Sardinia (excluding Oristano).

In this area, all visitors from Sardinia who stayed in one of the three municipalities adjacent to the S'Ena Arrubia pond were mapped: Arborea, Marrubiu, Santa Giusta. The province of Oristano was excluded as it was assumed that these visitors were day visitors. Moreover, we assumed that these visitors only use the car as a means of transportation.

- Area 2: Visitors from other Italian regions.

This area mapped all visitors from Italy who stayed in one of the three municipalities adjacent to the S'Ena Arrubia pond: Arborea, Marrubiu, Santa Giusta. Sardinia was excluded as it has already been covered in Area 1. It was assumed that these visitors used the car and plane/ferry as means of transportation. In this analysis, the cost of the flight was considered equal to that of the ferry.

- Area 3: Visitors from the Schengen area.

This area mapped all visitors from Europe (Schengen Area) who stayed in one of the three municipalities adjacent to the S'Ena Arrubia pond: Arborea, Marrubiu, Santa Giusta. Italy was excluded as it was included in Area 2. It was assumed that these visitors would use the plane as a means of transportation, while the cost of the car was considered negligible and integrated into the costs of using the plane (conservative estimate).

- Area 4: Visitors from other European countries.

This area mapped all visitors from Europe (non-Schengen area) who stayed in one of the three municipalities adjacent to the S'Ena Arrubia pond: Arborea, Marrubiu, Santa Giusta. This subdivision was introduced as it was considered that visitors from the non-Schengen area incurred higher costs and time. It was assumed that these visitors would use the plane as a means of transportation, while the cost of the car was considered negligible and integrated into the costs of using the plane (conservative estimate).

- Area 5: Visitors from other continents.

This area mapped all visitors from other continents who stayed in one of the three municipalities adjacent to the S'Ena Arrubia pond: Arborea, Marrubiu, Santa Giusta. It was assumed that these visitors would use the plane as a means of transportation, while the cost of the car was considered negligible and integrated into the costs of using the plane (conservative estimate).

3.1.2. Collection of Visitor Data

Visitor and attendance data were obtained from the database of the Sardinian Tourism Observatory. In this regard, this information was crucial to estimate the total number of days spent in the study are. Moreover, we derived the average period of staying per visitor

(Table 2). This enables the distribution of the trip's cost for each day of presence in the area, allocating to the recreational service the portion associated with a single day. One of the assumptions is that visitors utilize the recreational service in the area under study for only one day. This assumption seems reasonable due to the location of the wetland and the absence of other attractions and recreational service in the nearby areas.

Table 2. Attendance data by area.

Area	Year	Total Visitors N°	Total Attendance N°	Medium Stay (Attendance/Visitors) Day
Area 1 (Sardinia)	2021	13,972	31,816	2.3
Area 2 (Italy)	2021	5079	24,073	4.7
Area 3 (Schengen)	2021	3848	14,134	3.7
Area 4 (Non-Schengen Europe)	2021	162	565	3.5
Area 5 other continents	2021	169	565	3.3

3.1.3. Calculation of Visitor Rate by Zone

The rate of visitors (Table 3) was calculated in order to normalize visitor information and make comparison possible. This rate represents the number of visitors per million inhabitants in the area of interest. For this purpose, data on the population living in the area of interest were used. The data sources are: ISTAT, EUROSTAT, and WORLDMETER.

Table 3. Visitor rate.

Area	Total Visitor N°	Inhabitants Area N°	Accrual Number of Visitors per mln of Inhabitants
Area 1 (Sardinia)	13,972	1,437,626	9718.8
Area 2 (Italy)	5079	57,646,169	88.10646
Area 3 (Schengen)	3902	366,119,257	10.65773
Area 4 (Non-Schengen Europe)	112	391,957,316	0.4133103
Area 5 Other continents	169	2,515,529,823	0.067183

3.1.4. Calculation of Travel Cost

In order to assess the costs incurred by visitors, the following elements were considered: cost incurred to reach the area of interest as the weighted travel cost per population (Table 4) and cost incurred for staying in the area (Table 5). The cost incurred to reach the area of interest was calculated by evaluating the average distances from the area of interest, the relative cost per kilometer based on the means of transportation considered. The cost of the journey was weighted on the basis of the inhabitants in each area of origin. Table 4 provides an example of how the cost to reach the area of interest was calculated for visitors coming from Sardinia (Area 1).

