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VALUATION OF FOREST RESOURCES IN WATERSHED AREAS: SELECTED APPLICATIONS IN MAKILING FOREST RESERVE

Herminia A. Francisco and Nena O. Espiritu *

TOTAL ECONOMIC VALUE OF FOREST RESOURCES IN WATERSHED AREAS

A watershed is an area of land bounded by a divide which drains water including soil particles, dissolved nutrients, and other nutrients and minerals to a common point along a river or stream (NWRC 1976). Approximately 70% of the total land area of the country are considered as watersheds. These consist of about 419 rivers with a drainage area ranging from 40–100 km to 10,000–25,000 km. These water resources provide water to several irrigation systems, hydroelectric dams, and domestic and industrial watershed water system (Alvarez 1984).

There are three major functions of a typical watershed as cited by Balangue (1980). The watershed serves as a protective cover for soil and water conservation, for wildlife sanctuary, and for cushioning impact of adverse climatic changes. The watershed provides numerous forest products, which include: water, timber, forage, fuelwood, agri-silvicultural crops, rattan, wildlife, and other minor forest/plant products.

In addition, the watershed also provides services or amenities in the form of recreation, scenic views, aesthetic, and other forms of recreational activities(Table 1). There is also a wide diversity of flora and fauna in most watershed resources in the country.

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* Dr. Francisco is an Associate Professor at the Department of Economics, College of Economics and Management while Dr. Espiritu is a Researcher/Professor based at the Forestry Development Center, UPLB College of Forestry and Natural Resources.

The total economic value of the resource may be classified into use and non-use values. Use value may further be segregated into direct, indirect, and option values.

Direct Use Value

Direct use value includes uses that are possible with extraction activity or direct interaction with the forest resources and have commercial or subsistence values. These values include the use of the forest resources for timber, non-timber forest products, educational purposes, agricultural cultivation, and recreation and tourism.

The timber value of the forest has dominated extraction activities in the past but said use causes the drawdown or loss of other products and services as well. Further, there may be associated damages to society due to sedimentation of low-lying water bodies and farms. It is now recognized that the cost of consuming tree resources should also consider the value of the foregone products and resultant damages.

Non-timber forest products include: fuelwood; extractives such as resins, latex, gums, bark, and dyes; ornamental plants such as orchids; and food items such as seeds, spices, honey, fruits, and bush meat. The local community consumes most of these products but certain commodities are used as raw materials by other sectors and hence are sold to local traders for further re-sale.

The recreational value of the resource is now increasingly recognized both for domestic and international tourism. The development of this enterprise can lead to the growth of other local industries to cater to the demands of the tourists (e.g., food industry, handicrafts, and the service sector) and hence has considerable economic potential.

Indirect Use Value

The forest as a natural ecosystem serves many ecological functions that when disturbed can create havoc, most particularly to the adjoining ecosystems. Among said functions are the ability of the resource to store and regulate flow of water (watershed function) and the related ability to hold the soil intact in spite of heavy rains (soil retention). Also included is the ability of the forest trees to sequester carbon, thus reducing global warming, and also the system's ability to store a wide diversity of plant and animal species.

Other functions of the forest include nutrient cycling and microclimate regulation.

Option Value

The option value pertains to one's willingness to pay to keep the option open of being able to avail oneself of the direct and indirect uses of the forest at some future time. Actual use may or may not be realized.

Non-use Value

The non-use value of the resource includes existence and bequest values. Existence value is the desire to have the resource intact or preserved in its own right. It also includes wanting to have the resource available to mankind for some altruistic or humanitarian reasons. Bequest value measures what one is willing to pay to protect a given area or resource for the benefits of his children and of the generations yet to come.

Table 1. General Land Use Status

Land Use	Approximate Area (hectares)
Watershed	Entire Area
Special Use (Leased Areas)	143.95
Major Project Areas (e.g. agroforestry project)	84.35
UPLB – CF Campus	55.12
Makiling Botanical Gardens	300.00
Makiling Experimental and Demonstration Forest (includes PGI sites,cultivated areas, settlement areas)	3,660.95
Total	**4,244.37**

Source: IFC, 1994

THE WATERSHED AS THE BASIC UNIT OF VALUATION: RATIONALE

A major justification for undertaking development projects or even economic and environmental impact analysis using the watershed approach is the strong biological and economic logic of said approach. In particular, the fact that upstream activities have effects on downstream communities already establishes a strong causality in this relationship. Having the cause and effect relationship fairly well established, analysis of damages becomes easier to carry out.

