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INVESTIGATING HOUSEHOLD PREFERENCES FOR RESTORING PALLIKARANAI MARSH

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Investigating Household Preferences for Restoring Pallikaranai Marsh

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Abstract

The study examines households' willingness to pay for the conservation of Pallinkaranai marsh located in the south of Chennai, Tamil Nadu. A stated preference method, namely, Contingent Valuation method (CVM) over 213 households has been employed. The results reveal that farmers are willing to pay for the restoration of the marsh which provides higher level of water quality, recreational benefit and restorartion of flora and fauna.

Keywords: *Pallinkaranai, Contingent valuation, Chennai, bivariate probit regression*

JEL Codes*: Q510, C83, Q260*

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INTRODUCTION

The Economics of Ecosystem and Biodiversity For Water and Wetlands (TEEB) defines "Wetlands are areas where the water table is at or near the surface level, or the land is covered by shallow water."

The Ramsar Convention defines wetlands as: "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (article 1.1). Moreover wetlands "may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands" (article 2.1).

The Ramsar Classification of Wetland Types includes 42 types of wetlands, which belong to one of the three broad categories (Ramsar Convention Secretariat, 2011):

- Inland wetlands;
- Marine/coastal wetlands;
- Human-made wetlands.

Human-made wetlands covered by the Ramsar Convention include aquaculture, farm ponds, and permanently or temporarily inundated agricultural land - such as rice paddies, salt pans, reservoirs, gravel pits, sewage farms and canals.

There are a range of other wetland classifications used for different purposes, based on hydrogeomorphology and/or vegetation characteristics, such as :

- Marine (coastal wetlands, including coastal lagoons, rocky shores and coral reefs);
- Estuarine (including deltas, tidal marshes, and mangrove swamps);

- Lacustrine (wetlands associated with lakes);
- Riverine (rivers and wetlands along rivers and streams); and
- Palustrine (marshes, swamps and bogs)

Wetlands perform a wide array of ecological functions which includes water purification, flood protection, shoreline stabilization, groundwater recharge, and stream flow maintenance. Wetlands also provide habitat for fish and wildlife, including endangered species. Not all wetlands provide all of these benefits, and how the particular wetland works depends on its location and its type. But the wetlands are under threat due to demographic pressures and economic growth. Uncontrolled siltation, industrial effluents, dumping of wastes, felling of trees are the major threats the wetlands face affecting the flora and fauna of the biodiversity.

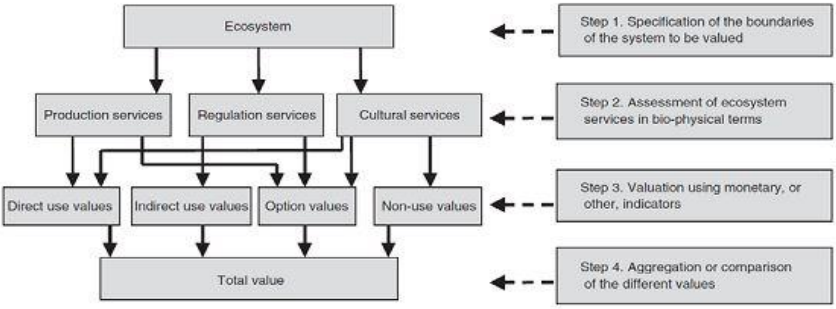
Valuation Methods

For the economic valuation of ecosystem services it is essential to understand the kinds of benefits people receive through them, and their willingness to pay for these services. Usually, there exists a market which decides the value for any service or good, this kind of a market does not exist for most of the ecosystem services, which leads to the difficulty of valuing these.

Hein *et. al*. (2006) provides a useful discussion of the steps involved in valuing ecosystem services and their relationship to the Total Economic Value framework(within the Millennium Ecosystem Assessment),

1. Specification of the boundaries of the ecosystem to be valued;
2. Assessment of the ecosystem services supplied by the system;
3. Valuation of the ecosystem services; and,
4. Aggregation or comparison of the values of the services.

Figure 1: Valuation of Ecosystem services



Source: Hein et.al (2006).

The total economic valuation of ecosystem services can be categorized as use values and non-use values. Use values involve human interaction with the resource whereas non-use values do not. Non- use values refer to those current or future (potential) values associated with an environmental resource which rely merely on its continued existence and are unrelated to use (Pearce and Warford, 1993), (Pearce and Turner 1990).

