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Economic Valuation and Sustainable Natural Resources Management: Review Paper

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Abstract
Environmental and natural resources have a wide range of benefits (broadly use and non-use benefits). Most of these benefits are non-marketable[1]. The decision as to what use to follow for a given environmental and natural resource, and eventually whether current rates of resource loss are extreme can only be made if the values (gain and loss) are properly valuated. This requires that all the values that are gained and lost under each resource use option are carefully considered and valued. As a result, economic valuation of environmental resources is very critical before making any decision for determining (identify) the uses of environmental and natural resources. Otherwise, there is a real danger that if no economic measure of the value of environmental resources is available, then it could be perceived that they have little or no value to society and can therefore be exploited. Thus, this paper tries to review literatures on valuation methods that aimed at quantifying natural resource values in monetary terms, the role of economic valuation in decision making on natural resource use and management.
Keywords: Economic valuation, valuation Approaches, Natural Resource Management

1. Introduction

Environmental and natural resources are used intensively because they have a wide range of values. As the same time continuity of values, which are provided by natural and environmental resource, became important in sustainable development (Belkayali *et al,* 2010). Sustainable development has a notion that keeps natural and environmental quality, in an acceptable range and highlights the need for protection of environmental and natural resources to its values (Kunte *et al.,* 1997*)*. According to the traditional economic view, in the essence of sustainability idea, market failure and resource valuation through the elimination of this failure is concerned (Kunte *et al*., 1998; Barbier, 1998). With this result, it is needed to build a strategy to make rational use of environmental resources depending on individual preference (Bateman and Turner, 1993). It is argued that successful development depends on the rational use of natural capital[2] (World Bank, 1998). The rational use of natural and environmental resources depends on the value it has and the value is measured through the process of economic valuation. The term economic valuation refers to the process of assigning monetary values to goods and services provided by environmental and natural resources, whether or not market prices are available (Barbier *et al*., 1997; Dosi, 2000).

Economic valuation of natural and environmental resources helps to provide good reason for management and protection of environmental and natural resources (Pearce and Seccobet-Hett, 2000). Decision making for environmental and natural resources management requires information (qualitative or quantitative, in monetary or non-monetary terms which could be determined by valuation approaches) to be provided by scientists to verify the extent of perceived resource loss (Dosi, 2000).

2. Classifying natural resources and environmental values

The total economic value (TEV) of an environmental and natural resource includes use benefits as well as non-use benefits (Robinson, 2001; Dziegielewska, 2009).

2.1. Use benefits (values)

Use benefits (values) include both direct and indirect uses. Direct use values may be derived from consumptive uses (e.g. Fuel wood collection) and or non-consumptive uses (e.g. hiking in the same forests), and may involve commercial (selling of fuel wood or collecting, visiting tolls) and or non- commercial activities (home consumption of fuel wood or enjoyment of an open access wilderness area) (Carson *et al.,* 2000). Indirect use values, also known as functional values, derive from the natural interaction between different ecological systems and processes; in particular, the ecological functioning of one ecosystem may affect the functioning and productivity of an adjacent system that is being exploited economically (Barbier, 1998, p.5). More generally, indirect use values may be described as the benefits individuals experience, indirectly, as a consequence of the primary ecological function of a given resource (Torras, 2000). For example, the indirect use value of a wetland

[1] Non-marketable: goods for which prices and monetary values are difficult to obtain
[2] Natural capital refers to the stock of natural assets such as land, forests, wild life and water resources from which people derive resource flows and services useful for their livelihood.

may arise from its contribution to filtering water exploited by down streamer users (World Bank, 1998); forests may provide different off-site benefits, such as controlling soil erosion, flood control, or carbon sequestration; coastal wetlands may contribute to the protection of properties and economic activities against hurricane wind damages (Farber, 1987, Young,1997,) and the use value of a mangrove system may derive from its indirect support, as a breeding ground, for an offshore fishery (Barbier and Strand, 1998).

