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Using the contingent valuation method to inform sustainable wetland management: the case of the Akrotiri wetland in Cyprus

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Abstract Wetlands are a crucial component of water resources, providing several ecological functions and services, including flood attenuation, groundwater recharge and water quality maintenance, as well as conservation of biodiversity and provision of recreational activities. In Cyprus, an arid country with scarce water resources, wetlands have been degraded and drained due to the increasing intensity of agricultural production, water pollution, dam construction and the failure of existing national policies to efficiently and effectively manage them. In this paper it is stated that in order to be able to design and implement efficient and effective policies for sustainable wetland management, both the use and the non-use values generated by their several services and functions need to be realized and captured. This paper employs a non-market valuation method, namely a contingent valuation survey, to estimate the economic benefits generated by the Akrotiri wetland in Cyprus. The paper proposes how the results of this survey can be employed to design and implement efficient and effective wetland conservation policies, as a part of integrated water resource management in Cyprus, as required by the European Union's Water Framework Directive.

Key words contingent valuation; non-use value; use value; wetland

INTRODUCTION AND MOTIVATION

A major component of water resources, wetlands are crucial to life-support functions, human health and the natural environment, and hence they are vital to the functioning of any economy in the world. Wetlands are amongst the Earth's most productive ecosystems, providing a diverse array of important ecological functions and services. These translate directly into economic functions and services such as flood protection, water supply, improved water quality, commercial and recreational fishing and hunting, and mitigation of global climate change (Barbier *et al.*, 1997; Woodward & Wui, 2001; Brouwer *et al*, 2003; Brander *et al.*, 2006). Therefore, wetlands are necessary inputs to production in economic sectors such as agriculture (arable and non-arable land, aquaculture, commercial fishing, and forestry), industry (e.g. power generation) and tourism, as well as to household consumption (UNEP, 2005).

Sustainable management of wetlands as a part of water resources is especially important in Cyprus, an arid country, which faces chronic water shortages (Koundouri, 2007). Similarly to the rest of the global wetlands (Barbier *et al*., 1997), wetlands in Cyprus were not sustainably managed in the last century as a result of lack of information on/or underestimation of, the economic values of many ecological functions they provide (Schuyt & Brander, 2004). The failure of the decision makers to capture the economic values of wetlands has led to their widespread degradation and depletion.

The aim of this paper is to contribute to the efficient and effective management of these wetlands, by estimating the economic value of the sustainable management of the Akrotiri wetland. A contingent valuation (CV) study is undertaken and the valuation (willingness to pay (WTP)) of 188 respondents of various wetland management scenarios is estimated. The results reveal that the public derives significant use and non-use values from sustainable management of this resource, and capturing of this value could aid the policy makers in their water resource allocation decisions in the near future.

The Akrotiri wetland

The case study in this paper is the Akrotiri wetland, located in the southernmost part of the country, in the Akrotiri peninsula, 5 km southwest of Limassol. It is an inland wetland, composed of a seasonal brackish lake and the surrounding saltwater and freshwater marshes, covering area of 25 km^2. Part of the wetland is located within the British sovereign bases. It is recognized as a wetland of national and international importance by the Ramsar Treaty, an important bird area by Birdlife International, and as a special protected area by the Barcelona Convention (Kailis, 2005).

The Akrotiri wetland is the largest inland aquatic system in Cyprus, providing habitat for important biodiversity riches. Moreover, Akrotiri lies on a major migratory route for birds travelling between northern Europe, Africa and Asia, functioning as a resting, wintering and breeding area. Consequently, 66% of all bird species recorded in Cyprus is found in Akrotiri. In total, 45 species included in the EC Birds Directive Annex I, have been recorded in Akrotiri (Demetropoulos, 2005).

The marsh is primarily used by the local communities for traditional methods of livestock grazing, which is beneficial for maintaining the semi-natural characteristics of these habitats, and also for controlling overgrowing of reeds, which are potentially harmful for biodiversity (Kuijken, 2004). Furthermore, the wetland provides areas for recreational and educational activities such as birdwatching and school trips.