The other rationale for the adoption of the watershed approach in the analysis of natural resource systems includes: the ease by which a holistic or systems approach can be applied in the analysis; the linkage provided by the hydrologic cycle to allow for the evaluation of the biophysical linkages of upland and downstream activities; and the logic of treating all costs (external costs included) as part of watershed management and operating costs since within the watershed unit, all external costs can be internalized (Easter, *et al*, 1985).

The watershed approach thus allows a systems analysis of the upland-lowland interaction as linked by the hydrologic cycle. This simply means that activities in the uplands will have their initial impact by altering the hydrologic processes that link the two communities. Any change in said processes is bound to manifest in some form of economic and social effects on both the upstream and downstream ecology and community.

The Upland-Lowland Linkages

In the early 70s, the government declared what are considered as critical watersheds. These watersheds form part of the 18 major river basins in the country. By definition, critical watersheds must be left untouched by man because of the very crucial role that they play to maintain the ecological balance in the country. In reality, these watersheds remain open to human encroachment on account of the multiple goods and services that they provide. Man's intrusion into these critical watersheds threatens the stability of the ecosystem, both upstream and downstream.

In the upstream of the watersheds, the most fragile ecosystems are the croplands and the water resources. With severe erosion, the sustainable productivity of the croplands is impaired, some even with irreversible consequences. Unrestrained logging and improper land use practices within the watersheds trigger accelerated erosion resulting to decline in crop production. The decline in crop productivity is brought about by the loss of productive topsoil and the destruction of the soil structure. This results to a less than efficient utilization of additional inputs and to the uneven flow of water that could eventually be detrimental to the downstream communities via losses of lives and properties.

Excessive logging and conversion of forest land to other less stable land-use systems can also significantly impair the watershed hydrologic processes and capacity. The most likely consequence of the removal of trees is the alteration of the quantity and quality of the water output from the watershed. In particular, water flows are expected to be high and strong during the rainy season. This is mainly due to the absence of tree root systems that serve to hold water and protect the soil resource base. In contrast, the supply of water may be less during the dry season with occasional drought occurrences in some parts of the country. In terms of the effect on water quality, water from forested land is generally superior to water coming from other land uses. For watershed hydrology therefore, it is ideal to retain tree vegetation in the country's watersheds especially those identified as critical for water supply.

The lowland ecosystems are endangered by environmental stresses taking place upstream of the watershed. Soil particles and other materials carried down by excessive soil erosion will eventually find their way to coastal water bodies, lowland farms, and river systems in the low-lying areas. Damages to coastal resources could be in terms of reduced fish production and lower recreational value of the resource. These effects come about as a consequence of the destruction of the fish habitat especially the coral reefs that are vulnerable to sedimentation.

In Bacuit Bay (El Nido), Palawan, Philippines, for example, the value of damages from sedimentation resulting from logging activities over a one-year period was monitored. The value was placed at $40 M-worth of fisheries and tourism earnings (Hodgson and Dixon 1988). Sediment deposition also contributes to the destruction of mangrove ecosystems. Mangroves serve an important role in fish production. However, the harvesting of mangrove products causes resource degradation apart from sedimentation. Damages due to sedimentation alone have not been established yet.

The effects on croplands depend on the type of materials carried to downstream farm areas. In some cases, the eroded soil could carry fertile topsoil for gardening. Once this happens, production in downstream farms could even increase because of the rich materials deposited in downstream farms. Continuous deposition of fertile soils is however, unlikely so that sooner or later, the downstream crop productivity is expected to go down due to erosion.

The river ecosystems could also be influenced by sedimentation through the alteration of the quantity, quality, and movement of water for irrigation, domestic, and industrial uses. Silts can displace the water system's storage capacity and increased turbidity of the water, making it unfit for irrigation and other uses. The end result is lower crop production. Nutrients carried by erosion into the lakes also hasten eutrophication of the lake and this translates to high level of water pollution and lower fish production. Where the watershed drains into water structures like dams, damages from sedimentation tend to be substantial. In particular, the service life of most of the country's hydropower dams has been significantly reduced due to sedimentation.

The cost of sedimentation may be estimated from the value of foregone benefits (e.g., reduced yield and lower power and water production) brought about by sedimentation. The cost of dredging the additional sediments beyond the natural rate of accumulation may also be used as a second best estimate of the cost of sedimentation.

So far, the succeeding section has discussed how improper activities of man in the upstream section of the watershed could have devastating economic and social impacts to society as a whole, and most especially to communities in the immediate downstream vicinities of the watershed area. These damages can be prevented through adoption of environmentally friendly technologies and implementation of programs/projects designed to protect the environment. The benefits of said intervention are measured in terms of the damages prevented and since the damages can be substantial as discussed earlier, the benefits protection are also expected to be huge.