Using the same procedure, the cost of reaching the area of interest was calculated for inhabitants from Areas 2, 3, 4, and 5, respectively. Moreover, for these areas, the following considerations were applied:

- Zone 2, transport considered: car (cost/km 1432 €) + plane 0.15 €/Km (Skyscanner data); average distance: calculated for each Italian regional capital from the area of interest (Google Maps data) and weighted for the Italian population minus Sardinia;
- Zone 3, transport considered: car (cost/km 1432 €) + plane 0.22 €/Km (Skyscanner data); average distance: calculated for each European capital in the Schengen area from the area of interest (Google Maps data) and weighted for the European Schengen area population minus the Italian population;
- Zone 4, transport considered: car (cost/km 1432 €) + plane 0.22 €/Km (Skyscanner data); average distance: calculated for each European capital in the non-Schengen area

from the area of interest (google maps data) and weighted for the European population of the non-Schengen area;
- Zone 5, transport considered: car (cost/km 1432 €) + plane 0.22 €/Km (Skyscanner data); average distance: calculated for each foreign capital from the area of interest (Google Maps data) and weighted for the European non-Schengen area population.

Table 4. Example cost calculation.

	Population	Cost [1] (€/Km)	Average Zone Distance (Km)	Average Cost of Travel [2] (€)	Weights Relative to Inhabitants [3]	Weighted Travel Cost per Population [4] (€)
Sardinia	1,590,044	1.432 [5]				
Sassari	476,357		124.0	177.3	0.3	58.8
Nuoro	201,517		88.1	126.0	0.1	17.7
Cagliari	421,488		94.8	135.6	0.3	39.7
Oristano	152,418			0.0		0.0
South Sardinia	338,264		55.6	79.5	0.2	18.7
Total						134.9

Notes: [1] For this example, the transportation mode is the car; [2] cost km × average zone distance; [3] population of the province divided (total inhabitants − inhabitants of Oristano); [4] average travel cost × relative weight; [5] ACI data.

Table 5. Cost of stay.

	Cost of Daily Stay (€)
Accommodation	36
Camping	43.75
3-star hotel	86
Media	**55.25**

The cost of the stay was calculated as an average of the costs associated with the different stay proposals offered in the area (Table 5):

The cost of the trip was then calculated (Table 6) using the "cost to reach the area of interest" (Table 4) and the "cost to stay in the area" (Table 5). The cost to reach the area of interest was doubled to account for the round trip. The value obtained was not used in its entirety but was weighted by the average visitor stay and used only the share relating to a single day (Table 4 column 5). This approach is based on the assumption that a visitor staying several days in the area will visit the place of interest in our study only once, while the other days will be devoted to other experiences. A comprehensive description of the total cost incurred by visitors according to the different Areas (1, 2, 3, 4, 5) is presented in Table 6.

Table 6. Total cost.

Area	Medium Stay (Attendance/Visitors) Days	Travel Cost per Day of Stay (€)	Cost of Stay (€)	Total Cost (Travel Cost) (€)
Area 1 (Sardinia)	2.3	118.5 [1]	55.2	173.7
Area 2 (Italy)	4.7	180.7 [2]	55.2	235.9
Area 3 (Schengen)	3.7	336.3 [3]	55.2	391.6
Area 4 (Non-Schengen Europe)	3.5	473.3 [4]	55.2	528.6
Area 5 Other continents	3.3	-	55.2	

Notes: [1] the figure in the table is multiplied by two (i.e., travel A/R and divided by the average stay; [2] this value is the sum of two contributions: (1) total "weighted travel cost per population," as described in the table, but using data from area 2; (2) total "weighted travel cost per population" for area 1 in order to also take into account travel within the region; [3] this value is the sum of two contributions: (1) total "weighted travel cost per population" as described in the table but using data from area 3; (2) total of the "weighted travel cost per population" for area 1 in order to also take into account travel within the region; [4] this value is the sum of two contributions: (1) total "weighted travel cost per population," as described in the table but using area data 4; (2) total of the "weighted travel cost per population" for area 1 in order to also take into account travel within the region.

3.1.5. Estimation of Cost Function

The data shown in Table 6 makes it possible to relate the visitor rate to the average trip cost for each area of interest (Table 7). On the basis of this data, various simulations were carried out by means of regression analysis to estimate the cost function that relates the cost of the trip to the visitor rate. It was decided to limit observation on areas 2, 3, and 4, as the results obtained by covering only these three areas are statistically more significant. However, further elaborations are in progress in order to improve the estimates and incorporate all areas into the calculation, providing a more accurate estimate of the cost function.

