Chapter 1
Introduction: Values and valuation are the key

PHILIPPINE COASTAL RESOURCES—A STORY OF DEGRADATION

The coastal ecosystems of the Philippines are some of the most productive and biologically diverse in the world. The Philippines, as part of the Southeast Asian region, lies in a rich biogeographic area in which most higher taxa of shallow-water marine life reach the peak of their species diversity. This diversity is associated with high primary productivity and high fishery yields. The productivities of some tropical marine ecosystems are given in Table 1.1, which highlights the relative productivity of mangroves, seagrass beds, coral reefs, estuaries and upwelling zones. These systems are responsible for much of the fish catch and marine food production in the country and for many other economically important activities.

Table 1.1. Primary productivity of some major marine communities[131].

Community type	Primary productivity (grams carbon/m^2/year)
Mangroves	430 - 5,000
Algal, seagrass beds	900 - 4,650
Coral reefs	1,800 - 4,200
Estuaries	200 - 4,000
Upwelling zones	400 - 3,650
Continental shelf waters	100 - 600
Open ocean	2 - 400

Coastal ecosystems in the Philippines and all over Southeast Asia are under severe stress from the combined impacts of human overexploitation, physical disturbance, pollution, sedimentation and general neglect[26, 66]. Although this region is the tropical marine and coastal biodiversity center of the world, the decline of coral reef, seagrass, mangrove and estuarine quality and productivity is disturbing. Surveys in the 1980s and 1990s have shown that more than 75% of the coral reefs in the country have been degraded from human activities (Table 1.2)[26, 52, 53, 134].

Table 1.2. Status of Philippine coral reefs based on surveys by three projects[26, 52, 53, 134].

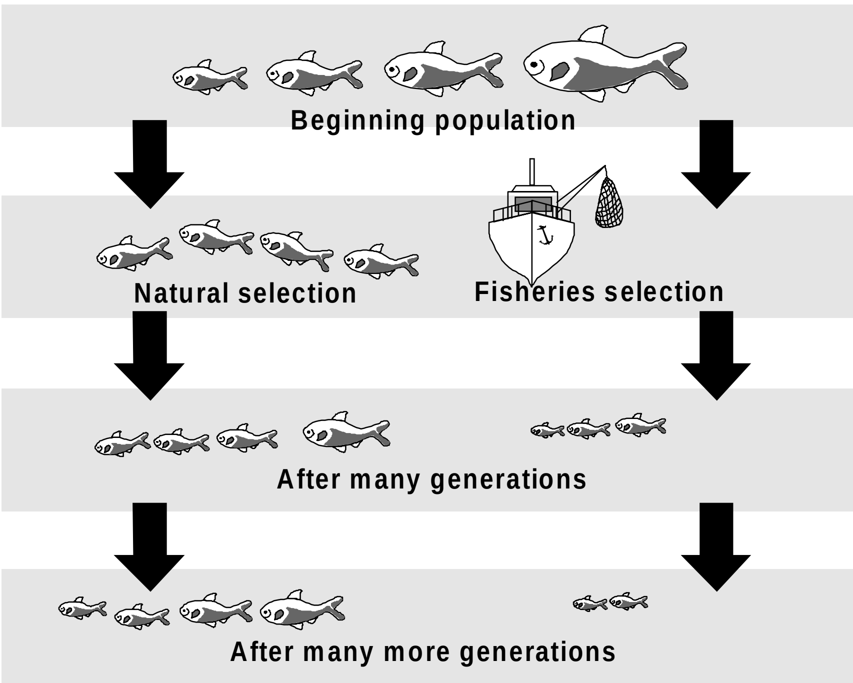
		% living coral cover							
Project sites	**No. of transects** *(Station)*	**Excellent** *(75-100%)*		**Good** *(50-74.9%)*		**Fair** *(25-49.9%)*		**Poor** *(0-24.9%)*	
		No.	%	No.	%	No.	%	No.	%
Philippines[a] *(various)*	632	35	5.5	153	24.2	242	38.3	202	32.0
Philippines[b] *(various)*	103	4	3.9	32	31.1	46	44.7	21	20.4
Lingayen Gulf[c] 1988	40	0	0	18	45.0	17	42.5	5	12.5