The proximity of the wetland to an important urban centre, to military installations and its relation to outflows from the Akrotiri aquifer system, make it especially susceptible to various environmental problems, including decreased water inflow, pollution due to agriculture and pesticides, as well as illegal waste dumping (Ramsar, 2003; Demetropoulos, 2005; Kailis, 2005). It is now recognized that the survival of the wetland depends on the management of the water balance of the area (Demetropoulos, 2005). Water inflow is expected to further decrease due to the limitation of surface water flows from the ongoing construction of the radars in the British sovereign bases.

A Contingent Valuation study on the management of Akrotiri wetland

A CV study was implemented in 2005 to estimate the public's valuation of sustainable management of the Akrotiri wetland. Following Kontoleon & Swanson (2003) three wetland management scenarios were valued, where the respondent's valuation (i.e. total willingness to pay (WTP)) for each scenario was defined as the value of simultaneous change in the quantity (area and water level) and quality (levels of biodiversity and educational and recreational activities provided, as well as the construction of British radars at the wetland). This survey design, which is also known as scenario difference approach, enabled estimation of value of different components of the wetland.

The CV survey on Akrotiri wetland consisted of three parts. In the first section the respondents were identified between users and non-users. All respondents were then read a statement describing the wetland, its functions, and the major threats it is facing. The proposed payment vehicle was the creation of a "Fund for the Conservation of the Akrotiri Wetland", financed by a one-off income tax on all taxpayers, under the management of the EU, and regarded as a trustworthy international entity. Taxation was used to avoid free-riding, which may occur with voluntary contributions (Whitehead, 2006).

Based on focus group discussions and consultations with ecologists and hydrologists at the Ministry of Agriculture and Natural Resources, three wetland management scenarios were developed to be valued relative to a *status quo* scenario: (i) *Wetland management scenario A* (*status quo*): No management action will be undertaken, the area of the wetland and the water level will remain the same. Biodiversity and infrastructure for educational and recreational activities will remain the same. Quantity and quality of all of these wetland attributes will diminish within the next 5 years unless active management efforts are undertaken. The British radars will be constructed; (ii) *Wetland management scenario B*: 300 000 m^3 of water would be used to flood the wetland, which would cause an increase of 200 ha in wetland area, resulting in a 10% increase in biodiversity. The infrastructure for educational and recreational activities would remain the same and the British radars would be constructed; (iii) *Wetland management scenario C*: 900 000 m^3 of water would be used to flood the wetland, resulting in increase of 400 ha in the area, thereby increasing the biodiversity levels by 20%. In this scenario investment would be made to improve the infrastructure for educational and recreational activities, however the British radars would still be constructed; and (iv) *Wetland management scenario D*: 900 000 m^3 of water will be used to flood the wetland, and the construction of the British radars would stop, resulting in an increase in the wetland area of 500 ha. Consequently biodiversity levels would increase by 25%. In addition, in this scenario investment would be made to improve the infrastructure for educational and recreational activities.

The policy change that would facilitate movement from the *status quo*, i.e. Scenario A, to Scenarios B, C and D, would be using water diverted from either Kouris or Yermasoyia dams in order to flood parts of the wetland for a 90-day period each year (Jalon, 1992). Movements from the status quo to Scenarios B, C and D would reveal the public's WTP for different intensities of wetland management. An "advanced disclosure" approach was employed, where respondents were presented in advance with the three management and *status quo* scenarios (Kontoleon & Swanson, 2003).

To elicit WTP for moving from scenario A to B, A to C, and A to D in the case where the respondent is willing to participate, their maximum WTP was asked. Before stating their WTP, the respondents were reminded to take into account their income, expenses, and other payments they make for environmental goods and services and other substitute sites in Cyprus. Debriefing questions were asked to identify between protest responses and true zero values, and to investigate which components of value and motivations for wetland management were important for the respondents. The final section of the survey collected various socioeconomic data on the respondents, including age, educational level, employment and income. Additionally, information on the attitudes of the respondents for environmental issues were elicited through a series of questions on their purchase of organic produce, environmental publications, fair-trade and environmentally friendly products, and recycling, as well as any donations they make to environmental organisations. These were measured on a rating-scale ranging from zero (never) to 4 (always), and using these, an environmental consciousness index (ECI) was calculated.

Data collection took place during the summer of 2005 in the two major cities in Cyprus, Nicosia and Limassol, through personal interviews with people intercepted randomly in various central areas of the cities. In total, 188 individuals responded to the questionnaire. The sample is representative of the Cypriot population.