TECHNIQUES TO VALUE WATERSHED RESOURCES

The last ten years witnessed the growth of environmental economics as a field of study with significant advances made in the valuation of use and misuse of natural and environmental resources. There are numerous publications that came out documenting the theoretical basis and results of applications of these techniques in both developed and developing countries.

Valuation techniques may be classified as market-based, surrogate market-based, cost-based, production function approach, and the direct elicitation methods such as the contingent valuation methodology and contingent ranking.

Market-based Approach

This approach is valuation that makes use of market prices, properly adjusted for inefficiency, have traditionally been relied upon if goods and services are traded in the market. Since many environmental commodities do not pass through the market system, the markets do not provide prices that can be used to value them.

Surrogate Market-based Approaches

Where there are related goods in the market for non-marketed environmental commodity, then, the prices of the related goods may be used. The markets for property/land, labor, and recreational services are used as surrogate markets to infer the value of environmental characteristics of the area/labor market and natural parks, respectively. The specific approaches falling under the sur-rogate market-based category are: hedonic pricing and travel cost methodology.

Hedonic Pricing Approach. More specific approaches in this group include the property value approach and the wage labor differential approach. In both markets, the basic principle is the same: the property (worth) is characterized by several attributes that can be physical, location/access, and environmental attributes, among other things. The value of the property/labor is thus a result of the composite characteristics of the commodity. The specific contribution of the individual attributes can be obtained through a regression analysis to derive the implicit price of say, the environmental attribute (e.g., level of pollution in the area). Once implicit prices are obtained for all the observations, a demand function (an inverse) can be derived for the environmental characteristic and its value derived from an estimation of the area under the demand curve.

Travel Cost Method. This method is used to measure the recreational value of natural resource scenic areas that are normally unpriced or priced with very low entrance fee. The fee collected is usually based on cost recovery for the staff manning the area and may not even be enough to cover the man-made improvements made in some of the country's national parks. To obtain an idea of how much value people attach to the resource for recreation, the approach assumes that the amount that people are willing to spend to visit the site is a good indicator of the value of the resource to them.

The travel cost would include cost of transport, foregone income from work loss days (adjusted to reflect value of leisure time), accommodation expenses, entrance fee, and other incidental expenses associated with the trip. The travel cost estimate is then used as a proxy to the price of recreation. A demand function for recreation (measured in visit-days per year or visitation rate per 1,000 population) with price, income, and prices of related goods as dependent variables, should be constructed. From this demand function, the value of the recreation benefits can be estimated.

Cost-based Approaches

The cost-based approaches measure the costs of ensuring the maintenance of the benefits provided by the environmental commodities. One must recognize that these cost measures are not really measures of benefits and should thus be viewed as proxy measures where benefit estimation is not feasible.

The specific methodologies under this category include the opportunity cost method (i.e., the time to collect non-marketed products, usually valued using the wage rate, is used to value the benefits from the products collected). The other approaches are the replacement, restoration, and relocation costs to restore the original condition of the environment. There is also the defensive or preventive expenditures incurred to prevent the change from the existing environmental situation.

The Production Function Approach

The production function approach involves two steps. The first step requires establishing a dose-response function with the response reflecting measures of damages in physical measures (e.g., production losses, incidence of morbidity/mortality). The dose corresponds to the level of environmental stress (e.g., soil erosion, air pollution). The dose-response function can be established from data obtained through experiments or survey work.

The second step involves translating the physical impacts to monetary measure. This stage is straightforward to the extent that market prices (adjusted for inefficiency) are available. In the case of loss production for example, the price of the crops may be used in the valuation. Where market prices are not available, cost-based techniques may be employed. To illustrate, morbidity impact may be valued using cost of illness approach. The cost of illness normally consists of hospitalization expenses and work loss days.

The Contingent Valuation Methodology (CVM)

The CVM technique entails creating a hypothetical market for the good in question and asking the respondents how much they are willing to pay (WTP) for the good in question. The crucial elements of this approach are the definition of the product, the specification of the payment vehicle, and the framing of the WTP questions. The hypothetical nature of the market makes the application of this technique quite open to a number of biases (e.g. starting point bias, strategic bias) and should thus be carefully considered.

The CVM is applied in such areas as water quality, air quality, biodiversity, and protection of endangered species and land/recreation facilities studies.

