Economic valuation of wetlands: acknowledging values and services

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K E Y W O R D S

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A B S T R A C T

The studies on ecosystem valuation carried out under Indus for All Programme during 2007 and 2008 are reported in this paper. Five ecosystems were valuated for direct-use value (DUV), non-use value (NUV) and indirect-use value (IUV), thereby providing a total economic value (TEV). The habitats were deltaic ecosystem, rangelands**,** freshwater, forests and agriculture. In this paper, valuation of wetlands was focused and was briefly compared with the values of other ecosystems. The role of wetland valuation as a conservation tool was analysed to shape national policies of freshwater and/or wetlands management. It is concluded that such tools are very useful in the conservation of critical ecosystems as long as the information is disseminated to a wide audience.

Introduction

The term "valuation" refers to the assignment of monetary values to flows of services provided by ecosystems such as lakes and forests. In Pakistan, publishable quality valuation studies focusing on the monetization of environmental services were first produced by individual academics. A study carried out less than a decade ago, placed a Rupee value on the flow of recreational services associated with stands of forests at the Margalla Hills National Park (Khan, 2004). While the study provided results in a policy relevant format, the audience for the study was probably restricted to the Capital Development Authority, Islamabad. By contrast, a study carried out by the World Bank a few years later inspired much interest among federal-level planners and policy makers, primarily in the Planning Commission, the then Ministry of Environment, and the Finance Ministry (World Bank, 2006). This study estimated that the cost of environmental degradation in Pakistan is Pak Rs. 1.7 billion per day or USD 18.8 million (inflation adjusted May 2012 values), a figure based on service flows from rangeland and forest ecosystems together with soil salinity, soil erosion, water, urban air, and airborne lead and indoor air pollution. Most recently, only in the last four years, WWF – Pakistan, applied valuation methods to rangelands, and forest ecosystems again, but added values for three other ecosystems, namely coastal, agricultural and freshwater ecosystems (WWF, 2008). One of its goals was to set a standard for future studies applying methods to primary data, since the World Bank study neither collected field data nor applied standard valuation methods to such data, basing itself instead on secondary data. However, WWF - Pakistan's primary goal is to truly engage planners, development practitioners, and policy makers in the commissioning, oversight and application of valuation studies and their results. Accordingly, WWF - Pakistan prepared national guidelines on valuation focusing on the forest sector (WWF, 2010) and produced a number of additional policy, academic (Dehlavi and Adil, 2010), and best practices studies on ecosystem valuation and green accounting. The term "green accounting" refers to aggregate indicators that would assist environment, economic and natural resource ministries to determine how much depreciation spending to set aside year on year to replenish forests, rangelands, freshwater, and other kinds of natural capital stock after their use to fuel economic growth. For example, this refers to the amount of money to set aside to pay for afforestation and reforestation after harvesting of timber for commercial use.

This paper largely focuses on WWF - Pakistan's findings and their potential uses, also providing an accessible introduction to ecosystem valuation. In order to distinguish itself from a standard textbook introduction to economic valuation for environmental assets, Pakistan specific examples of wetlands and conservation planning are used to explain and illustrate valuation in practice. Further, also to provide a unique and applied exposition of wetlands valuation, WWF - Pakistan's practitioners who themselves implemented the first six years of a 50-year Vision of the Indus Ecoregion and who also carried out the valuation studies share here their aspirations and on-the-ground experiences. One aspiration is that ecosystem valuation becomes a redundant scientific exercise by 2060 or thereabouts in Pakistan, inasmuch as its methodology eventually becomes subsumed in standard resource accounting software; and, that its Pak. Rs. time-series data results (collected annually or at any periodicity necessitated or permitted by cost considerations and technology) become as commonplace to government statisticians as Pak. Rs. gross domestic product data. At this future date monetary, fiscal, and other policies that today help control the extent of unspent money that may be allocated for wear and tear of man-made capital such as factories, buildings, and roads, will consider generating savings to replenish natural capital stocks that fuel Pakistan's economic growth.

