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Review

Types of valuation methods for environmental resources: Higuolhlights of key aspects, concepts and approaches in the economic valuation of forest goods and services

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It is essential to understand and recognize the role that environmental resources such as forest goods and services play in the provision of income to peoples' livelihoods (especially the poor and marginalized communities). The purpose of this paper is to give a concise account and scientific basis of the importance of the phenomenon of valuation of environmental goods and services which is manifested in two ways. Firstly, it helps policymakers in designing and implementing effective sustainable livelihoods and poverty reduction strategies. Secondly, the size and nature of environmental values have implications for issues of conservation and sustainable resource use. This paper outlines the contemporary models and approaches of valuing the direct use benefits, indirect use benefits and intermediate use services of the forest as an ecosystem and not a mechanical body to produce goods and services for income generation, overlooking the fundamental principles of sustainable forest management and sustainable development. Shortcomings and remedial measures of valuation methods are also summarized. Through appreciating the total value of the forest resources, national governments and local communities would be able to promote sustainable forest resource use across all strata of society and incorporate the value of natural forests and woodlands in their System of National Accounts to avoid unnecessary conversion of forests into other development projects.

Key words: Forest goods and services, natural woodland, sustainable, economic valuation, user surveys, non-use values.

INTRODUCTION

It is estimated that 80% of the population of "developing" countries relies on forest goods and services for their primary health and nutritional needs (FAO, 1995, 2001). In 1993, the world trade in NTFPs was estimated at US$ 11-billion. In addition to their economic value, NTFPs can play a vital role in restoration and maintenance of important cultural traditions and improve the quality of life for millions of people (Falconer, 1992; Crafter et al., 1997; Bishop, 1999; Harshaw, 2000; Dovie et al., 2001; Chamberlain et al., 1998; Hassan et al., 2002). It is further generally assumed that the sustained extraction and processing of NTFPs by local people can enhance their cash income and provide an alternative to tropical deforestation (Hedge et al., 1996; Dlamini, 2007). However, the degree to which such products may potentially contribute to rural incomes is poorly documented (Hedge et al., 1996; Campbell et al., 1997; High and Shackleton, 2000; Dlamini and Geldenhuys, 2009, 2011a).

There is still no indication that the deforestation rate of natural forests and woodlands is decreasing (Crafter et al., 1997; Gram, 2001). Destructive mining operations,

