Significance of Placing a Value on Wetland Conservation to uphold Quality of Life in Sri Lanka

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Abstract: *Sri Lanka on the whole is one vast wetland. Besides being endowed with nature's bounties in abundance and a rich cultural heritage, it has been rated among the 'highest hot spots' in the world. Sri Lanka's Maduganga Estuary has been recently designated as the country's third Ramsar site, wetland of international importance. In spite of wetland contributes to the economic up liftment of small scale fisher folk, it also provides wide range of services. However rapid urbanization, industrialization, and incautious land reclamation have taken their toll on the coastal environments as well. To counter these negative impacts, the concept of sustainable developments which seeks economic developments or growth patterns that cause the least harm to the environment came into being in the twentieth century as new socio economic paradigm. A more radical view is taken by ecological economists who insist on capitalization of natural and environmental resources as a solution to the problem. In this paper an attempt is made to develop some insight into the value of ecosystem services using contingent valuation method when critical threshold s are crossed as a result of the continuance of economic activities. It is the Muthurajawela marsh, once considered, as one of the best wet lands in Asia was considered for the study. The contingent valuation (CV) method was carried out to systematically evaluate the conservation value of coastal wet lands in Muthurajawela Marsh. The study initiated in Sri Lanka showed that the estimated average value of the individual's Willingness to pay (WTP) for conservation of wet lands under the open – ended format was Rs 100.00 per month per house hold. Using the OOHB bid function , an expected WTP value of Rs 264.27 was obtained. Assuming the total household number in the district under investigation (500,000) this would indicate gross figure of Rs. 50,000,000 - 132,135,000)per calendar month to affect conservation of wetlands. The WTP values could also be considered as an economic tool when policy makers compare the development with conservation of wetland.*

Introduction

An estimated fifty percent of the world's wet lands, ranging from fast disappearing vast mangrove swamps in East Asia to the environmentally challenged Jamaica Bay marshes in the heart of New York have disappeared in the past 100 years (James 2004). Many of those that remains have been fragmented with dams, sluices and canals. Mostly the wetlands have receded under the pressure from growing population and cities. But sometimes they have been deliberately eradicated as in Iraq where the former regime drained most of the vast extent of marshlands that stood between the Euphrates and Tigris river since the dawn of history and turned much its population into refugees. The cultural significance of wetlands has been neglected factor considered in the global perspective. The most serious problem confronting the world is the swift environmental degradation of both natural and cultural environment. In this context the importance of our cultural heritage with regards to wetland cannot be over emphasized. Wet lands which include rivers, lakes, marshes, estuaries, lagoons, mangroves, sea grass beds and peat lands are among the most precious natural resources on earth. These highly varied ecosystems are natural areas where water accumulates for at least a part of the year. Wetland supports high level of biological diversity. Coastal wetlands which include estuaries, sea grass beds, and mangroves are among the most productive. Other wetlands also provide sanctuaries to a wide variety of plants, invertebrates, fishes, amphibians, reptiles and mammals, as wells to millions of migratory and sedentary water birds. Wetlands are not only sites of exceptional biodiversity they are also sites of enormous social and economic value in both traditional and contemporary societies. Since ancient time, people have lived along watercourses, benefiting from the wide range of goods and services available from wet lands. Sri Lanka on the whole is one vast wet land (Fig. 1), (Wickramage 2002).

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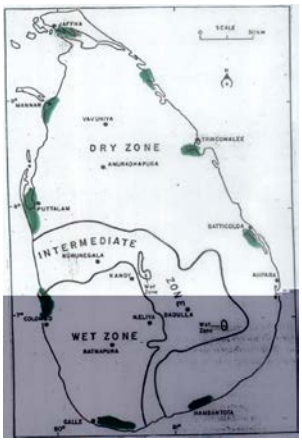

Fig.1 Distribution wetlands in Sri Lanka

Besides being endowed with nature's bounties in abundance and a rich cultural heritage, it has been rated among the 'highest hot spots' in the world. Sri Lanka's Maduganga Estuary has been recently designated as the country's third Ramsar site, wetland of international importance. The first is the Bundala National park declared a Ramsar site in 1990 and the Annaiwilundawa Tanks Sanctuary as the second declared in 2001.