APPLICATION OF SELECTED VALUATION METHODOLOGIES IN THE MAKILING FOREST RESERVE (MFR)

The Makiling Forest Reserve (MFR) is a 4,244-hectare (ha) forestland situated in the province of Laguna in the Southern Luzon, Philippines region. The forest is rich with various plant and animal life. The forest contains mostly mixed hardwood stands representative of Philippine forest vegetation, from mixed dipterocarp to mossy forest. Aside from this, native and exotic species have been introduced to enrich and diversify forest life. As of 1989, approximately 53.3% or 2,263 has, of MFR was covered with secondary and natural forest types; 49% (208 has) was covered with forest plantation; 13.6% (577 has) was either cultivated or cleared areas; and about 18.7% (796 has) was open or grassland areas (IFC, 1994).

The forest reserve can be delineated into several land uses of varying economic, social, and educational importance. These land uses include the following: watershed, leased areas, site of the UPLB College of Forestry campus, major project areas and others (see Table 1). The largest land use is devoted to the Makiling Experimental and Demonstration Forest which serves as an educational and scientific laboratory (IFC, 1994).

From these various land uses come a wide array of services and products available to users from all age groups and interest groups. Being a forest reserve, timber extraction is not allowed but collection of fuelwood and selected non-timber products are allowed through some permit system. To the communities living within the reserve, the non-timber forest products are readily accessible in addition to their use of the land for agroforest production systems.

The intended use of the MFR is primarily that of being a laboratory for educational uses and scientific research works to the university communities. Scientists and educators study the diverse plant and animal life found in the forest. There is thus an added pressure to protect the biodiversity of the place. The forest also serves as practicum area for students enrolled in some forestry courses in the University's College of Forestry program.

In addition, the watershed serves the water requirements of various sectors such as the households, institutional users, resort owners, and farmers. There is thus a need to protect the area for this watershed function. An important feature of the MFR is the various sites for recreational activities. These are the Makiling Botanic Gardens, Mudspring, Pook ni Maria Makiling, and Peak 2. The recreational services provided by these sites could be inexhaustible.

Valuation Studies in MFR

Various studies have been conducted to value resources in MFR. Most of these studies are special projects and theses in the BS Economics program of the Department of Economics and hence are unpublished. The publication of these studies in a monograph is now underway and is expected to be completed early next year.

Recreation Benefits

A brief description of the different recreational sites in MFR follows:

1. *Makiling Botanic Gardens (MBG)*. The MBG covers an area of 300 ha, which include an arboretum, nursery, and recreational sites. The natural attractions that include trees and flowers make the botanical garden a socially and economically valuable site. In addition, there are man-made facilities in the area such as the pavilion and swimming pool where social gatherings may be held, and concrete tables and chairs for picnics.
2. *Mudspring*. The main attraction of the area is the craters of boiling mud that emit smoke of sulfuric fumes. These are believed to be the main crater of Mount Makiling which is considered a dormant volcano. The size of the craters expands gradually through time. The Mudspring site is 969 meters away from the main road going to MFR and is a 12–15 minute walk.
3. *Pook ni Maria Makiling*. The whole park extends to an area of 3 ha. It is four kilometers away from the College of Forestry. This place provides picnic areas with concrete tables and benches. There are also playgrounds and a pergola for children. Like the MBG, numerous tree and flower species can be found therein.
4. *Peak 2*. This is a famous trail which traverses the forest reserve and ends up to one of the three peaks of Mt. Makiling. It emanates from the main road leading to the Mudspring and crossing Molawin Creek passing numerous dipterocarp and molave natural forest areas.

Calderon (1990) used the travel cost method to estimate the recreational benefit of the Makiling Botanic Gardens and the Pook ni Maria Makiling along with two other sites in Laguna. The study estimated an average travel cost of P17.33 per visitor, using 1989 prices. The most recent estimate by Econ 175 students placed the average travel cost at P102.37 per visit for MBG.

The contingent valuation methodology was also used to assess how much people are willing to pay to improve facilities in the Mudspring and in Peak 2. The results as shown in Table 2 reveal that the average willingness to pay (WTP) for improvement in Mudspring is P26.32 per visit and P21.78 per visit for Peak 2.

Valuation of the Protection of the Watershed Function of MFR

Soguilon (1996) used the CVM to obtain how much current users are willing to pay to protect the MFR for its watershed function. The results of the study showed that WTP varies by type of users and by the mode of collection. The household sector on the average, would be willing to pay P95.88 for a one-shot donation to protect the area. If instead, a monthly fee will be sought, they are willing to pay P26.23, while a monthly donation of only P1.38 can be expected from them. The farmers would be willing to pay the least with none for monthly fee to P11.07 for a one-shot payment. Their yearly donation would only be P5.33. The resort owners have direct business interests for the protection of the area, hence they are willing to pay more. The average WTP for this user group is P251.67 for a one-time fee or P68 for a yearly donation. The monthly donation was estimated at P10.67.