2.2. Non-use benefits (values)

Non-use benefits may be obtained from environmental and natural resources without actually using them. These include existence value, option value and bequest value (Dziegielewska, 2009). Existence value is the value of simply knowing that a resource exists, for example, some people derive satisfaction from the fact that many endangered species are protected against extinction. Many people are willing to pay for protection of these species' habitats, even those located in remote, hard to access areas. Bequest value refers to benefits from ensuring that certain goods will be preserved for future generations (Dziegielewska, 2009). For example, many of us are concerned with future damages from global warming and would be willing to pay to reduce them, despite the fact that the vast majority of the damages are expected to affect the Earth long after our generation is gone.

Option value is the value given a resource when there is a risk associated with future supply and demand (Dziegielewska, 2009). It is the amount of money an individual is willing to pay to ensure that that a resource is available for use in the future.

3. Economic valuation of environmental and natural resources

Economic valuation can be defined as the process of assigning quantitative values to the benefits provided by the environmental and natural resources (Barbier *et al*., 1997; Dosi, 2000).

Economic value of any benefit is measure in terms of what the minimum amount an individual is willing to give up the consumption of goods and services in order to obtain some other goods and services (Arrow *et al*, 2000). Environmental and natural resources valuation allows benefits received by society to be compared to the monetary costs and to the opportunity costs of other foregone investments (Loomis, 2005). The inclusion of monetary estimates of the economic value of non- marketed environmental and natural resources allow for more formal consideration of these values in the decision making for natural resource management.

As it stated above, an obvious basis for economic value is given by the willingness to pay and receive payments for items exchanged in market transactions. For goods and services that can be sold at the market, the value of the goods or services to be consumed is easily referred from its price in the market (Carson and Mitchell, 1998). Environmental and natural resources like food, timber, energy, recreation, and materials for which there are economic markets can be most easily valued and are most tangible.

However, the majority of the flow goods and services associated with environmental and natural resources are non-marketable (Hanley and Spash, 1993). For instance the provision of water by watersheds, pollination of crops by birds and bees, filtering pollutants by wetlands, coastal protection by wetlands and seaside vegetation, and aesthetic values have are not exist in any economic market (Robinson,2001). But economists develop techniques that used to value non-marketable environmental and natural resources.

3.1. Economic valuation approaches

As it will be illustrated in the following section, various techniques have been developed and applied to measure environmental and natural assets' values in order to assess the economic impacts resulting from alterations of conditions influencing the flow of goods and services these assets provide (Robinson, 2001), these techniques can be grouped into three major valuation approaches

3.1.1. Existence of a market price for the natural and an environmental values

If the observable prices are not distorted, then the economic value of (marginal) environmental changes can be valued by directly using existing market prices (Carson and Mitchell, 1998; Hanley *et.al*, 2002). Obviously, if the natural resource of interest provides multiple goods and services, many of which are unmarketable, this valuation approach would fail to provide reliable measures of the resource's value (Hanley and Spash, 1993).

3.1.2. Surrogate market valuation.

Surrogate market valuation approach consists of measuring the value of unmarketable environmental services by looking at the market price (or the shadow price) of related economic goods (Hanley *et.al*, 2002). According to Hanley and Spash (1993) these related goods may consist of (i) environmental services', (ii) complementary goods, (iii) Substitute goods (i.e. goods which may replace environmental services, (iv) other marketable goods providing indirect information about the environmental change. Again, the surrogate market valuation approach is potentially capable of providing reliable welfare measures only if the value of the environmental and natural resource under consideration is revealed by related market behaviour and market prices. This may occur for use values, but will never occur for non-use values. It follows that if a resource does not (only) provide benefits through its present (or expected) use, but because of its mere existence, the surrogate market valuation techniques are intrinsically unable to provide (reliable) value estimates.

3.1.3. Expressed preference approach.

Expressed preference approach consists of directly asking individuals which value they attach to unmarketable environmental services, and to express their preferences towards changes in service flows (Dosi, 2000). This approach is potentially able to estimate both use and non-use values, or simply when applied in a holistic way- a natural resource's total value.