The use values can be further grouped into direct use values and indirect use values. Direct use values are derived from the uses made of a wetland's resources and services, for example collection of fuel wood, water for irrigation, harvesting of fish and the natural environment for recreation. Indirect use values are associated with the indirect services provided by a wetland's natural functions, such as storm protection and nutrient retention. People place an Option value on a service too. When they are unsure about their future demand for a service they are willing to pay to keep open the option of using a resource in the future, mainly because they are risk averse to some extent(See Figure 1)

The values derived from any environmental resource can be categorized into (Torras, 2000)

- Direct use value which relates to the direct use of the resource like timber, agriculture, fishing etc.
- Indirect use value is associated with benefits that individuals experience indirectly, or as a consequence of the primary function of a given resource.
- Option values refer to all use values (both direct and indirect) that can be realized at some point in the future. In other words, the option value is the value attributed to the possibility of using the good in the future
- Existence Value originates from the utility that arises from the simple perception of the existence, even in the absence of an expected use (Walsh *et. al.*, 1984; Brun, 2002)

The choice of valuation methods also involves choosing the socio-cultural context which emerges from the understanding of what values are, or should be, and how they should be elicited. Valuation methods imply certain models of humans, nature and their interactions and they define whether values are revealed, discovered or constructed (Vatn and Bromley, 1994). Seen in this perspective, valuation methods function as "value-articulating" institutions by defining a set of rules concerning valuation processes (Jacobs, 1997). In other words, valuation provides a tool for self-reflection, alerting the different groups of stakeholders to the consequences of their choices and behaviour on various dimensions of natural and human capital (Zavestoski, 2004). It can therefore contribute to change the way in which societies manage wetlands.

The following Table 1 lists the ecological functions of wetlands, the economic good and services it provides and the valuation methods.

Table 1: Ecological Functions and Valuation Methods Of Wetlands

Ecological function	Economic goods and services	Value type	Commonly used valuation methods
Flood and flow control	flood protection	indirect use	Replacement cost Market prices Opportunity cost
Storm buffering	Storm Protection	Indirect use	Replacement cost Production function
Sediment retention	Storm Protection	Indirect use	Replacement cost Production function
Ground water recharge/ Discharge	Water supply	Indirect use	Production function, NFI Replacement cost
Water quality maintenance/ nutrient retention	Improved water quality Waste disposal	Indirect use Direct use	CVM Replacement cost
Habitat and nursery for plant and plant species	Commercial fishing and hunting Recreational fishing and hunting Harvesting of natural materials Energy resources	Direct use Direct use Direct use Direct use	Market prices, NFI TCM, CVM Market prices Market prices
Biological diversity	Appreciation of species existence	Non - use	CVM
Micro- climate stabilization	Climate stabilization	Indirect use	Production function
Carbon sequestration	Reduced global warming	Indirect use	Replacement cost
Natural environment	Amenity Recreational activities Appreciation of uniqueness to culture/ heritage	Non - use	CVM

Source: Branderi *et. al.* (2006).

BACKGROUND

Pallikaranai Marsh is a fresh water swamp located in the south of Chennai, and covers an area of 50km^2. The swamp is helpful in recharging the aquifers of the region. It is one of the last few remaining natural ecosystems in the city. The first known manipulation of this system was the construction of the Buckingham canal in 1806; it was devised as a navigation canal of 421.55 km length connecting Pedda Ganjam in Andhra Pradesh and Marakanam in TamilNadu, mainly for the purpose of ferrying salt.

The swamp faces major problems due to **Disposal of partially treated sewage.** Water quality analysis within the marsh and the adjoining water bodies had shown the presence of mercury, lead and cadmium in quantities that were four times the permissible levels.**Gallons of water are being pumped out** from the surrounding area for commercial distribution, which is one of the causes of disease in Pallikaranai. **Spillover from Perungudi dump yard** (On the Northern side of the Pallavaram Radial road is in operation since 1987, under the Chennai Corporation) and **Alandur Municipal Corporation** (On the Eastern side of the Tambaram Velachery Main road) severely pollutes the ground water and affects the Marsh's fragile ecosystem. The total area allotted for dumping solid waste was only 0.3km^2 but at present more than 3.4km^2 have been used for this purpose. The area surrounding Pallikaranai was originally fertile, agriculture land spreading over 250 km^2. Constructions of educational and research institutes, the IT corridor (South Chennai), the Mass Rapid Transport System (Sub – Urban trains) of the Ministry of Railways, the National Institute of Ocean technology, and the Centre for Wind Energy tecnology has resulted in rapid degradation of the land. Also **Frequent fires** in the dump yard causes atmospheric pollution and smog during the mornings. The fires also affect the birds.

A forum called the Save Pallikaranai Marsh Forum was formed after the floods of 2002. After continuous efforts by the forum and the media the TamilNadu Pollution Control Board commissioned a study with the objective of evolving short and long term measures for protecting the marsh. This was a major milestone because the region was originally declared as a wasteland. On 9 April 2007, 3.17km^2 of the marsh was declared a Reserve forest: This excludes the area that is being used as the garbage disposal site. Decision regarding the closure of the Perungudi dump yard (along with the Kodungaiyur dump yard in North Chennai) has been made. Garbage from Chennai will be disposed of in four places in Malaipattu, Minjur, Vallur and Kuthambakkam villages where the corporation plans to set up waste management systems. Figure 2 shows the enroachments that had occurred over the years of the marsh.

LITERATURE REVIEW

In India, the recreational value of Khecheopalri, a lake situated in the west district of Sikkim state, which has recreational, biodiversity and sacredness values was assessed using the CVM. An Ordinary Least Squares (OLS) regression was used to analyse the WTP (Maharana, 2000).