The value of the MFR for watershed may also be inferred from how much people spend to protect themselves from water quality deterioration. A study by Cruz (1996) reveals that 20% of the households living in Pleasantville and 13.3% in the Forestry area purify their water. More fetch water from other sources with 73% in Pleasant Ville and 56% in the Forestry area.

Defensive mechanisms by those households who perceived problems in their water quality include boiling of water, filtering and purifying of water, using mineral water, and fetching water from another place. Estimates of defensive expenditures were given in the study but were not expressed in annualized value, particularly for those using water purifier. Revisions in estimates are being prepared through a follow-up study.

The study also estimated peoples' WTP for water quality improvement. The value obtained ranges from P50 to 300 per month.

Table 2. Valuation of Goods and Services Derived from the Makiling Forest Reserve

Good or Service	Value	Valuation Method
1. Recreational Sites		
a. Pook ni Maria Makiling	Per Visit: P294	Travel Cost Method (TCM)
b. Botanic Gardens	Per Visit: P19.07	Contingent Valuation Method (CVM)
c. Mudspring	Additional WTP with Improvement Per Visit: P26.32	TCM
d. Peak II	Per Visit: P21.78	CVM
2. Watershed		
Users: a. Household	One Time: P95.88 Per Year: P26.23 Per Month: P1.38	CVM
b. Farmer	One Time: P11.07 Per Year: P5.33 Per Month: P0.00	CVM
c. Resort Owner	One Time: P251.67 Per Year: P68.00 Per Month: P10.67	CVM
Water Quality Improvement	P112.67 in Forestry area and P220.30 in Pleasantville	CVM
	1997 study using Defensive Expenditure	On-going
3. Minor Forest Products	P1,616 per year for fuelwood to P8,600/yr. for ornamental products*	Market Price Value and opportunity cost
4. Forest Trees: Carbon Sequestration Function	On-going	Value of related good
5. Biodiversity	P156/yr.	CVM

The average WTP is P112.67 for those in the Forestry area and P220.30 for those living in Pleasant Ville. About 23% of the respondents in the Forestry area have WTP = 0 while only one out of the 30 respondents in Pleasant Ville is not willing to pay anything.

VALUE OF MINOR FOREST PRODUCTS TO THE RURAL ECONOMY

Minor forest products refer to all the products of the forest, other than timber, such as fruits, seeds and seedlings. Punzal (1994) estimated how much sample households in MFR derive from the forests in terms of non-timber forest resources. She estimated that on the average, those households collecting forest products collect P1,616 worth of fuelwood to as high as P8,600 worth of ornamental product such as Palosanto (Table 3).

The study by Sasing (1994) made use of a tree-valuation approach to estimate the value of non-timber products vis-a-vis the timber

Table 3. Value of Non-timber Products Gathered by Some Households from MFR

Non-Timber Forest Product	% of Households Collecting	Average Value/Yr.
Fuelwood	55	P1,616
Fruits: kaong	2.5	180
Seeds:		
Mahogany (*Swietenia Macrophylla*)	36	585
Narra (*Pterocarpus indicus*)	12.5	550
Palomaria (*Leucaena leucocephala*)	7.5	800
Gimelina (*Gmelina Arborea*)	7.5	1,200
Ornamentals		
Mahogany pulp (*Swietenia Macrophylla*)	32.5	2,800
Mahogany shell (*Swietenia Macrophylla*)	32.5	1,060
Kaong Stem (*Arenga pinnata*)	17.5	165
Pakpaklawin (*Asplenium musaefolium*)	22.5	240
Palosanto (T*riplaris cumingiana*)	22.5	8,600
Spanish cedar (*Cedrela odorata L.*)	17.5	3,800
Wildlings		
Mahogany (*Swietenia Macrophylla*)	12.5	260
Narra (*Pterocarpus indicus*)	7.5	185
Jade vine (*Strongylodon macrobotrys*)	7.5	80
Gimelina (*Gmelina Arborea*)	7.5	50

resources. The approach entails estimating the timber value per tree of selected species and valuing the non-timber resources of the same tree species. She found out that for all tree species evaluated, the timber value is less than the non-timber resource. A critical factor in the estimation is that the non-timber products are available in a stream flow over a long period of time whereas the timber product is available only at the end of the crop rotation.