3.2. Environmental and natural resources valuation techniques

Economists have devised techniques of using implicit or simulated markets to estimate the monetary values of non- marketed environmental and natural resources. Navrud (2000) argued that these valuation techniques rigorously based on either observed behaviour (Revealed preference, RP) towards some marketed good or stated preferences (SP) in surveys with respect to the non-marketed good. According to Kolstad (2005), a revealed preference method of valuation means that infer preferences for environmental goods and services. It includes travel cost, simulated markets and market prices and hedonic pricing. Whereas a stated preference method of valuation involves finding an individual's willingness to pay for goods by posing a set of questions regarding preferences directly to the individual (Carson and Mitchell, 1998). It includes contingent valuation methods, contingent ranking and choice experiment.

3.2.1. Hedonic pricing method

The hedonic pricing method (HPM) is based on the theory that a goods or a service is valued for the attributes or characteristics it possesses (Thomas and Callan, 2007). This perception of value suggests that an implicit or hedonic price exists for the product attributes and these can be determined from the explicit price of the products. The hedonic pricing method is used to estimate economic values for ecosystem or environmental services that directly affect market prices (Hanley *et.al*, 2002).

In environmental economics, researchers use hedonic pricing method to value the environmental characteristics of a certain goods (Anderson, 1993). It is most commonly applied to variations in housing prices that reflect the value of local environmental attributes. The method is based on the assumption that people value the characteristics of a good, or the services it provides, rather than the good itself (Hanley *et.al*, 2002). Thus, prices will reflect the value of a set of environmental characteristics that people consider important when purchasing the good.

3.2.2. Travel cost method

The travel cost method (TCM) is one of the oldest approaches to environmental valuation proposed in letter from Harrold Hotelling to the US Forest Services in the 1930, first used by Wood and Trice in 1958, and popularized by Clawson and Knetsch in 1966 (Hanley *et.al*, 2002).

The travel cost model (TCM), or recreation demand modelling approach, is a revealed preference method that fundamentally depends on observing actual behaviour (trips taken over some period) rather than on answers to hypothetical questions (Loomis, 2005).The method involves using travel costs as a proxy for the price of visiting outdoor recreational sites (fishing, hunting, boating, and forest visit) (Hanley *et.al*, 2002). For example, Menkhaus & Lober (1995) used the Travel Cost Method to estimate the value that US eco-tourists assign to Monteverde Cloud Reserve in Costa Rica. They arrived at a total annual US ecotourism value of USD 4.5 million. Values such as this can be used to calculate revised (higher) entrance charges that more adequately reflect the ecotourism benefit for the area. This study arrived at an average entrance charge of USD 40, which is considerably higher than the USD 5- 10 usually charged at national parks in Costa Rica. The costs will include travel costs, entry fees, on-site expenditures and outlay on capital equipment necessary for consumption.

3.2.3. Production function approaches (PFA)

The production-function method also known as change-in-productivity approach, it seeks to exploit the relationship between environmental attributes and the output level of an economic activity (Adams et al. 1986). The underlying assumption is that, when an environmental attribute enters a firm's production function, environmental changes' economic impacts may be measured by looking at the effect on production, and by valuing such effect at market (or shadow adjusted) output prices.

The production-function approach (PFA) has been widely used, particularly to evaluate the impacts of environmental quality changes (acid rain or water pollution) upon agriculture and fisheries (Adams et al. 1986). Other examples of application include analysis of the impacts of water diversion (Barbier, 1998), and the valuation of the protection benefits provided by coastal wetlands against hurricane damage (Farber, 1987).

According to Barbier (1998), because of the direct dependence of many production systems in developing countries on natural resources and ecological functions, the Production Function Approach is considered widely applicable to many important economic and investment decisions in these countries. For example, Kramer et al. (1995) used the Production Function Approach in combination with other valuation methods to estimate the value of a national park currently being established in Madagascar. The establishment of this park benefits farmers in terms of reduced crop losses as a result of reduced flooding, due to the fact that deforestation in the park is prohibited. Deforestation rates in the Mantadia area were first estimated by using remote sensing data. Future deforestation rates were projected on the basis of the historical analysis. These land use changes were used to project effects on flooding. Finally, the predicted reductions in flooding brought about by the park and buffer zone were used to predict reduced crop losses; these were estimated and valued in economic term.