Another interesting study on Kabartal wetland, situated in the upper Indo – Gangetic flood plains in Northern India, uses the CVM to assess the willingness to accept a compensation of the local people as an alternative to access the wetland. The WTA gave an estimated mean value of US$27,500 per household over a period of 60 years. The referendum format used was open ended but based on a response range schedule in order to avoid the high percentage of protest bids (two schedules were used, one highest bid category for the non-landholders and another lowest bid for the landholders category). Respondents were asked to agree on a single bid value and then a final

question was posed asking why they could not accept less money. An Ordinary Least Squares regression was used to analyse the WTA (Ambastha, 2007).

A CVM study has been conducted in the Bhoj wetland,Bhopal, Madhya Pradesh. The main threats to the Wetland have mainly been identified are siltation, solid waste pollutants, sewerage, Trapa cultivators, Encroachment, Weeds and eutrophication, Agricultural waste and hospital Waste. The Contingent Valuation Method resulted in two outcomes. One of these was a voluntary payment by the people to the Bhoj Wetland Maintenance. The second payment vehicle was a compulsory tax imposed upon the people of the city. An open-ended bidding game was used and the respondents were asked a follow-up question to their initial non-zero bid, which was a close-ended question. This was followed by a question that mentioned the finite income that they had and if they wanted to change the initial figure given by them. This questionnaire format tried to avoid the range biases by adding two follow up questions to the initial open ended question, the first of which was a close-ended question based on the answer to the initial open-ended question asked. In the questionnaire a table detailing the amount to be asked in the first follow-up question, based on the amount offered as the initial bid, was included. Two regression equations were estimated for the model one for each of the two payment vehicles used in the survey. The dependent variable in the first equation is the Willingness-to pay voluntarily and in the second equation the Willingness-to-pay in the form of a tax. Both of these are then regressed on a vector of socio-economic variables such as income and education level, as well as a number of dummy variables. The Contingent Valuation study has assessed the median voluntary WTP to is Rs.241 and the median WTP to be paid as tax is Rs.29.50 among the 2, 01,116 households in the city (Verma,2001) An interesting study done in 2001 included "payment time" as an additional factor. The aim of

the study was to estimating the aggregate WTP for Lake Mendota in Wisconsin (Stumborg, 2001).

A study on Chandernagore municipality in West Bengal, along the banks of the River Ganga which hosts a conventional sewage treatment plant (STP), estimates the local public's willingness to pay (WTP) for improvements in the capacity and technology of the sewage treatment plant. A cross sampling method was used the survey and a choice experiment was designed with the assumption that the observable utility function would follow a strictly additive form. The results for the Conditional logit Model (CLM) are reported that treated wastewater quantity and quality are significant factors in the choice of a wastewater treatment programme, and ceteris paribus, these two attributes increase the probability that a wastewater treatment programme is selected. To calculate the WTP a CLM with interactions is used . This model is used to calculate the value assigned by the household to each wastewater treatment programme attribute. On an average a household was willing to pay Rs 5.82 in monthly municipal taxes to ensure that the wastewater is treated with secondary treatment and the quality of the water discharged to the river is high (Birol and Das, 2010).

The profile generation performed in this paper has been inspired by two papers. A study by Ragu te al (2012) classifies the sample into six profiles (based on Millet or Non- millet farmers, Literate or Illiterate, and Organization participation or Non-Organization participation). The results reveal that the millet farmers and the non-millet farmers are willing to participate at higher compensation levels in the initial bid price offered, but they are still WTA a lower bid price than the initial compensation offered for both MPVs and LPVs (Most Preferred Variety and Least Preferred Variety Category). The results suggest that the contingent valuation method used here seems to be an appropriate tool with which to reveal

farmer participation decisions regarding a millet conservation programme. Another study by Das *et. al*. (2008) in West Bengal for solid waste management uses Choice Experiment Method. The results of this study reveal that even though there is significant heterogeneity within the population residents sampled exhibit significant WTP to ensure improvements in SWM services.

Though the CV method is used extensively the method has its weakness too. People face difficulty placing a monetary value on the ecosystem, mainly because of its many life sustaining functions, the discount rate, and the potential irreversibility of damages done to ecosystems. People also value the ecosystem for aesthetic reasons that are difficult to measure. Also, few influential members may dominate the focus group which may not provide with the correct results. Another difficulty is that every individual's WTP is according to his or her income. The difference between WTP and WTA needs to be examined in contingent valuation surveys. It is common that people will be WTP a much smaller amount to preserve an ecosystem, but they are WTA a much larger amount as compensation for damages to the ecosystem.

METHODOLGY AND DATA SOURCES

The study involved **a Contingent Valuation approach** interviewing the residents of the area, nature lovers and NGOs. In this project residents were directly asked their willing to pay to protect the Pallikaranai Marsh. Also Data on population and household statistics has been collected from the Chennai Corporation and Kancheepuram Corporation. The results reveal whether the residents are willing to pay a significant amount either through a membership fee, lump sum donations or through an addition in tax payment for the protection and up gradation of the Pallikaranai Marsh.