Table 7. Average travel cost and visitor rate per area of interest.

Area	Average Travel Cost (Euro)	Visitors' Accrual (Number of Visitors per mln of Inhabitants)
2	235.90	88.11
3	391.60	10.66
4	528.60	0.29

The general formula for the calculation of the travel cost for each zone is given by:

$$\sum_{i=1}^{n} Km\ driven\ with\ Trasportation\ [Xi] \times cost\ per\ Km\ with\ Trasportation\ [Xi] \times Weight[i]$$

where:

X = transport means (car, plane, ferry, and train). n refers to the number of provinces/region /countries in the zone under evaluation.

Please note that in this study, we have considered only cars and planes, since we assumed them to be the fastest and cheapest way of reaching the site.

Therefore, we have on the X-axis the average travel cost, and on the Y-axis, the visitor rate. The blue points (visitor rate) are obtained from the data in Table 6, while the line with the orange dots (predicted visitor rate) is obtained through the cost function V = 150.3 − 0.30C obtained through regression analysis. In particular, the orange dots were obtained by substituting the cost variable (C) in the travel cost function with the value taken from the Table 7, allowing us to derive the V value (Figure 2).

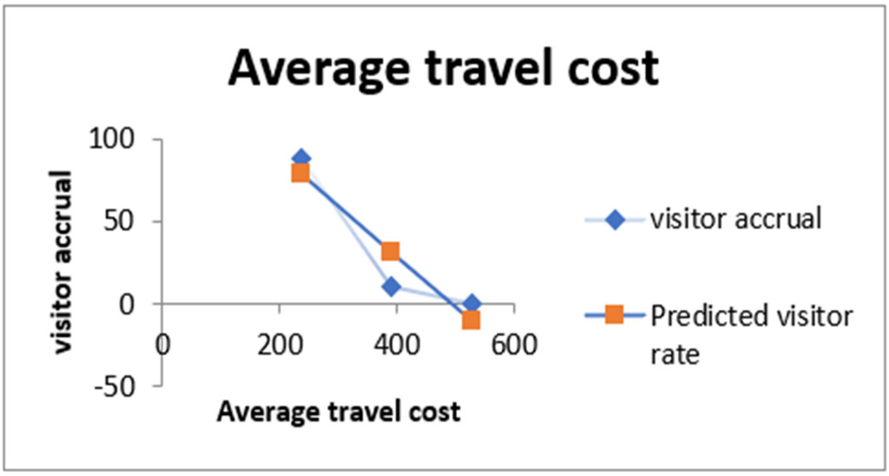

Figure 2. Derived cost function.

3.2. Calculation of Consumer/Recreational Surplus

Based on the results of step 5 (e.g., travel cost equation), an assumption is made that there is an increase in the price for the use of the good, as described in Table 7. The number of visitors for each area is calculated as a result of this increase, and finally, the total value of visitors is determined (see Table 8). Below is an example of how the number of total visitors was calculated against an increase in the cost of travel:

(a) *Ex. 1—travel cost increase of 10 euros*; the new travel cost for each zone is calculated as follows: Zone 2: 235.9 + 10 = 245.9, Zone 3: 391.6 + 10 = 491.6, Zone 4: 528.6 + 10 = 538.6. The visitor rate for each zone is calculated on the basis of the increased travel costs using the travel cost function V = 150.3 − 0.30C. The following values are obtained: V = 76 for Zone 2, V = 30 for Zone 3, V = −12 for Zone 4 (please note that the contributions for Zone 4 are always negative, so they are not considered in the calculations). Then, the visitor rate is converted to total visitors per area by using information about million inhabitants (e.g., 57,646,169 for Zone 2, 366,119,257 for Zone 3). Finally, the different contributions are added up to achieve the value of total visitors per zone.

We then obtain a curve describing the number of total visitors as the cost of travel increases (Table 9).