However free access to common biological property resources can lead to excessive exploitation and even extinction of species. Rapid urbanization, industrialization, and incautious land reclamation have taken their toll on the coastal environments as well. To counter these negative impacts, the concept of sustainable developments which seeks economic developments or growth patterns that cause the least harm to the environment came into being in the twentieth century as new socio economic paradigm. A more radical view is taken by ecological economists who insist on capitalization of natural and environmental resources as a solution to the problem.

From this perspective, a new paradigm is being advocated that places priority on the environment on the economic growth in considering any social stability. Thus the new paradigm is based on the green accounting system rooted in society and reflecting the regime of environmental quality improvement exercised by all economic development activities. In this new system there is a method to establish monetary values for non- market resources. The valuation of natural environmental resources has been based primarily on welfare economics even though many natural resource economists have been trying to develop theories and techniques for the valuation of the environment. In this paper an attempt is made to develop some insight into the value of ecosystem services using contingent valuation method when critical threshold s are crossed as a result of the continuance of economic activities.

Importance of eco system services

Ecosystem services operate in intricate and little explored ways that would be very difficult to substitute for using technology (Tailor 1983). Consequently, the most critical factor in sustainability is likely to be of environmental resources in the production ecosystem services or for ecosystem services in their provision system stability is likely to be the maintenance of adequate stocks of environmental resources to ensure an adequate flow of ecosystem services. It is said that natural ecosystems help to support society. For example, the annual floods of the Nile River replenish the productivity of the Nile flood plain soils and also provide the basis for an agricultural system that dates back several thousand years. The construction of Aswan Dam has ended this annual floods and it has trapped the important sediments upstream of the dam thereby impoverishing Egyptian agriculture and leading to massive migration into Cairo with all problems associated with urban poverty and unemployment. Land use decisions in the mid states of United States of America have led to the loss of flood protection services provided by upstream wetlands. This loss has been considered to be major factor in the recent intensive flooding of the Mississippi river and its tributaries. In particular the underlying systems are complex and adaptive these problems may be difficult than is commonly understood. Specifically the problem of loss ecosystem services is likely to be

complicated by phenomena for which small changes in economic activities such as a mall change in either the level of pollution or pattern of land use lead to large changes in the pertinent environmental systems (Batabyal 2001). The problem green house gas is an another example of non-marginal responses. These emissions have been responsible for causing(or at least intensifying)the cyclic EL Nino and the La Nina climatic fluctuations that have profound implications for social welfare. Here again marginal increases in carbon dioxide emissions lead to marginal increases in global temperature but eventually a threshold is crossed and this leads directly to massive warming in the area of the Pacific Ocean and to the destabilizing phenomena associated with El Nino and La Nina.

Pahalawattarachchi (1997) in Sri Lanka has reported that decayed debris with desirable c/n ratios, fallen from mangrove are source of food for fish in brackish and sea water. Mangrove provides enormous amount of economic and ecological benefits to its surrounding and people around. Cuttle fish (*Gleoxina coaxans*) are living freely and are economically valuable. Mangrove environment is a breeding ground for crabs, prawn and different species of fish (Fig.2).

Fig.2 Mangrove environment for habitat

This wet land plays an important role in the life cycles numerous of fish species and prawns which migrate from the ocean to lagoon to breed and feed. Young fish and prawns find shelter in the lagoon in between the root systems of the mangroves until they are ready to migrate to the open sea. This situation contributes to the economic up liftment of small scale fisher folk. Mitigation of floods, protection from storms/prevention of coastal erosion, breeding habitats of edible fish etc are some ecological and economical dimension of biodiversity use (Fig.3).