Attributes

The main attributes for the study are the following:

1. ***Flora Of The Marsh*** **-** The plant diversity of the Marsh is enriched by the presence of 2 species of grasses that are endemic to peninsular India, viz. Cynodon barberi and Iseilema anthephoroides. The Marsh is inhabited by about 102 varieties of trees, shrubs, herbs, grasses and sedges.

2. ***Fauna Of The Marsh*** **-** Close to about a 113 species of birds have been noticed in the Pallikaranai marsh, of which black – winged stilt, pheasant tailed jacana, purple moorhen, little grebe, open – billed stork, egrets and grey herons are resident birds, it also includes the rare visiting species of House Swift, Brahminy Kite, Magpie Robin, House sparrow, Red-whiskered Bulbul and the Eurasian Thick knee. The marsh also provides home to a large number of fishes, Crustaceans and Molluscans; Mammals like the spotted Deer, Leaf-nosed Bat, Bandicoot and house rat; and also reptiles and Amphibians. Also, there is an incredible spurt in flamingo numbers at Pallikaranai, reported from November 2012 to May 2013.

3. ***Waste Water Treatment*** **-** With most of the households in the neighbourhood letting their water waste into the marsh, it has been extremely polluted. The presence of the dump yard and the effluents from it also contributes to it. The southern portion of the Pallikaranai Marshland has already been notified as a Reserve land under the Tamil Nadu Forest Act, 1882. Waste water treatment must be considered very important as the polluted water contaminates the ground water, and also results as serious health issues to the people living in that region.

4. ***Tourism*** **-** With a lot of birds visiting the Marsh, people have taken interest, and Tourism is on the raise at Pallikaranai Marsh. Certain areas abutting the Pallikaranai marsh have been freed of human

intrusion (encroachments have been removed in parts of Ambedkar Nagar). But the facilities for Tourism like bird watching and resting has to be developed

5. ***Awareness*** **-** The awareness of the people in the locality about the Pallikaranai Marsh is low. The aim of this dissertation is to increase the level of awareness of the people.

Table 2 reports the status quo and future expected level of the attributes.

Table 2: Status-Quo Level and the Future Expected Level of the Attributes

	Attributes	**Status – quo**	**Alternative**
1	Flora	Low level	High level
2	Fauna	Low level	High level
3	Waste Water Treatment	Very little control	Total control
4	Tourism	Less facilities	More facilities
5	Awareness	Low	High

Sample

The total sample size was aimed at 200. The survey results provided with 213 observations (185- Residents in the locality, 20-Nature lovers and birdwatchers, 8-NGOs), and all 213 observations have been used in the study. A random sampling method has been adopted on account of large population in the region and unavailability of data based on income levels. A pilot survey of 8 people with a rough questionnaire was performed in October, 2013. The survey took place in the months of December and January, 2013 focusing on the residents around the Pallikaranai Marsh. The Survey methods included face to face interview, online questionnaire and Social networking sites.

Questionnaire

Before every survey the respondents were given a brief introduction about the Marsh, the history, its degradation and the renovation happening over the years.

The aspects captured in the survey were:

1. Household demographics
2. Economic status
3. Awareness variables
4. Services provided
5. Dependence factors
6. Conservation attitude
7. Economic Valuation

Household demographics included information on respondent's Gender, Age, Education level, Occupation, Marital Status and Number of Children. The economic status was captured by asking the respondents their expenditures and income slabs. The Awareness variable captured the awareness of the respondents with respect to the degradation of the Marsh, Renovations of the Marsh, Knowledge about plant and animal species etc. The next section questioned the Respondents on the services provided by the Marsh – like recreational benefits, aesthetic benefits and necessities – thereby assessing the Respondents dependence on the Marsh. The Respondents willingness to conserve the Marsh was captured in the fifth section. They were finally asked their WTP Rs.50/ Rs.75 or Rs.100 per month as they moved from Scenario to Scenario. The lower amount was fixed; the respondents were free to choose their highest contribution amount.

EMPIRICAL RESULTS

Social, Economic and Demographic Characteristics of the Sampled Households

The total sample of 213 households surveyed, constituted of 116 male and 97 female. The survey results reveal that on an average the households interviewed have been residents around the Pallikaranai Marsh for 11 years. Most of the residents in the locality are temporary

residents, and a majority of them being a resident less than 15 years. TABLE 3 reports the socio-economic characteristics of the households.

The average household head age is 46 years, and about 81 percent of the household heads have a university degree or above, while 19 percent of them have technical school education or less. Over 30 percent of the households have at least one child younger than 18 years of age. In more than half the surveyed households the household head works in service sector (52 percent) followed by being self-employed (20 percent), and 16 percent of the sample is students. Among the respondents, 50 percent and 32 percent had completed Under graduate and Post graduate level of education. Less that 20 percent of the sampled population have education below the Under graduate level. In analysis, the education has been categorized into 2 categories – Those with School Education, and those with University Education. The average household monthly expenditure is Rs. 32000, a large portion of it is spent on food, followed by dwelling, and education and entertainment.