BIODIVERSITY

There are 225 families, 949 genera, 2,038 species, 19 subspecies, 167 varieties and many numerous cultivars of flowering plants and ferns within MFR. These species may not have any direct use value at the moment but could also be useful at some future time. Some people may also be willing to pay certain amounts just for the mere existence of these diverse species.

Espiritu and Quimbo (1996) also made use of the CVM to obtain WTP for the conservation and protection of MFR. An average WTP of P156 per household was obtained in their study.

CONCLUSION

The valuation of resources found in the watershed area is important in assessing impacts of changes in the watershed. These changes may have detrimental impacts or beneficial impacts if the nature of the change is intended for the protection of the resource. In general, the change will also have positive impacts, largely in terms of short-term economic effects. However, there are often long term environmental damages associated with the realization of the economic benefits. A rational judgement on whether said changes are worth carrying out entails a comparison of their costs and benefits. The watershed approach of evaluating impacts is needed to make sure that all relevant effects are captured in the analysis.

There is now a wide array of choices of techniques to put monetary value on the impacts of changes carried out in the watershed area. Some are fairly straightforward to use while others need careful design and implementation for them to be useful and reliable. At present, there are several textbooks on resource valuation that can be used to ensure that application of these tools has sound theoretical validity.

APPENDIX A

REVIEW OF SELECTED STUDIES

Nena O. Espiritu

Numerous methodologies are available to elicit economic values. They may be grouped into three broad categories: market creation techniques, methods based on surrogate or implicit markets and the production function approaches. A number of case studies done in developing countries are reviewed in this section. It was evident that little empirical work on valuation studies has been done in the Philippines and other developing countries. However, enough evidence exists to show that the techniques can be used to elicit orders of magnitude estimates. What is needed, therefore, are more studies on the application of valuation concepts and methodologies.

Market Creation Techniques

Market creation techniques are also known as contingent valuation methods. This method is particularly useful when data are unavailable to value the environmental effects of a particular project or when relevant market behavior is not observable. These cases include species preservation; historical or cultural phenomena; scenic, ecological or other characteristics; genetic diversity and preservation of open spaces; unobstructed views or public access to amenity resources.

The contingent valuation method uses a direct approach — it basically asks respondents how much they are willing to pay for a benefit, or how much compensation they will be willing to accept to tolerate a cost. The individual's behavior is inferred from the answers he provides in a survey framework. The aim of the contingent valuation method is to elicit valuations which are close to those that will be revealed if an actual market existed. This method is applicable for valuing a wide range of non-priced environmental good or service. However, it is more effective when the respondents are familiar with the environmental good or service in question. The success in the use of this method also lies in the design, implementation and interpretation of questionnaires.

A number of studies have been conducted to apply the contingent valuation method for eliciting economic values. A survey was done to estimate the value of viewing elephants in Kenya. Respondents were asked their willingness to pay to maintain the elephant population at current levels through increased enforcement activity. The average value was US$89 and this yields an annual viewing value of US$25 M (Brown and Henry, 1989).

Whittington, et al (1990) tried to estimate the consumers' willingness to pay for an improved water system in a village in Southern Haiti. Results of the study showed that willingness to pay for a new water system was positively correlated with income, the cost of obtaining water from existing sources, and the education of members. It was negatively correlated with the individual's perception of the quality of water at the traditional source used before the construction of the improved water supply system. The researchers also concluded that it is possible to obtain reasonable and consistent answers in a contingent valuation survey conducted among a very poor, illiterate population.

A contingent valuation survey was conducted in Lake Danao National Park, Ormoc City, Leyte to study the recreation and preservation benefits of the park. The study was able to elicit a willingness to pay estimate worth P118/year for urban respondents and P89/year for rural respondents.

Recreation demand is also significantly influenced by year of education, household size, household annual income, number of visits per year to the park, number of days spent on places other than the forest, willingness to pay for an entrance fee, environmental attributes preferred, organization membership and household locations (Predo, 1995).

Espiritu and Quimbo (1996) applied the contingent valuation method to elicit estimates of willingness to pay for the conservation and development of the Makiling Forest Reserve. Majority of the interviewed households answered positively when asked of their willingness to pay for the protection and conservation of the forest reserve. The average estimate was P156 per household.

The CVM was also done in 1980 to estimate the economic value of Lumpinee Park, a Thai national park. Visitors for recreational purposes indicated a slightly lower willingness to pay for yearly contributions to maintain the park than visitors who came for morning and evening exercises. The willingness to pay of park users was estimated at 13 million baht per year. The study also concluded that the welfare gain associated with the continued existence of the park is clearly demonstrated (Grandstaff and Dixon, 1986).