Fig. 3. Soil erosion

They filter and clean water ,holding back soil and silt that would otherwise destroy the reef. At the same time, reefs break waves which would otherwise damage shore lines and mangroveseedlings. Mangrove environment also enables to develop eco-tourism.

Traditional Knowledge systems

Mangrove wood is used for wood but fisher folk also use them to construct their fishing equipment (canoe). Twigs and branches of mangrove are used as brush file to harvest fish. Mangrove derived pole and posts are used for the construction of fish traps such as Jakotu (fish kraals) and Cirrahavalei. Tanic chemical extracted from the bark of mangrove is used to stain the fishing nets. Roots of mangrove species is used to manufacture cork lid. The milky sap of the *Excocaria agallocha* is toxic and may cause blindness but traditional people believe that the sap is a cure for leprosy. The scientists currently are investigating the sap in search of new AIDS medicine.

Status of biodiversity

Although there are 55 species of mangroves recorded world wide, it is reported 21 species and 16 mangrove associated species are scattered throughout the island (Abewickrama . 1964). But later it was reported that

Muthurajewela, (Fig.4) wet land sanctuary harbours 190 species belonging to 65 families with one endemic species, three nationally threatened species and eleven alien invasive species. Also there are 209 fauna varieties with seventeen endemic varieties and twenty six nationally threatened varieties. Due to the ecological and biological importance of the wet land sanctuary, it was recently named a "protected wet land of the world''. Seven major vegetation, Marsh, Lentic flora ,Shrub land, Reed swamp, Grass land, stream bank make up the flora diversity of Muthurajawela. " Fishing tiger " is another rare species living in Muthurajawela. Mangroves and lentic are the most important environment in the marshy land providing habitats for the migratory birds (World conservation unit 2000).

Fig.4 Muthurajawela Marsh

Rhizophora mucronata, and *Rhizophora apiculata* are abundantly found in brackish water in Sri Lanka. *Sonneratia alba* and *Bruguiera gymnoriza* are widely seen in fresh water. Species like *Excocarica agallocha* and *Rhizophora anamalae* are also thriving among the mangrove forest and also believed to possess medicinal properties. There are several unidentified mangrove species thriving in the mangrove forest. An unusual species of Rhizophora was recently identified and classified as *Rhizophora anamalae* Fernando.2003)

Eco system assessment: A biophysical approach

Problems of scale in ecosystem assessment

It is a major issue in biophysical assessment. The genetic variation within the species is analyzed based on geographically separated populations and among individuals within single populations. Kadekodi (2003) has reported that tigers live in the mangrove forest of Sundarbans, the terai grass lands of Dudhwa, dry and moist deciduous forests of central India, the rainforests of western Ghats and the North East and in many other habitats. All these tigers belong to the same sub species. Each population of tiger has its unique set of adaptations developed as a result of their interactions with the local environments over many generations. It is vital to recognize the diversity of this adaptations which are only represented in local population of the species. On a wider scale, the variations in the biological communities in which these species live, the ecosystem these communities exists and interactions that take place among these are matters of scales. Just as in pure economic systems different scale effects emerging from the dynamics of ecosystems (Tab.1).

The fact that the eco- system and economic services or products have quit different temporal scales makes the integration of the two somewhat difficult. Sufficient scientific knowledge about the time rate of complementarities and substitutability of different species and ecological entities over different temporal scales are lacking. For instance there is no sufficient information about the interactions and dynamics of bird life and insect life in an eco system such as Nalbari Island in Chilika lake. He also points out that it may be possible to generalize large scale effects of economic system changes from micro level changes by linear aggregation of functions and services. But the same cannot be said about aggregation of ecological systems. Further more, large scale economic operation (with economies of scale) may affect eco system differently as compared to a sum of a large number of small scale operations. Returning back to the example of Chilika Lake what a group of 100 fisherman societies or communities

can do individually with traditional prawn culture, a large scale mechanized fishing of prawn culture can un do the same to the lake ecology. This may not happen in one operation but over a time scale. This shows how difficult it is to assess eco systems.