Table 3: Social, Economic and Demographic Characteristics

Characteristic	Sample mean (std. dev)
Years in locality	11.31 (6.60)
Gender	0.54 (0.5)
Household size	2.82 (1.26)
Household head age	46.46 (12.77)
Monthly food expenditure (in Rs)	10671.65 (5639.94)
Monthly expenditure (in Rs)	32044.7 (21607.83)
Share of income spent on food	36.33 (17.61)
Number of children	0.77 (0.90)
	Percentage
Household has a child<18 years of age = 1, 0 otherwise	30
Education level of household head	
Household head completed technical school or less = 1, 0 otherwise	18.8
Household head has a university degree or above = 1, 0 otherwise	81.2
Occupation of the household head	
Employment in service sector = 1, 0 otherwise	51.6
Self-employed = 1, 0 otherwise	19.7
Pensioner = 1, 0 otherwise	6.6
Housewife = 1, 0 otherwise	6.1
Worker = 1, 0 otherwise	8.4
Student = 1,0 otherwise	16

Source: Pallikaranai marsh CVM survey (2013).

Awareness of Respondents

The awareness of the resident in the locality is very high, about 95 percent. A vast majority of the population feels that the Human settlement and the Dump yard is the major cause of degradation of the Marsh land (87 percent and 84 percent), it is mainly because of its very close presence and the spillover to the marsh(See Table 4). 62 percent of

the residents feel that the constructions of building, roads and bridges in the marsh area are the cause for the degradation, while 56 percent of the residents consider the sewage discharge to be a major cause. The respondents and the residents in the locality feel that the Pallikaranai marsh is an important element of natural ecosystem, and provides high recreational value and aesthetic value. Its importance for commercial purpose and a necessity is negligible.

Table 4: Awareness of Respondents

Characteristic	Percentage
Awareness of the residents	
Aware of the problems	95.3
Aware of renovations - by the Forest department	65.7
Aware of renovations - by the NGOs	62.9
Major cause of degradation according to the residents	
Dump yard	83.6
Human settlements	86.8
Construction	62.4
Sewage discharge	55.8
Importance of the Pallikaranai Marsh to the residents	
Recreational value	47.4
Heritage value	39.9
Necessity (bathing, washing, agriculture, etc.)	4.7
Aesthetic value	40.8
Value addition	19.2
Important element of natural ecosystem	93.8
Commercial purpose (fishing)	6.1

Source: Pallikaranai marsh CVM survey (2013).

Willingness To Pay

The respondents were presented with three hypothetical scenarios of the three attributes- water quality,range of recreational benefits and range of aesthetic benefits. A double-bounded dichotomous bid was adoptedTable 5 shows the change in the scenarios of the attributes.

The survey results show that in spite of high the awareness among the respondents only less than 50 percent of them were willing to pay. It was also noted that about 90 percent of the respondents who were willing to pay voted towards paying as a membership fee than as an addition in tax payments or as a lumpsum donation.

Table 5: Measurement of Attributes

Scenarios	Quality of Water	Recreational Benefits (includes Tourism)	Aesthetic benefits (includes Flora and Fauna)
Scenario A	Low	Low	Low
Scenario B	Moderate	Low	Low
Scenario C	High	Moderate	Moderate
Scenario D	High	High	High
Scenario A depicts the current scenario, and Scenarios B, C, D depicts the future expected scenarios.			

Source: Pallikaranai marsh CVM survey (2013).

RESULTS AND DISCUSSIONS

WTP Differences In The Survey

Of the 213 households,, 104 were willing to contribute for the Marsh to move from Scenario A to Scenario B, the average WTP was Rs.180. With the Average WTP of Rs.200, 96 people were willing to contribute to move from Scenario B to Scenario C. In the final stage, 78 people were willing to contribute to move from Scenario C to Scenario D with an Average WTP of Rs. 245. The Maximum WTP at each stage was Rs. 500, while the minimum WTP was Rs.50, Rs.75 and Rs.100 respectively.Table 6 reports the willingness to pay differences.

Table 6: Willing To Pay Differences

Scenario	Observations	Max	Min	Average
Scenario A to B	104	500	50	180.29
Scenario B to C	96	500	75	199.22
Scenario C to D	78	500	100	245.19

Source: Pallikaranai marsh CVM survey (2013).

Ordinary Least Squares Regression Model

A preliminary OLS regression was run which provides the following results - The more number of years the respondent has been residing in the locality the more is the Average WTP. Female respondents are more Willing to Pay than Male respondents. Older the Family head, lesser is the average Willing to Pay of the Respondents. When the respondent is more educated he is more willing to contribute towards the protection of the Marsh. A person with a higher income has a higher Average WTP. Larger the household size, the grater is the Average WTP. Food, Education & Entertainment expenditure has a significant positive relationship and the Health expenditure has a significant negative relationship. The OLS model had R-square value of 0.269, the main reason for such a low R – square value is due to the very low sample size from the huge population.Table7 reports the Ordinary least squareresults.