The curve obtained from Table 9 and represented in Figure 3 gives us an indication of how visitors to different zones will behave, assuming there is an increase in the cost of the recreational experience. The final step is to estimate the total economic benefit of the site for visitors by calculating the consumer surplus or the area under the demand curve (Figure 3), which represents the value of the recreational service on an annual basis. This curve was calculated by summing the areas of the trapezoids obtained for each increase in the cost of travel (Table 9, resulting in a total estimate of economic benefits from the recreational uses of the site of approximately €1.25 Mln/year. The derived demand curve is shown in Figure 3.

Table 8. Travel cost increase vs. number of visitors.

Travel Cost Function		**Cost Scenario (Euro)**	**Zone 2 Visitorsrate (Visitors per mln of Inhabitants)**	**Zone 2 Total Visitors**	**Zone 3 Visitors Rate (Visitors per mln of Inhabitants**	**Zone 3 Total Visitors**	**Zone 4 Visitors Rate (Visitors per mln of Inhabitants**	**Zone 4 Total Visitors**	**Total Visitors**
V = 150.3 − 0.30C		0	79	4567	33	11,906	−9	−3363	16,474
		10	76	4394	30	10,808	−12	−4539	15,202
Travel cost		20	73	4221	27	9709	−15	−5715	13,931
Area 2	235.9	30	70	4048	24	8611	−18	−6891	12,660
Area 3	391.6	40	67	3876	21	7513	−21	−8066	11,388
Area 4	528.6	50	64	3703	18	6414	−24	−9242	10,117
		55	63	3616	16	5865	−25	−9830	9481
Inhabitants		60	61	3530	15	5316	−27	−10,418	8846
Area 2	57,646,169	70	58	3357	12	4218	−30	−11,594	7574
Area 3	366,119,257	80	55	3184	9	3119	−33	−12,770	6303
Area 4	391,957,316	90	52	3011	6	2021	−36	−13,946	5032
		100	49	2838	3	923	−39	−15,122	3761
		110	46	2665	0	−176	−42	−16,298	2665
		115	45	2579	−2	−725	−43	−16,886	2579
		120	43	2492	−3	−1274	−45	−17,473	2492
		130	40	2319	−6	−2372	−48	−18,649	2319
		140	37	2146	−9	−3471	−51	−19,825	2146
		150	34	1973	−12	−4569	−54	−21,001	1973
		160	31	1800	−15	−5668	−57	−22,177	1800
		170	28	1627	−18	−6766	−60	−23,353	1627
		180	25	1454	−21	−7864	−63	−24,529	1454
		190	22	1281	−24	−8963	−66	−25,705	1281

Table 8. *Cont.*

Travel Cost Function	Cost Scenario (Euro)	Zone 2 Visitorsrate (Visitors per mln of Inhabitants)	Zone 2 Total Visitors	Zone 3 Visitors Rate (Visitors per mln of Inhabitants	Zone 3 Total Visitors	Zone 4 Visitors Rate (Visitors per mln of Inhabitants	Zone 4 Total Visitors	Total Visitors
	200	19	1109	−27	−10,061	−69	−26,880	1109
	210	16	936	−30	−11,159	−72	−28,056	936
	220	13	763	−33	−12,258	−75	−29,232	763
	230	10	590	−36	−13,356	−78	−30,408	590
	240	7	417	−39	−14,454	−81	−31,584	417
	250	4	244	−42	−15,553	−84	−32,760	244
	260	1	71	−45	−16,651	−87	−33,936	71
	265	0		−47	−17,200	−88	−34,524	0

Table 9. Surplus calculation.

Cost Scenarios	Number of Visitors	Calculation of Subtended Area [(Number of Visitor for the RowX + RowX + 1) × 10/2]
0	16,473.50421	158,379
10	15,202.20793	145,666
20	13,930.91165	132,953
30	12,659.61537	120,240
40	11,388.3191	107,527
50	10,117.02282	94,814
60	8845.72654	82,101
70	7574.430262	69,388
80	6303.133984	56,675
90	5031.837706	43,962
100	3760.541428	32,128
110	2664.982393	25,785
120	2492.043886	24,056
130	2319.105379	22,326
140	2146.166872	20,597
150	1973.228365	18,868
160	1800.289858	17,138
170	1627.351351	15,409
180	1454.412844	13,679
190	1281.474337	11,950
200	1108.53583	10,221
210	935.5973229	8491
220	762.6588159	6762
230	589.7203089	5033
240	416.7818019	3303
250	243.8432949	1574
260	70.90478787	177
265	0	0
	Recreational value	1,249,199