Table 1. Different scale effects of ecosystem dynamics

Temporal	Examples of ecosystem changes	Geographical	Political	Socio economic
present	Microbes, fuel wood supply, refugium	Farm , water shed	Agreement among neighbors, local communities	subsistence
Agricultural cycle	Soil retention, food production, water and nutrient regulation, pollination	Forest, wild life reserve, grassland	Local panchayats	Local market
Political term	Basin diversion, river linking	Eco region river basin	State government	State dev. Fund/ investment, cultural shift
Timber cycle	Carbon sesquestration, genetic resources, soil formation	nation	National government	National policies: Ex./Imports, tourism, recreation, extraction
Generation	Climate change	continent	International agency	Int. markets, piritu. scientific

Assessment of ecosystem services

As much as assessment of eco- system as stock is complex, so also are the services from them.. Magurran (1988) classifies eco system services by certain ecological criteria. They are such goods and services which are shared within the ecosystem itself, shared between other systems, goods and services of biotic and a biotic origin and by ecological hierarchy. Species services internal to the ecosystem are many. Supply of food (e.g fish) propagation (e.g. birds and bats pollinate cultivated species), dispersal of seeds (e.g. by birds), colour ful display and aesthetic beauty (e.g. peacocks), adventures (e.g. presence of wolves, lions, and snakes) etc are some examples. In all these cases the concept to examine are regulation of intrinsic rates, direct and indirect interaction with other species, density dependent versus independent mechanism of population regulation, and resource limitation. Eco system services also include regulation of exogenous chemical or physical inputs. Examples are nitrogen cycle, carbon cycle, nutritional cycle etc. Here again obtaining a reliable answers from the issue of valuation of all such eco system services is not possible. Also main stream economics is grossly inadequate to handle many of the issues listed above. For instance marginal cost of extinguishing one specie cannot be equated to that gains from saving it. It is difficult to understand how the depletion of particular species or sequence of their deletion would affect particular ecosystems or how the dynamics of those altered ecosystem would impinge on the economy now or in the future. In other word option value of biodiversity in relation to ecosystem function is potentially very large when it comes to ecosystem functions, the status of the use values and option values are quite distinct. Daal. (1984) has reported the declining status of the Chilika lake in India which very large brackish water lake with a drainage of basin of over four thousand three hundred square kilometers. The estimated lower bound value of biodiversity losses of this lake is as 30 million US dollars. Some of the most recent ecological and economic assessment of biophysical economic characteristics of the lake is presented in table 2.

Table.2 ecological and economic parameters of Chilika lake

Variable	Units	1986 - 87	1996 - 97
Weed area	Sq.km	395	500
Water area	Sq.km	790 - 805	
Forest	Sq.km	180	203
Degraded plantation	Sq.km	20	212
Agricultural land	Sq.km	700	1112
Lake depth	M	1.35	1.4
Salinity	Ppt	7.02	3.60
Silt area	Sq.km	-	46
Aquaculture (Fish & Shrimp)	Mt	8230-	2560
population	No	91860	115780
Agricultural income	Rs/hh	-	12340
Population density	No/sq.km	2.34	3.1
Prices	Rs/kg	Fish 20 Prawn 200	36 500

But the biophysical assessment of such a major wetland is totally incomplete on many scores. Some of the major indicators that are absolutely necessary for developing any good physical assessment (economic assessment and valuation)are lake bottom characteristics , lake temperature, wind velocity and directions defined at different spots, salinity variations over time and space within the lake and so on. As one realizes, all these are to be obtained in a time and apace domain.