Table 7: OLS Results

VARIABLES	AVERAGE WTP
Years in locality	2.433* (-1.318)
Gender	-31.34* (-17.66)
Age of family head	-1.776** (-0.834)
Education – university	56.90** (-22.62)
Higher Income	14.16 (-25.62)
House hold size	16.46* (-8.392)
Food expenditure	0.00243 (-0.0016)
Education & entertainment expenditure	0.00504*** (-0.00083)
Health expenditure	-0.00285* (-0.0017)
Constant	22.4 (-48.58)
Observations R-squared	213 0.269

Source: Pallikaranai marsh CVM survey (2013).
Note: *- significant at 10 percent **- significant at 5 percent ***-significant at 1 percent

Heterogeneity of WTP Across Households

In order to estimate heterogeneity of WTP across households, six household profiles are generated.able 8 reports the heterogeneity across households

Based on income levels: Profile 1: poorer households whose income is less than or equal to 25 percent percentile; Profile 2: wealthier households whose income is more than or equal to 75 percent percentile.

Based on whether the households feels that the quality of the environment has improved or not : Profile 3: Agrees that quality of environment has improved; Profile 4: Disagrees that quality of environment has improved.

Based on the educational level of the respondent: Profile 5: Completed school level education; Profile 6: University level education

Table 8: Heterogeneity Across Households

	Years in locality	Age of family head	Respondent has completed university education	Employed	Household size
Profile 1	11.15	46.35	74.07 percent	0.63	2.91
Profile 2	11.06	46.78	92.59 percent	0.74	2.76
Profile 3	13.21	44.1	75.86 percent	0.72	2.52
Profile 4	11.03	46.82	81.08 percent	0.68	2.93
Profile 5	10.9	42.63	0 percent	0.65	2.63
Profile 6	11.39	47.34	100 percent	0.68	1.26

	Food expenditure	Education and entertainment expenditure	Health expenditure	Observations
Profile 1	6509.26	981.48	2498.15	54
Profile 2	15462.96	14972.22	5300.93	54
Profile 3	10017.24	3206.90	4696.55	29
Profile 4	11091.22	5406.08	4451.69	148
Profile 5	9150.00	2737.50	4372.50	40
Profile 6	11023.12	5792.49	4725.15	173

Source: Pallikaranai marsh CVM survey (2013).

The Profiles reveal that - The respondents of all profiles have lived in the locality for about 11 years. The age of the family head is close to 44 years in all the profiles. 92 percent and 74 percent of the richer and poorer households have completed university level

education showing a high level of education in the sample. 82 percent of those respondents who disagree that the quality of environment has improved is educated. 74 percent of the richer household respondents are employed, while only 63 percent of the poorer household respondents are employed. 68 percent of the respondents who disagree that the quality of environment has improved is employed, and 72 percent of those respondents who agree that the quality of environment has improved is employed.68 percent of the University educated respondents are employed while 65 percent of the School educated respondents are employed.

The average WTP are reported in Table 9.The WTPvaries from Rs.112.5 for those respondents who have completed school level education to Rs.232.5 for those respondents of the wealthier households.

Table 9: Average WTP for the Given Profiles

	Obser-vations	Max	Min	Average WTP
Profile 1 : poorer households	22	300	100	154.17 (-55.92)
Profile 2 : wealthier households	40	500	100	232.5 (-182.65)
Profile 3 : agrees quality improvement	16	500	100	227.08 (-167.76)
Profile 4 : disagrees quality improvement	73	500	50	175.4 (-140.02)
Profile 5 : completed school education	12	200	75	112.5 (-31.68)
Profile 6 : completed university education	92	500	50	203.31 (-159.78)

Source: Pallikaranai marsh CVM survey(2013).

Bivariate Probit Results

The Biprobit results are reported in Table 10. From Scenario B to C: More the number of years the respondents is residing in the locality higher is his WTP; Higher the education level of the respondent higher is

the WTP; When the respondent earns Higher income his WTP is high; Gender and Age of Family head does not show any significant relationship. And From Scenario C to D: The number of years residing in locality is insignificant; The education level of the respondent is insignificant; When the respondent is employed his WTP is less; Gender and Age of Family head does not show any significant relationship

Table 10: Bivariate Probit Results

VARIABLES	**Willing To Contribute To Shift From Scenario B To Scenario C**	**Willing To Contribute To Shift From Scenario C To Scenario D**
Years in locality	0.0217*	0.000594
	(-0.0152)	(-0.015)
Gender	-0.0711	-0.122
	(-0.184)	(-0.191)
Age of family head	-0.00487	-0.0042
	(-0.00884)	(-0.00879)
Education – university	0.587**	0.211
	(-0.25)	(-0.248)
Higher Income	0.318*	0.0743
	(-0.276)	(-0.277)
House hold size	0.0167**	0.0907*
	(-0.0863)	(-0.0865)
Food expenditure	5.61e-05***	4.65e-05**
	(-0.0000171)	(-0.0000182)
Education & entertainment expenditure	3.13e-05**	4.14e-05***
	(-0.0000133)	(-0.0000134)
Health expenditure	-4.10e-05**	-4.10e-05**
	(-0.0000189)	(-0.0000198)
Constant	-1.496***	-1.151**
	(-0.537)	(-0.532)
Observations	213	213

Source: Pallikaranai marsh CVM survey(2013).