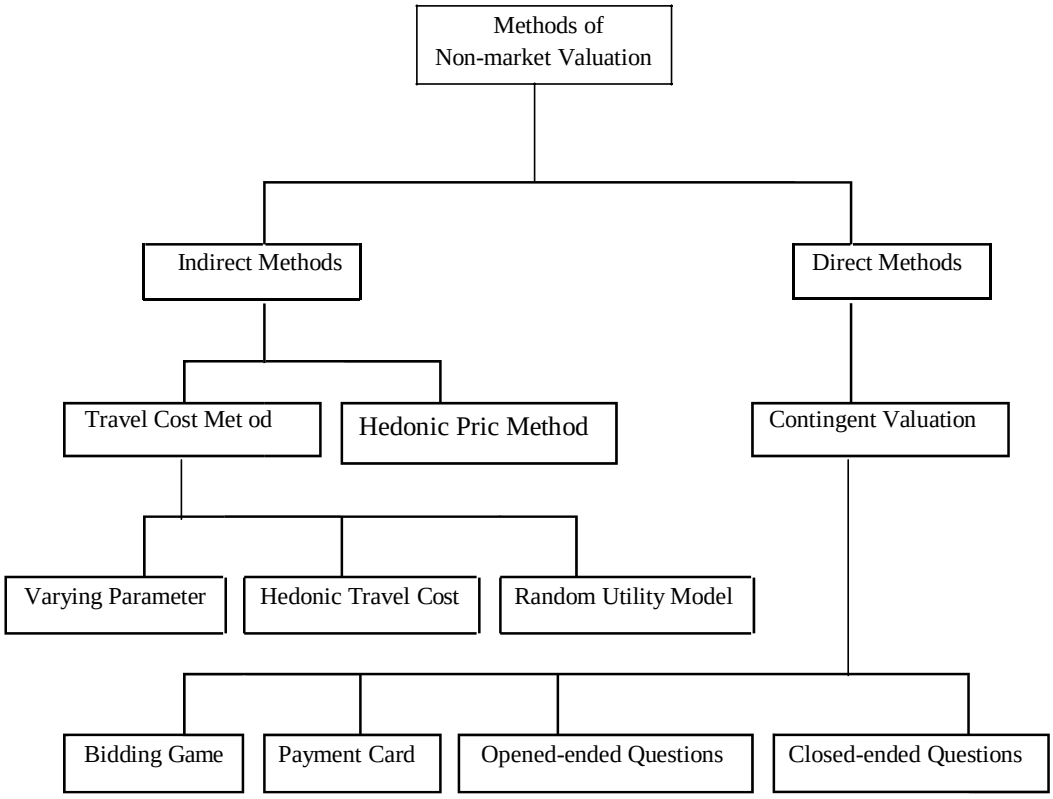

Figure 2. The relationship between different specific non-market valuation techniques for NTFPs (Source: adapted from Sarker and Mckenney, 1992).

become the variables to be used to determine the value of a resource. The weakness of this method is that, it only deals with single destination trips and assumes that travel is a means, rather than an end in itself (Sarker and Mckenney, 1992; McKenney and Sarker, 1994; Klemperer, 1996; Bishop, 1999; Dlamini, 2007, 2011). Under the Travel Cost Method there are three methods: the Varying Parameter, the Hedonic Travel Cost and the Random Utility Model methods. These variants of the travel cost method can be used to analyse the effect of the quality of the site characteristics rather than the gross value. They work with significantly more sophisticated econometric models than the basic travel cost method (Sarker and McKenney, 1992; McKenney and Sarker, 1994; Bishop, 1999; Dlamini, 2007). The origin of the travel cost methods is attributed to an economist named Harold Hotelling, but its operational development and current popularity are due to work done by Clawson (1959), Knetsch (1963) and Clawson and Knetsch (1966). A detailed description of the Travel Cost Method and its subsidiaries is well articulated in Table 1.

The Hedonic price models are based on a hypothesis that goods are aggregations of characteristics and that the demand for these goods is interrelated to these characteristics (Sarker and Mckenney, 1992; McKenney and Sarker, 1994; Bishop, 1999). The characteristics are true arguments of utility functions and any transaction is tied to a group of characteristics, thus the demand for certain characteristics is embedded in the prices and consumption levels of market goods. A good example would be to consider that the price of a house in a city includes the contribution of certain market goods (e.g., size, and design of the house, number of rooms, etc.) and the neighbourhood environmental conditions (e.g. air quality when near a sewage, noise pollution if near an airport, etc). Overall hedonic price models is a means to quantify the contributions of the market and non-market aspects of a particular good to its equilibrium market price through sound statistical analysis (Sarker and Mckenney, 1992; McKenney and Sarker, 1994; Bishop, 1999; Dlamini, 2007, 2011). The hedonic price model was first used by Griliches (1971) and further developed and refined by Rosen (1974) and Palmquist (1991).

The household production function model involves situations where individuals purchase private inputs at market prices and combine them with their time and natural resources and environmental attributes to produce out-door recreation experiences. This model has two stages. Firstly, the household reduces the cost of producing a given level of experiences. Secondly, the recreationist maximizes their utility subject to their budget constraint to determine the level of recreation experiences to consume. The household production theory was deve-loped by Becker (1965) and was subsequently refined to

accept values can be four times higher than willingness to pay (Klemperer, 1996). Experimental economics approach is another direct method of deriving un-priced values of environmental goods and services. High profile experiments can be put in place to elicit individuals' valuation for environmental amenities. However, conducting such meaningful experiments is generally difficult and expensive (McKenney and Sarker, 1994).