RESULTS

The WTP results are reported in Table 1. Several respondents stated zero WTP for each one of the wetland management scenarios. In order to differentiate true zero WTP values from protest responses, five follow-up questions in close-ended response format were asked (Federal Guidelines, 1983; Haab, 1999): two respondents had true zero values for each wetland management scenario and 11.2–14.9% respondents protested the wetland management scenario suggested to them. Previous analysis has revealed

Table 1 Percentage of respondents who have heard of, visited and WTP for the wetland, and mean and median WTP values (CYP).

Variable	Percentage
Heard of the wetland (%)	71.2
Visited the wetland (%)	29.2
WTP to move from scenario A to B (%)	87.2
WTP to move from scenario A to C (%)	88.8
WTP to move from scenario A to D (%)	85.1
	Mean (std.dev.)
Average number of visits	4.8 (14)
Mean WTP to move from scenario A to B	12.4 (13.6)
Median WTP to move from scenario A to B	6.5
Mean WTP to move from scenario A to C	14.8 (14.6)
Median WTP to move from scenario A to C	12.5
Mean WTP to move from scenario A to D	17.1 (17.2)
Median WTP to move from scenario A to D	12.5

Source: Akrotiri Wetland Management Survey, 2005.

Table 2 Value components of participants.

Reason stated	Value	"Agree" (%)
I care for the existence of the wetland	Existence	85.4
I might want to visit the wetland in the future	Option	85
I consider the wetland to be part of my cultural heritage	Cultural	83.2
I want the wetland to be available for future generations	Bequest	99.6
I enjoy giving for purposes like environmental conservation	Warm Glow	90.1
I want the wetland to be available for people who want to use it	Altruistic	98.1

Source: Akrotiri Wetland Management Survey, 2005.

Table 3 Differences for participation and WTP values for users and non-users of the wetland.

Variables	Non-Users Mean (std.dev.)	Users
Mean WTP to move from scenario A to B	11.5 (12.6) N = 118	14.7 (15.8) N = 46
Median WTP to move from scenario A to B	6	12.5
Mean WTP to move from scenario A to C	14 (14) N = 120	16.6 (16.2) N = 47
Median WTP to move from scenario A to C	12.5	12.5
Mean WTP to move from scenario A to D	16.9 (17.7) N = 114	17.6 (16.1) N = 48
Median WTP to move from scenario A to D	12.5	12.5

Source: Akrotiri Wetland Management Survey, 2005.

that protesters have significantly lower incomes and ECI levels, and are less likely to have children, university degrees and visit the wetland compared to those who are WTP for the wetland management scenarios (Birol *et al*., forthcoming).

The respondents' mean and median WTP increases with increasing wetland management. The public is WTP CYP 12.4 to flood the wetland and keep water levels and wetland areas high, which will increase the biodiversity level by 10%. They are WTP a further CYP2.4 for a further 10% increase in biodiversity levels and improvement in the infrastructure for recreational and educational activities. Finally they are WTP an additional CYP2.3 in order to have the construction of the British radars stopped and biodiversity levels to increase by a further 5%.

Table 2 reports the reasons why participants stated positive WTP values for wetland management scenarios, across the three scenarios. Of all participants, 83–99.6% agree with the components of non-use values. The most important value components were those related to bequest and altruistic values.

It is hypothesised that the users' and non-users' WTP for wetland management and for components of wetland management would differ. Consequently, the valuation of these two groups of the three management scenarios was investigated (Table 3). The results reveal that although compared to non-users, users are WTP higher values for each one of the wetland management scenarios; the differences are not statistically significant. Moreover, investigation of the social and economic characteristics and environmental attitudes of the users and non-users of the wetlands reveal that these two groups are similar in terms of ECI and percentage that is employed. However, they

differ in terms of having a child and distance to the wetland, where those respondents with children and those that live closer to the wetland are more likely to be the users of this resource.