The habitat studied

Five ecosystems where selected for the evaluation studies. These are as follows:

Deltaic ecosystem: This encompasses the tail end of the Indus River some 200 km south of Hyderabad down to the system of creeks that run into the Arabian Sea, covering 41,440 km^2 of estuarine, mangrove and inter-tidal habitats. The mangroves in the delta are some of the most productive but critically threatened habitats in the Indus Delta.

Freshwater: Sindh has some of the most unique and ecologically important freshwater habitats in Pakistan. Ranging from the largest freshwater lakes e.g. Manchar Lake and Keenjhar Lake to the wetlands complex on the edge of Achro desert, freshwater wetlands are important to the environmental services and economics of the country and especially Sindh.

*Rangelands***:** Rangelands make up approximately 78,000 km^2 of land in Sindh. Rangelands support some of the most productive habitats occurring in arid zones, grazing lands (in irrigated areas) and mountainous regions. Rangelands are the source of livelihood for thousands of herdsmen and pastoral communities across the country. They are also a very good source of medicinal plants. For

this study, Chotiari Reservoir and wetlands complex was selected.

Forests: Forests comprise of several habitats such as riverine, irrigated plantation and mangroves. Rangelands are also considered as part of the forest management system. In Sindh, riverine forests were once widespread and played important ecological services as part of the Indus River Basin. Currently riverine forests in Sindh are confined only to patches, primarily due to the reduction in inundation as a result of construction of barrages and reservoirs upstream in the River Indus.

Agriculture: Thousands of hectares of land have been converted to agricultural land in the region. Currently, approximately 40% of land use in Sindh is agriculture. Agricultural practices in the region go back to thousands of years. Once fertile land, poor land and water management resulting into salinity and water logging, coupled with scarcity of water has rendered much of the land uncultivable.

The following discusses wetlands ecosystems and the results of valuation work undertaken by WWF - Pakistan between 2007 and 2010.

Priority wetlands

In many instances, valuable flows of services emerge from environmental assets – e.g., forests, freshwater lakes and air quality – but are not counted in billions of rupees, either on a case by case basis or for Pakistan as a whole. Let us take Pakistan's largest freshwater lake, Keenjhar Lake, as an example to illustrate types of valuable flows of services that this 14,000 ha lake provides. Among benefits that can be reaped at the lake site itself are fisheries catch and eco-tourism; referred to as "*direct use values (DUVs)*" for purposes of valuation studies. Similarly, an example of what valuation studies refer to as an indirect benefit or "*indirect use values (IUVs)*" is the supply of water, both commercial and domestic, that Karachi obtains from the lake. In the case of Karachi, one million of its nearly 20 million residents are connected to the reticulation system, and as much as 80 % of their annual domestic water needs are met by Keenjhar Lake. Finally, valuation studies refer to «*non-use values (NUVs)*" and these are the warm glows, so to speak, that people who may or may not ever have visited the lake get from knowing that it exists (*existence values*), knowing that they may one day visit it (*option use values*), and being safe in the knowledge that conservation actions may result in maintaining the lake for future generations (*bequest values*).

Ecosystem Valuation

Table 1 below lists the DUVs, IUVs, NUVs and TEVs (Total Economic Values) associated with wetlands in the Indus Ecoregion, Sindh Province, namely forest, rangeland, freshwater, coastal, and agricultural ecosystems. It is worth making several points about the values that are listed here.

Table 1: Ecosystem Values (Present Value, Rs. Billion)

May 2012	DUV	IUV	NUV	TEV
Deltaic (Keti Bunder)	9.0	0.7	0.4	10
Rangeland (Chottiari)	2.4	-	2.4	5
Freshwater (Keenjhar)	7.5	6.9	0.4	15
Forest (Pai)	0.8	0.1	1.9	26
Agriculture (Pai)	23.0	-		
Total	42.8	7.7	5.1	56

Source: *inflation adjusted figures based on WWF 2008 and Dehlavi and Adil, 2010 (All values calculated using a 10 % discount rate; assumes a limitless time horizon).*

Table 2: Ecosystem Values (Present Value, USD million)