Note: Standard errors in parentheses, *- significant at 10 percent **- significant at 5 percent ***-significant at 1 percent.

Cost Benefit Analysis

In order to perform a cost benefit analysis the costs and benefits have been assess. The Data of total number of Households in the Wards around the Pallikaranai Marsh has been collected from the Kanchipuram Municipality. The costs incurred/planned costs has been collected form the Forest Department, and the Benefits has been extrapolated from the Average WTP of the Respondents.

Costs

In order to take up ecological restoration and conservation of Pallikaranai wetlands, a scheme has been sanctioned, under State fund, at a cost of Rs.15.75 crores over a period of five years from 2011-2012 to 2015-2016. The Government has spent a sum of Rs.5.17 crore for carrying out the works during the year 2011-2012. During 2012-13, works like habitat improvement, protection, research and monitoring, publicity awareness etc. have been carried out at an outlay of Rs.5.00 crores. It was proposed to implement the scheme at an outlay of Rs.5.00 crores during 2013-2014

Benefits

Table 11: Total Benefits

Scenario	Total Observations	Observations exclusive for the present scenario	Percentage of people from the Sample	No. of Households in Pallikaranai
Scenario A to B	104	8	0.04	3403.94
Scenario B to C	96	18	0.08	7658.87
Scenario C to D	78	78	0.37	33188.45

Source: Pallikaranai marsh CVM survey(2013).

Scenario	Average (per month)	Yearly = Monthly * 12	Total Benefits = No.of households * Yearly WTP
Scenario A to B	**180.29**	2163.48	7364364.03
Scenario B to C	**199.22**	2390.64	18309608.72
Scenario C to D	**245.19**	2942.28	97649714.74
			123323687.5

Source: Pallikaranai marsh CVM survey(2013).
Note: *The total number of households in pallikaranai is 90630.

The project is expected to produce a net benefit of Rs. 12 crores, for which the planned costs are only Rs. 5 crores. This gives a Net Benefit of Rs.7 crores. This shows that, if feasible policies are made, the Government can use the funds from the local people for speedy renovation and improvement of the Marsh.

Table 12: Net Benefits

YEAR : 2013 – 14	
Benefits From Wtp	12,33,23,687.5
Planned Costs	5,00,00,000
Net Benefit = Benefit – Cost	**7,33,23,687.5**

Source: Pallikaranai marsh CVM survey (2013).

Respondents Non Willingness To Pay

Of the surveyed 213 people, 109 of them were not willing to contribute for the renovation and conservation of Marsh. Looking into the social, economic and demographic characteristics of the households not willing to pay, it reveals that these households' characteristics are similar to that of the rest.

Table 13: Social, Economic and Demographic Characteristics of Respondents Not Willing to Pay

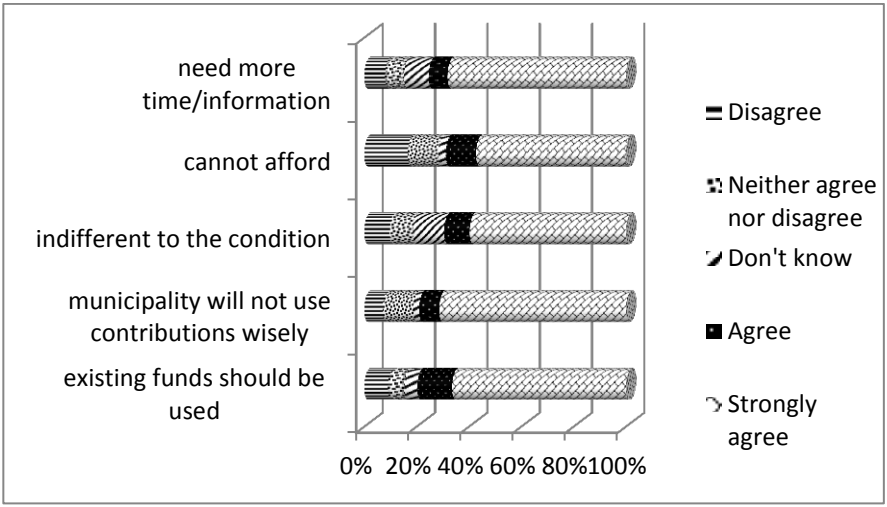
Characteristic	Sample Mean (std. dev)
Years in locality	10.95 (6.21)
Gender	0.59 (0.49)
Household size	2.76 (1.33)
Household head age	46.05 (13.03)
Monthly food expenditure (in Rs)	9206.42 (5663.89)
Monthly expenditure (in Rs)	26794.95 (15914.6)
Share of income spent on food	35.87 (17.42)
Number of children	0.76 (0.89)
	Percentage
Household has a child<18 years of age = 1, 0 otherwise	29
Education level of household head	
Household head completed technical school or less = 1, 0 otherwise	26
Household head has a university degree or above = 1, 0 otherwise	74
Occupation of the household head	
Employment in service sector = 1, 0 otherwise	53
Self-employed = 1, 0 otherwise	18
Pensioner = 1, 0 otherwise	8
Housewife = 1, 0 otherwise	6
Worker = 1, 0 otherwise	10
Student = 1,0 otherwise	14