3.2.4. Contingent valuation methods (CVM)

The most obvious way to measure nonmarket values is through directly questioning individuals on their willingness-to-pay (WTP) for a good or service called the contingent valuation method (Mitchell and Carson, 1998). It is a survey or questionnaire-based approach to the valuation of non-market goods and services (Rahim, 2008; Carson and Mitchell, 1998). Willingness to pay (WTP) is a measure of the maximum amount that a person would pay for a particular good or service, such an environmental quality or species existence, or for an incremental change in the amount of an environmental service provide (Carson and Mitchell, 1998).

The contingent valuation method (CVM) for the valuation of environmental goods was first used by Davis (1963) in the study of hunters in Maine. However, it was not until that mid-1970s that the method's development began in earnest (Hanley *et.al*, 2002). Since then, the method has been used by economists to measure the benefits of a wide variety of goods.

Contingent valuation is particularly useful for estimating the value of non-marketable goods and services. It is referred to as a "stated preference" method of valuation because it involves the survey of personal opinions of value regarding hypothesized, but unrealized, environmental changes (Mitchell and Carson, 1998; Thomas and Callan, 2007; Wills, 2007).

Scholars estimate the total economic values of resources using contingent valuation methods at different time and places. For example, Kramer et al. (1993) used the Contingent Valuation Method in a national postal survey to assess the value that US residents place on the protection of tropical rainforests. The survey was mailed to a random sample of 1,200 US residents. It asked them how much they would be willing to contribute to a hypothetical United Nations Save the Rainforest Fund. The researchers arrived at a mean Willingness-to-Pay of USD 24-31 per household. Taking into account all households with an income of more than USD 35,000 annually, this would apply for a one-time donation of USD 780 million to USD 1 billion for rainforest protection.

In India, Hadker (1997) estimates Bombay residents' willingness to pay for the maintenance of Borivli National Park, which is located within the city limits of Bombay. The study arrives at Willingness-to- Pay of 7.5 rupees per month per household. This amounts to a total present value of USD 31.6 million. This figure could be used to influence policy decisions, given that the National Park currently runs on a budget of USD 520,200. Another interesting finding of this study for policy-makers was that businessmen are willing to pay significantly more than other professionals, as it is this group who may be able to finance environmental improvements.

4. Economic valuation and natural resource management

By providing a means for measuring and comparing the various benefits of the resources economic valuation can be a powerful tool to aid and improve wise use and management of resources. For example, a study conducted in New York shows that the Catskill/Delaware watershed provides 90% of the drinking water (high quality water with little contamination) for the New York City. But increased housing developments and agriculture caused water quality to deteriorate. By 1996, the New York City had two alternatives: building water filtration system at estimated cost of up to $6 billion or protect the watershed. In order to protect the Catskills watershed, measures were taken to help limit further development, improve sewage systems and reduce the impact of agriculture by less fertilizing and building up riparian zones along a river bank at a total projected investment of about $1 to $1.5 billion. New York City water manger chose to protect the watershed (National Academy of Sciences, 2004).
A study conducted by Bedru (2007) on the use of common pool resources use (area enclosure) in the highlands of Tigray, northern Ethiopia using cost benefit analysis (comparing the cost and benefit of using the degraded land as agriculture or area enclosure) showed that when degraded land is taken away from its current use for area enclosure the overall a net present value higher (NPV is positive (ETB 1 579/ha); this implies that society benefits more that it losses by reallocating semi productive land to enclosure.

5. Conclusion

Major reason for excessive depletion and conversion of the environmental and natural resources is often the failure to account adequately for the non-market environmental values in development decisions. Depletion of environmental and natural resources is an economic crisis because important values are lost, some perhaps irreversibly once it is degraded. The decision as to what use to follow for a given environmental and natural resource, and eventually whether current rates of resource loss are extreme can only be made if these gains and losses are properly analysed and evaluated. Therefore, in environmental decision- making, policy makers should use economic valuation as a way to quantify the trade-off in a policy choice.

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