2012 May	DUV	IUV	NUV	TEV
Deltaic (Keti Bunder)	99.5	7.8	4.2	111
Rangeland (Chotiari)	27.1	-	27.1	54
Freshwater (Keenjhar)	83.7	76.9	4.2	165
Forest (Pai)	9.0	0.9	20.8	286
Agriculture (Pai)	255	-		
Total	474	85.6	56.3	616

Source: *inflation adjusted figures based on WWF (2008) and Dehlavi and Adil (2010) (All values calculated using a 10% discount rate; assumes a limitless time horizon).*

First, DUVs, IUVs and NUVs are arithmetically summed to produce TEVs, which are the only values that are policy relevant. In the case of deltaic or coastal ecosystem, DUVs consisted of fisheries, while IUVs were those of the prevailing market values associated with carbon sequestration for stands of mangrove forest, both dense and sparse. The IUVs of Pai Forest in Shaheed Benazirabad also consisted of carbon market values for tree species in the forest. The NUV for the study is based on perceptions of a representative sample of Karachiites, interviewed in each of Karachi's 18 towns (Dehlavi *et al.*, 2010).

Second, values in Table 1 (above) need to be adjusted before being interpreted, among others by determining per hectare values, and selecting discount rates and time horizon assumptions to allow comparison and use. Thus, in the case of Keenjhar lake, the TEV of Pak Rs. 15 billion needs to be divided by 14,000 ha to produce a per hectare value of Pak. Rs. 1.05 million. The corresponding values for other ecosystems are Pak. Rs. 1.33 million (coastal), Pak. Rs.0.27 million (rangeland), Pak. Rs. (forest) and Pak. Rs. 22.9 million (agriculture).

Third, the WWF study methodology for the calculation of net present values (NPVs) listed in Table 1 uses an assumption of an infinite time horizon. That is, it is assumed that the benefits described, e.g., fish catches, are sustainable. Suppose we assume these benefits exist for only 50 years, then with a 10 % discount rate, the NPV is little affected. These values are obviously sensitive to the discount rate. For instance, if discount rates are assumed to be 20 %, this would halve the NPV. In Table 1, the 10 % discount rate is used because this corresponds to the average yield of the 6 - months Treasury Bill (T-Bill) for the past 15 - 20 years (about 10 % between March 1991 and April 2009, at the time the study was carried out). This is a conservative benchmark for the time value of money in Pakistan. Pakistan Investment Bonds probably would have been better instruments than 6 month T-Bills to obtain average yields for this purpose, but data are available only from 2001 onwards. A sensitivity analysis (for discount rates of 1 %, 5 %, 10 %, 15 %, and 20 %) has been presented in Dehlavi *et al.,* (2008).

Fourth, another important point to note for Table 1 is that the numbers presented are annual means from the authors' cluster sampling procedure. In the case of Keti Bunder, DUV figure in Table 1, the associated standard errors lead to a 95 % confidence interval ranging from 303,569,915 to 1,176,928,997. This means that gross margins in Keti Bunder are significantly different from zero. Only estimates which were significantly different from zero were included while calculating the total annual benefit values. Similar interval estimators exist for all the sites in Dehlavi *et al.,* (2008). To put this in layman›s terms, the figures are not meant to be interpreted as being exact, but lying within a range. This is a statistical point, but one worth emphasising to Pakistan›s planners and policy makers who need to be fully informed.

Fifth, methodology used to compute values relies on multivariate or econometric analysis. Most of the techniques in use were devised within the branch of economics known as welfare economics, each relying broadly on two types of streams of data. One technique, the "revealed preference" class of techniques,

relies on the tracking and recording of all relevant transactions and time allocations of respondents, producing a huge dossier of their movements and purchases, allowing modelers to use individual respondents' economic biographies to reveal the worth placed by the estimated total number of users of the ecosystem service in question. The other technique relies on the surface of it rather simply on peoples' own "stated preferences" as reported by them; but, it too relies on complicated techniques. These often establish a hypothetical market and within this exercise bear responsibility for demonstrating that standard strategic and other biases did not interfere while answers were volunteered.