Finally, the relationship between the WTP for wetland management scenarios and scenario attributes was further examined by estimating a stacked regression model. An ordinary least squares (OLS) regression was run, where logarithmic form of WTP was specified to be a function of change in biodiversity, provision of infrastructure for recreational and education purposes, and construction of the radars, as well as of other respondent-specific social and economic, as well as attitudinal characteristics including ECI, employment status, number of children and having visited the wetland. The results are reported in Table 4, and they reveal that the respondents are WTP more for increases in the level of biodiversity and infrastructure for recreational and educational purposes provided by the management scenario, and decrease if the British radars are constructed (i.e. the respondents are WTP for the radars not to be constructed). Respondents that have higher ECI (which is correlated with education level) and employment (correlated with income level) are WTP more for wetland management scenarios. Moreover, the respondents' WTP increases in the number of children they have, as expected, revealing the "bequest values" that respondents have over conservation of the environment for their future heirs to enjoy (Krutilla, 1967; Kosz, 1996). Respondents that are further away from the wetland are WTP less for the wetland management scenarios, exhibiting a "decay factor" (Bateman *et al.*, 1995). Finally, the number of visits to the wetland is positively and significantly correlated with the respondents' WTP. Given that almost 70% of the respondents who have visited the wetland at least once have been there for recreation and similar purposes, this result reveals use values of the wetland are substantial. In order to investigate whether users and non-users have different preference structures the stacked regression was run separately for users and non-users.

Log-likelihood ratio tests reveal that the valuation of users and non-users cannot be pooled at 0.5% significance level. Consequently, users and non-users have different

Table 4 Ordinary Least Squares Regression on determinants of WTP for wetland management.

Variable	Pool Coefficient (Std. Err.)	Users	Non–users
Constant	2.01***(0.12)	0.78*** (0.11)	2.1*** (0.12)
Biodiversity	0.72*** (0.18)	0.40*** (0.16)	0.89*** (0.18)
Education & recreation	0.17** (0.09)	0.18** (0.09)	0.16** (0.1)
Radar construction	–0.13* (0.08)	–0.07 (0.07)	–0.15** (0.08)
ECI	0.001** (0.0003)	–0.0002 (0.0002)	0.002*** (0.0004)
No. of Children	0.037* (0.028)	0.18*** (0.03)	–0.05*(0.03)
Employment	0.2*** (0.07)	0.32*** (0.07)	0.15** (0.07)
Distance	–0.001*** (0.0003)	–0.0008*** (0.0001)	–0.0007** (0.0003)
No. of visits	0.0005**(0.0002)	0.0005*** (0.0002)	–
Sample size	491	139	352
Log likelihood	–1060.35	–357.83	–908.15
R–squared	0.999	0.999	0.999
Prob >chi2	0.0000	0.0000	0.0000

Source: Akrotiri Wetland Management Survey, 2005. *** 1% significance level, ** 5% significance level, *10% significance level with two-tailed tests.

determinants of value. Users' WTP for wetland management scenarios is not significantly affected by the construction of radar, whereas non-users are WTP higher for the scenarios that stops radars from being constructed. Social and economic and environmental attitudinal characteristics that affect WTP also differ between two groups. Users' valuation is not significantly affected by their ECI, whereas for non-users WTP increases with ECI. Users' WTP increases in the number of children, probably because the users enjoy the recreational and educational aspects of the wetlands with their children, whereas the opposite is true for non-users, possibly due to budget constraints.

POLICY IMPLICATIONS AND CONCLUSIONS

In this paper, an environmental valuation method, namely a contingent valuation study is undertaken to estimate the economic value of the Akrotiri wetland, which is the most important wetland in Cyprus. The results of this contingent valuation case study indicate that the public, both users and non-users of the resource, derive positive and significant economic values from sustainable management of the Akrotiri wetland. The estimations reveal that impacts of the social, demographic and economic characteristics of respondents on their contribution and valuation conform to economic theory. The results reveal that, overall, the public values increase in the quantity of water in the wetland in the wetland area as high as CYP14.7 for users and CYP11.5 for non-users, and they derive additional value from increases in the level of biodiversity provided by the wetland, improvements in infrastructure for recreational and education activities in the wetland and the removal of the British radars. The estimated economic values can provide the policy makers with the necessary economic information for the construction of sustainable and efficient management strategies for Akrotiri wetland. Finally, this case study provides implications for other similar wetlands in Cyprus such as the Larnaca Salt Lake, given the current mandate for wetland conservation under the EU's WFD and the obligations of the Ramsar Conventions.

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