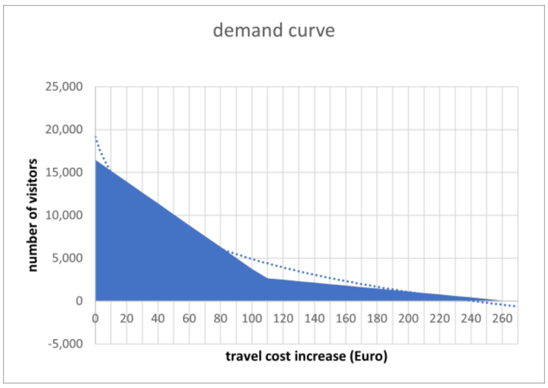

Figure 3. Consumer surplus curve.

4. Discussion and Conclusions

Ecosystem services are crucial for maintaining healthy environments, thus generating numerous positive externalities that create economic benefits for both local communities and society [15–37]. This paper evaluates touristic activity in the wetland, namely the lagoon of 'Ena Arrubia in Sardinia, by applying the zonal travel cost methodology. The estimated value is about €1.24 Mln/year.

The results are in line with the purpose of this paper, which is twofold: first, the application of TCM allows us to obtain a demand curve and an estimate of economic value for the Sant'Ena Arrubia pond. Second, the results highlight the importance of preserving such areas, with implications for policy (resource management processes, pricing policy, marketing, maintenance, or long-term investment in the site) [38–41]. Understanding the value that specific sites provide to visitors and residents enables the inclusion of local communities in assessing the value of landscapes [42]. For this reason, the outcome of this paper may serve all stakeholders in the field of sustainable land use and territorial governance.

Specific studies have shown that sustainable land use, through the identification and appropriate use of ES, is not only ecologically healthier but also economically more beneficial, both for local communities and society as a whole [43]. Among the positive externalities in the study area, the maintenance of the wetland plays a fundamental role. For this reason, it is clear how an evaluation of the area from an economic point of view, can contribute to its protection and enhancement by offering a wide range of environmental, recreational, and economic benefits to visitors and local communities [44,45].

The assessment of the area's recreational service is integral to implementing a system of economic, environmental, and social sustainability linked to strategic governance.

This economic assessment serves as support to encourage actions both in terms of territorial governance, applying a system of territorial social responsibility, and for the territory's tourist and industrial activities, in terms of corporate social responsibility [46–48]. The economic assessment of touristic activity is an important tool that can support decision-making in protecting the area. In this regard, protection costs should also be taken into account when assessing the net economic benefit of attracting tourists to the wetland. These costs are, for example, associated with making the wetland accessible to visitors and mitigating potential damage caused by tourism. Furthermore, conservation of the area also has positive effects on other ecosystem services, such as biodiversity conservation, wetland feeding, habitat conservation, flood control, etc. However, further studies are suggested to evaluate greater impacts.

Furthermore, the results could have implications for the assessment of ES provided or depleted by agriculture in that area, which, as stated above, has a close connection to the study area [24]; specifically, ES in terms of feeding wetlands [49] or pressures in terms of pollution [50]. The results contribute to the effort to populate natural accounting systems, which are becoming increasingly of interest in the context of natural resource management policies [51]. Additionally, it contributes to several uses such as raising awareness and interest, national income and well-being accounts, payment for ecosystem services, etc. [17] In the context of PES, the value may be useful for remunerating benefits derived from measures to protect the wetland, as well as remunerating positive externalities or penalizing negative externalities of surrounding economic activities, such as irrigation [52–55].

This analysis presents some methodological limitations. These mainly relate to the use of secondary data, which were considered less time-consuming and expensive. Moreover, in our analysis, we assume that individuals spending more than one day in the proximity of the area would have also visited the wetland. Based on the absence of other attractions and recreational services in the nearby areas, this assumption is considered reasonable, at least for a preliminary evaluation. We also did not include the time component (conservative estimate) [56–58]. Although there are studies in the literature where the time component is not considered, the travel cost method generally requires quantifying both costs associated with distance (kilometers traveled) and the period of time spent reaching the area of interest, with time itself being a cost for the visitor. In our case, this decision is justified by the unavailability of data to quantify the time required to reach the site. Therefore, we suggest that future work could benefit from surveys to address the aforementioned limitations. Future research could also compare the presented case study to other ponds to assess the environmental and economic sustainability of different wetlands in the region.

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