Source: Pallikaranai marsh CVM survey (2013).

This brings out that the major reasons for them not willing to pay lies in their psychological factors. The following figure explains that the majority of people feel that the existing funds should be used efficiently, and that the municipality will not use the contributions wisely. The other

reasons being that the respondents need more time or information, they cannot afford and that they are indifferent to the condition. Figure 2 reports the reasons for not willing to pay.

Figure 2: Reasons for not Willing to Pay



Source: Pallikaranai marsh CVM survey (2013).

CONCLUSION

Conclusion and Policy Implications

This paper aims at residents' perception of restoring the Pallikaranai Marsh using the CVM.

In order to provide a convenient way for the respondents to assess the scenario, the attributes (According to Quality of Water, Recreational Benefits and Aesthetic benefits) were fixed at different Scenarios. The results reveal that the respondents' average WTP was Rs.180, Rs.200 and Rs.245 as they moved from one Scenario to another.

The influence of the variables Years in locality, Gender, Age of Family head, Household size, Education, Higher income and other expenditures has been assessed using the OLS method and Bivariate probit model. The heterogeneity across households has been capturing using six profiles, and their average WTP assessed as well. A Bivariate Probit regression is used to analyze the outcomes in two situations where the household is willing to move from Scenario B to C, and where the household is willing to move from Scenario C to D.

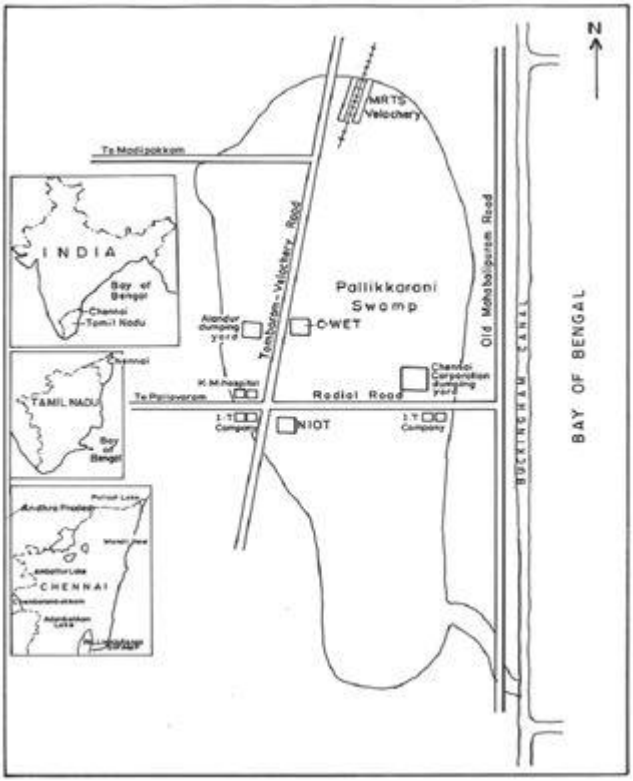
There are few drawbacks of the survey. First, a large majority of the sample were from the middle and high income group, thereby not providing adequate focus to the low income group. Second, the target was mainly the residents around the Pallikaranai marsh; those who care and work towards the conservation and renovation of the Marsh - Bird watchers, nature lovers and NGOs- formed only a small part of sample.

The residents in the locality of the Pallikaranai Marsh are aware of the problems faced by the Marsh. Over the past few years there have been conservation and renovation measures by the Government and the NGOs. In order to take up ecological restoration and conservation of the Marsh the government has sanctioned a State fund, at the cost of Rs.15.75 crores, over a period of five years from 2011-12 to 2015-16.

The possible policy measure is for the government to involve the people in the locality, and perform a community initiative in order to restore the Marsh. Collection of membership fees, taxes and lump sum donations seems a feasible measure only when the residents gain confidence with the Government. A compulsory tax can be levied, but it comes with its own drawbacks as well, the residents will never know if the taxes are being used efficiently! Therefore the best measure is to increase the awareness of the residents, and develop a sense of belongingness for them towards the Marsh. Though it is a psychological

factor, it could be achieved by performing camps educating them, nature walks, bird watching etc.

Figure 3: Encroachment on Pallikaranai Marsh



Source: Chandramohan *et. al.* (2009).

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