Contingent valuation

In general, economics has two rather different means of enhancing the understanding of environment and natural resource problems. Positive economics is useful in describing actions of people and impact of those actions on the environment. Normative economics , often referred to as a welfare economics can provide guidance on how optimal service flows can be defined and achieved. Cost benefit analysis (CBA), the applied side of modern welfare economics, tries to find ways to place a monetary value on the gains and losses to those affected by a change in the level of provision of a public good. A major issue in environmental CBA is to how to conceptualize and estimate the total value of wetland conservation in a consistent and usable manner. The contingent valuation (CV) method is consistent with the sovereignty assumption and is unique among benefit measurement techniques in its ability to obtain detailed distributional information.

Objectives

1. To address the issue of valuing non marketable resources(Natural resources and such as wet lands and forests).
2. To resolve the controversial issue - conflicts arising between wetland conversion for development and conservation.
3. To develop an empirical technique based on the under lying economic theory to measure the total economic value of wet lands using welfare changes associated with the conservation of wet lands.
4. To translate theoretical concepts and definitions into operational techniques to other urban and coastal wetland areas
5. To develop a method for estimating the non use (passive use) value of wet land resources and to identify the benefit transfer opportunities of the findings of the study and generic lessons for other coastal wetlands in the country.

Methodology

It is the Muthurajawela marsh, once considered, as one of the best wet lands in Asia. This is located in the Western coast of Sri Lanka and lies between latitudes 70 06'N - 70 12N and longitudes 790 49' E - 790 53' E. A study that applied the CV method was carried out to systematically evaluate the conservation value of coastal wet lands in Muthurajawela Marsh and Negombo lagoon(MMNL) area in Sri Lanka. Here willingness to pay (WTP) by the surveyed population was explored. Two methods were used in this study to estimate the WTP values. The open ended method and one and a half bound (OOHB) format. Steps were also taken to educate general public on traditional values attributed to wet lands by forefathers and to project and protect these values. In connection with the above, a soft launching of a publication " Guide to Bundala, Sri Lanka's first Ramsar site prepared by the IUCN with the department of Wild Life Conservation .was carried out.

Results and Discussion

The study initiated in Sri Lanka showed that the estimated average value of the individual WTP for conservation of wet lands under the open –ended format was Rs 100.00 per month per house hold. Using the OOHB bid function , an expected WTP value of Rs 264.27 was obtained. Assuming that the true WTP is bounded by these figures (Rs 100.00 – Rs 264.27) and using the total household number in the district under investigation (500,000) this would indicate gross figure of Rs. 50,000,000 - 132,135,000)per calendar month to affect conservation of wetlands. This does not include the broader surrounding districts which might have an interest in conservation of the MMNL wetlands. It was also possible to develop a method to separate total economic value use and non use value. The total WTP was divided into use (direct , indirect and optional)and non use values(bequest value- knowledge that will benefit from the wet land and existence value which occurs due to mere existence of the wet land). Accordingly the aggregated preference for the use value is 0.552 and the non use value is0.448in conservation of wet lands in the MMNL area. Similar studies had been initiated by different researchers in other parts of the world showing the importance o f ecosystems. Costanza et al (1998) have attempted to work out eco system services on per biome basis and arrived at the average annual value of these services to be of the order of US$ 33 trillion (approx. twice the GDP of the world). To this in the same year Alexander et al (1998) arrived at what they call the "worthy" ecological services as a maximum value of US$ 1.8 To 16.3 trillion based on the assumption that only paid out services are accountable, non use and non market values are excluded and subsistence wages of the world subtracted (as equivalent to the minimum services to be rendered by the ecosystem) This value is considered some what similar to the monopoly of or Ricardian rent .

Conclusion

The investigation demonstrated the feasibility of initiating empirical explorations to define the population's willingness to pay (WTP) for conservation of wetlands. The WTP values could also be considered as an economic tool when policy makers compare the development with conservation of wetland. This technique could be extended to study other wet lands located else where. Development paths that consume environmental resources intensively are likely to be unsustainable and development paths that conserve key environmental resources are likely to be sustainable.

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