Sixth, the standard methodological steps accompanying valuation studies, also described in detail in WWF (2010) are:

1. agree the aims and objectives of the valuation study to be commissioned by economic planners and policy makers;
2. define geographical and analytical boundaries while listing primary and secondary data requirements;
3. consult "rank tables" to prioritise assets, services and attributes and, for each, list preliminary information requirements;
4. choose revealed and stated preference technique(s) noting general / essential informational requirements of the specific technique (e.g., Market Value method). Also, consult "criteria tables" to apply the technique which is most appropriate for the given type of lake, forest, etc;
5. consult questionnaire design best practice guidelines separately for each technique since attitudes, opinions, knowledge, resource use, and demographic informational requirements vary by technique;
6. use Simple Random Sampling (or "probability sampling") where resources permit such an approach in order to get a genuinely random sample;
7. define the sample to be taken from the sampling frame (i.e., the entire population);
8. consult sampling statisticians appropriate to the needs of the method chosen;
9. test several functional forms and discuss their merits, noting that the functional form of a model has a strong effect on the magnitude of the results;
10. make a judgment on the desired accuracy of the TEV (or DUV, IUV, NUV) at the outset before commissioning the study;
11. apply a Benefits Transfer technique if resources are insufficient to carry out a satisfactory field-based valuation study (the World Bank 2006 study for example uses secondary data);
12. use a sensitivity analysis and make clear assumptions relating to the net present value; and, adopt different pathways for results dissemination: an academic / technical one (e.g., format of the present guidelines), a policy-level one, and one for stakeholders / public.

How does valuation help the conservation of wetlands?

In practice, how does one include ecosystem services into national policy? This refers to more precise inventorying of natural resources, assessments of costs of environmental degradation in terms of health or foregone incomes, but also use of TEV study results to argue for increased allocations to environmental sectors. The current system awards conservation budgets based on a given sector's share to gross domestic product and cannot be said to be the result of consultation among environment, economic, and resource ministries. An urgent overhaul of the old system is needed since it privileges goods and services production through land uses that fragment habitats and cause ecosystem damage.

The notion of man-made and natural capital management based on actuality must take into account concrete linkages between fiscal policy, monetary policy, industrial and natural resource extraction policies, the patterns of use of natural resources, and broader factors of national welfare. These linkages can be developed when the flows of services to people from ecosystems are monetized (marketed and non- marketed service flows such as flood protection), and that the results of such valuation studies are embedded within policy directives to achieve efficiency. Again, in layman's terms, imagine yourself setting money aside in your household budget (think national budget) for replacing light bulbs indoors (think man-made capital) and for maintaining trees and grass in your garden (think natural capital) that attracts beautiful bird species that sing and sit on branches for your delight. Further imagine that your household budget savings are decided jointly by yourself and your spouse (think different ministries), and that the trees somehow fuel the budget with which you purchase light bulbs (imagine you sold some of your garden plants to create savings!). Then valuation would be the good advice that allowed you to save efficiently to replace the right amount of plants sold, but did so by appealing to your sense of budget management by telling you proportional worth of the plants as a share of your total household budget.

Pakistan's Ministry of Climate Change and the National Forest Programme Facility have already taken a groundbreaking step in this direction by commissioning a set of national guidelines to assist statisticians and resource economists, among others, in conducting and overseeing forest valuation studies. The long-term journey is not a difficult one. In fact, it can be approached through a series of simple steps. The first step is to agree that monetization of the environment and environmental services is a necessary step in order to manage and improve resource allocation to the environment sector. Once this consensus has emerged, the lead ministry i.e. the Ministry of Climate Change in consultation with experts, civil society and other partners undertakes to identify important services in order of priority while consulting a broad spectrum of stakeholders will allow for a richer and more complete perspective.

The valuation studies would need to be outsourced by the Government of Pakistan to competent persons and groups. The consultants would in turn identify information needs and the on-ground valuing of ecosystem services together with those overseeing and commissioning the studies. Once these studies and assessments have been completed, there exist various ways that the results of these studies may be used to inform policy directives, decisions surrounding resource allocation and investment in natural capital, strategic utilisation of conservation benefits, or encourage provincial and district governments to use these findings to guide their planning and investment priorities.

Finally, the results of these studies, actionable findings, and associated policy formulations must be communicated to the necessary provincial and district line departments in order to shape current and future planning.

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