USER SURVEYS AND ECONOMIC VALUATION

The ultimate aim of natural resource surveys and accounting is to promote sustainable use of the resources and prevent degradation (Hedge et al., 1996; Dovie et al., 2001; Sheil and Wunder, 2002; Geldenhuys, 2002; Dlamini, 2007, 2011). The economic valuation of the NTFPs aspect of forest goods and services is faced with numerous challenges like the inventory of NTFPs. The underlying reasons for the difficulty in the valuation of NTFPs are attributed to the complex nature of the products leading to most having non-wood values. Non-wood values have been described as those goods and services produced by the forestland which enter an individual"s preference (or utility) function and for which individuals are willing to sacrifice their scarce resources (McKenney and Sarker, 1994: Dlamini, 2007) and these products may not have a defined market price. The local factors that influence land-use priorities, such as lack of secure land tenure, the low level of price stability for NTFPs, the non-economic preferences, and the traditional taboos and norms regarding extraction of these products need to be integrated into the economic valuation (Gram, 2001). Present-day knowledge about the economic value of NTFPs is based on a doubtful foundation because the different methods used by scholars have led to different results.

Consequently, widely different conclusions are made regarding the value of the various NTFPs (High and Shackeleton, 2000; Dovie et al., 2001; Gram, 2001; Godoy et al., 2000; Sheil and Wunder, 2002). Godoy et al. (1993) present a detailed summary of common failings of biometric rigour and reporting protocols in assessments of forest goods and services particularly non-wood forest products (NWFPs), which are basically NTFPs, from the perspective of natural resource economists, and makes suggestions for how methods could be improved. Refer to Table 2 for a summary of shortcomings of NWFPs resource assessments for valuation studies, and this is inconclusive as more and more scholars are coming up with more and more efficient resource assessment and valuations methods.

SIMPLISTIC APPROACH FOR VALUATION OF NTFPs EXTRACTED FROM AFRICAN FORESTS

Below is a generally ideal equation for calculating the value of NTFPs, under sustainable and unsustainable extraction (Godoy et al., 1993, 2000; Dlamini, 2007, 2011). The following equation would be the most ideal method to calculate the value of NTFPs under sustainable extraction:

$$\sum_{I=0}^{N} QI(PI - CI)$$

where: *Qi* = quantity of goods extracted; *Pi* = forest/farm gate price of the goods; *Ci* = cost of extraction (marginal costs of extraction); *i* = set of non-timber forest products.

If the extraction rates are non-sustainable, adjustment should be made for the eventual depletion of the products by adding to *Ci*, a depletion premium based on the expected date of extraction (Godoy et al., 1993, 2000). However, the aforestated equation was found to be inappropriate for calculating the value of NTFPs extracted per household in rural Swaziland due to the following factors (Dlamini, 2007, 2011):

1. Extraction costs are largely very low, as none of the resources harvested require specialist tools, usually just an axe, sickle or a bushknife and such tools are used for a multitude of uses within the household. Transport used for conveying edible and medicinal NTFPs was mainly „walking". Thus, once the capital cost is spread over a number of different uses and then subject to a discount factor over the life of such a tool, then the annual cost or cost per unit harvested is negligible (Shackleton and Shackleton, 2000). Furthermore, the collecting containers for the NTFPs were old sacks and used plastic bags.
2. The impact of opportunity cost of labour were also very small, firstly because the daily rates paid for labour collecting NTFPs does not exist within the rural areas, as these products are collected by women and children as well as unemployed men, and there is a large surplus of unskilled labour. So the application of opportunity cost of labour under such circumstances would be unrealistic (Shackleton and Shackleton, 2000). Then the approach of Shackleton and Shackleton (2000) and Shackleton et al. (2002) was modified and adopted where the following equation is fitted:

Annual value extracted per household = Annual quantity extracted (either for domestic use or trade) × Mean farmgate price.

The value of NTFPs gives a clear indication of their socio-economic contribution to sustainable livelihoods in rural communities where the majority of the population are poor. This would bring a strong motivation for national governments to allocate financial resources and capacity building for sustainable forest resource use and management towards enhanced sustainable development. Furthermore, national governments will see the urgent need to include and give a true reflect of the value