Methods Based on Surrogate or Implicit Market Values

Travel Cost Method (TCM)

The travel cost method has been extensively used in developed countries to value recreational goods and services. This method seeks to determine the demand for a recreational site as a function of such variables as consumer income, price and various socio-economic characteristics. This method is based on the simple proposition that an individual's observed behavior can be used to derive a demand function and to estimate a value for an unpriced environmental good by treating travel costs as a surrogate for variable admission fees. To estimate the recreational value of a site, this method uses the amount of time and money spent by visitors in travelling to a site as price proxies, together with participation rates and visitor attributes.

A study was conducted to measure the value of domestic ecotourism at a tropical rainforest site in Costa Rica using the travel cost method. By observing travel behavior, the researchers found that Costa Rica visitors are willing to pay US$35 per domestic visit. The study finds that visitation is highly correlated with education and that households in areas with high population densities make more trips (Tobias and Mendelsohn, 1991).

In another study, TCM was used to estimate a demand function for safaris in Kenya. The analysis is based on a survey taken from samples of approximately 80 percent of tourists who came either from North America or Europe. The price of safari is defined as the sum of land travel costs, airfare and travel time costs. The estimated economic value of a safari yields a viewing value for elephants of US$23M to US$27M per year (Brown and Henry, 1989).

The Lumpinee Park in Thailand was also used as an example of travel cost analysis in a developing country setting. The travel cost model used was of the standard form, i.e., visitation rates were assumed to be a function of total travel cost, availability of substitute sites and income (Grandstaff & Dixon, 1989).

Ygrubay (1994) implemented the benefits transfer approach to value the positive benefits to society of nature-based recreation. Borrowing the travel cost method estimates abroad, valuations focused on recreation amenities provided by visiting forest-based national parks, game refuge, birds and wildlife sanctuaries and by visiting coastal resources such as beaches or seashore parks. In 1988, benefits derived from use of coral reefs for scuba diving amounted to P0.97 M and P2.6

M in 1992. Visits to national forest parks were valued at P12.9 M in 1988 and about P18.4 M in 1992, in constant 1988 prices.

Calderon (1990) used the travel cost method to study the recreational value of forests by including 5 recreational areas in Laguna as study sites and by interviewing more than 1,800 visitors. An average value of P17.33 per visitor was derived from the study.

The travel cost method was successfully applied to study the economic impact of the creation of a national park in Madagascar. The model examines the allocation of trip choices to Madagascar and other international nature tourism destinations as a function of travel costs, socio-economic characteristics, and quality variables. The model was then used to predict the project benefits to tourists. The average increase in willingness to pay per trip was estimated to be $24 per tourist (Kramer, Sharma and Munasinghe, 1995).

Hedonic Price Approach (HPA)

This is another example of the surrogate market technique. The hedonic price approach attempts to identify how much of a property differential is due to a particular environmental difference between properties and to infer how much people are willing to pay for an improvement in the environmental quality that they face and what the social value of improvement is (Pearce and Turner, 1990). Studies on hedonic price method usually assume that price of a property is dependent on site variables, accessibility variables, neighborhood variables and environmental variables of interest. Carefully carried out, this approach can provide measures of willingness to pay for environmental quality.

This method has limited applicability in developing countries because it relies on housing markets that function fairly well, as well as sophisticated information and tools of statistical analysis. Jimenez (1983) used these techniques to explain changes in housing prices in the Manila slum area, which were upgraded due to water and sanitation service improvements.

Production Function Approaches

Also known as dose-response relationships, this method is the most familiar valuation technique suitable for examining the effects of environmental quality on products that enter into market transactions. The basic assumption in using this method is that changes in environmental quality can decrease (or increase) the quantity and quality of products being marketed.

A valuation study was conducted to evaluate the revenues generated by fishing and tourism with and without ban on logging in Bacuit Bay, Palawan. The researchers found that if logging was banned, gross revenues from tourism and fishing would continue, but at reduced rates because of damage from sedimentation. Gross revenues from logging, tourism and fishing was computed as $25 M. The study concluded that it is preferable to ban logging and maintain the fishery (Hodgson and Dixon, 1988).

Another study was conducted by Briones (1986) on the benefits of watershed management of a multi-purpose dam to be built on the Lower Agno River to supply hydroelectricity, irrigation water, and flood control as well as improved water quality. The study shows that by introducing a watershed management scheme (involving afforestation, soil erosion control, and forest protection), the costs of sedimentation damage caused by mine tailings in the dam reservoir was reduced from $30 M to $14M. The study concluded that the management scheme showed net benefits: the costs of introducing a management scheme were less than the expected costs of sediment damage.

APPENDIX B

DEALING WITH THE COUNTRY'S MULTITUDE OF WATERSHED RESOURCES: A STRATIFICATION STRATEGY

Herminia A. Francisco

The National Water Resources Council (1976) delineated the Philippines into twelve (12) water resources regions as basis for developing comprehensive plans for water resources in the country. The country's water resources are however, divided into 419 river basins of varying sizes and characteristics. Since it is not possible to study all of these basins or watersheds, one may start with one of a few watershed units in doing the valuation study. It is suggested that the characteristics of the sample watershed(s) be explicitly described in the report so that some site specific characteristics will be noted before the results of analysis obtained from the study sites can be compared with other watersheds in the country.

One way of handling the situation is through the development of a stratification scheme for the country's watershed resources. With a well-defined stratification system, the analyst can easily identify to which stratum the sample watershed(s) belong. Since each stratum will have a defined range of biophysical and socio-economic characteristics or descriptors, one can classify the different watersheds of the country into the various strata. In the future, as more budget and time will permit, sample watersheds from each stratum may be subjected to a more in-depth analysis.

There are several ways of classifying watershed resources. A first level classification could be by agro-climatic zones. There are four (4) agro-climatic zones in the Philippines: Type I which has two pronounced seasons; Type 2 with no dry season but a very pronounced maximum rainfall; Type 3 wherein seasons are not very pronounced; and Type 4 where rainfall is more or less evenly distributed.

The watershed resources can be classified into whether they are "critical" or "non-critical" based on definitions of the Department of Environment and Natural Resources. Descriptors of these two types normally include, among other things, extent of forest cover, size of drainage area, volume of water production.

It is also possible to base classification in terms of the predominant land use, i.e. whether dominated by forestlands, grasslands, human settlements, etc. Still other relevant descriptors could include relief or topography, size, erosion hazards, and land suitability. The Bureau of Soils and Water Management has completed a 10-year data collection project for most parts of the country, except on some fairly inaccessible upland areas. With 70% of the country's land area classified as watershed, it is most likely that there are a number of watersheds where significant amount of data are already available.

Delineation of the Sample Watershed into "Production Units"

The sample watersheds could further be delineated into several production units on account of the multiple uses of most watershed resources in the country. The "production units" may correspond to varying land uses found in the resource unit. These land uses can include: timber forest (also referred to as production forest since it is grown mainly for timber production) and protection forest which serves as wildlife sanctuary, recreation site, and storage of genetic biodiversity. The protection forest represents the "no touch" zone since this area is intended for the provision of non-marketed though economically and socially desirable services. There can also be a plantation forest within a watershed, which consists of even-aged tree species catering to particular uses such as paper and pulp. The classification may also include agroforest farms, which may further be delineated into agroforest farms in public lands and those in private lands. The usefulness of the said distinction is seen more in the light of policy implication of varying performance of the farms under the two-property rights structure.

There can also be croplands within the watershed area. The croplands can be distinguished in terms of whether the crops are perennials or annuals. It is expected that the impact of these two land uses on the hydrologic processes will be different, thus, necessitating the distinction. There can also be grasslands and water resources within the watershed that must be accounted for and described.

Resource Assessment to Identify Quality Classes or Varying States of Degradation

For forest-based resources, important descriptors of status of resource degradation include access to the resource, density of stock, volume or height of standing stock, and relative maturity of the tree species. A combination of these factors to the extent possible may be useful in delineating quality classes of the different land use categories.

For crop-based systems like agroforestry and crop production, the relevant descriptors may be type of production system, type of crops, fertility class of the lands, and land suitability of the farms. For grasslands, the suggested descriptors include extent of forage cover, livestock density, and degree of management. For surface waters, the use of the water is important as well as the amount.

Some studies indicate that in the early '80s, there are 70% watershed areas, which have become both unproductive and hydrologically unstable due to various degrees of degradation and abusive land use practices (Alvarez, 1984; Saplaco, 1984; Veracion, 1984). One can only expect that the extent of degradation in the current period is much worse than the figures in the 1980s on account of the massive deforestation and increased upland population growth taking place.

It is said that the most significant manifestation of watershed degradation in the country is the degree of erosion and sedimentation taking place. As early as the '70s, erosion and sedimentation are recognized as the most serious environmental problems of the country and in other developing tropical countries. It is thus not surprising that a number of studies done in the country (Francisco, 1986; Cruz, et al., 1987; Briones, 1985; Hodgson and Dixon, 1988) has focused on valuing the environmental impacts of soil erosion and sedimentation.

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