[a]University of the Philippines Marine Science Institute (1985)
[b]ASEAN-Australia Living Coastal Resource Project
[c]ASEAN-US Coastal Resource Management Project

Mangrove resources are in no better condition than coral reefs in the Philippines. Since 1918, the mangrove cover in the country has declined from about 450,000 ha to less than 150,000 ha in 1988[40]. The most rapid decrease occurred in the 1960s and 1970s when government policies encouraged the expansion of aquaculture during a period when real prices for fish and shrimp were steadily rising[101]. National laws prohibit the cutting of mangroves, except in specified management areas. Nevertheless, this ecosystem type continues to decline at a rate of approximately 2,000 to 3,000 ha/year[124].

Fisheries of all kinds in the Philippines are near or have surpassed sustainable levels of catch. Most studies show that all important fisheries are overfished and that the real return in terms of volume of catch and economic value is declining[86, 87, 94]. In some cases where volume has increased, the catch composition has changed to a lower value of catch because of changes in the ecological make-up of the fishery. The causes are complex but the bottom line is that fishing effort is greater than the resource can support, fishery recruitment is limited and habitats are degraded. Because catch per unit effort has decreased dramatically over the last fifty years, there are now fewer fish and a lowered reproductive capacity as shown in Figure 1.1.

Figure 1.1. Long-term impacts of overfishing will decrease the size and abundance of fish in the ocean[19].



While recognizing the condition of coral reefs, mangroves and fisheries, it is important to highlight the commonality linking these systems together and also connecting them to land: water. Water and its transport role is crucial since pollution of all kinds can easily be carried by water to affect living coastal resources. We often assume that the absorption capacity of the ocean is unlimited but we now realize this is not true. As the sea becomes more polluted, living coastal resources will be lost at an increasing cost to society.

The most important factor linking the ecosystems together and the one that values their products and services as well as being responsible for their use and abuse is the human element. Humans have of course created the whole situation of overuse and degradation by not being sensitive to the 'carrying capacity' of both the local and global ecosystems of which we are a part. Coastal systems are particularly vulnerable to human abuse because more and more people are living, working and recreating in coastal areas. This highlights the need for limits to population growth if we want to manage our natural resources for the future.

WHY MANAGE OUR COASTAL RESOURCES?

The reason we must manage our coastal resources is that they are a huge natural and economic resource in the country in terms of food supply, livelihood, other revenue and quality of environment. Management, which implies wise use and maintenance of the resource, is crucial to ensure the continued productive stream of net benefits without inputs from humans. In other words, we can simply harvest and use fish, mangroves, clean water, beaches, estuaries, without any investment, so long as we do not damage the ecosystem or overexploit the natural production levels of each system and its products.

The problem in the Philippines and many other tropical countries, simply, is that we are damaging and overexploiting all the coastal ecosystems and their natural ability to produce to the point of doing permanent damage to the system. This means that in the future we will have much less resource left and its net natural productivity will be significantly reduced or there will be nothing left. An analogy would be letting termites eat the foundation of our house. At first the effects would not be too noticeable but one day it would collapse! This is also the case for fisheries—one day they may just disappear or at least decline significantly as seen in fisheries for lobsters, grouper, some species of tuna and others.

One way to encourage us all to improve our management, protection and support for these natural coastal ecosystems is to place economic values on their presence, products and uses. As a society, we tend to value money and we understand costs and benefits in monetary terms. Thus, the information in this book is intended to portray the economic values of coastal resources so that we may place more importance on their management and long-term protection. This will hopefully improve our commitment and quality of response in managing these resources. It can also help us justify the investment required to manage our use and to control our abuse of coastal resources.

CONCEPT OF "VALUE" AND COASTAL RESOURCES

"Because ecosystem services are not fully 'captured' in commercial markets or adequately quantified in terms comparable with economic services and manufactured capital, they are often given too little weight in policy decisions. This neglect may ultimately compromise the sustainability of humans in the biosphere."[35]

Resource valuation is an essential component of sustainable development. To assess options for resource management, the decision maker needs to be provided with complete and accurate information on the potential impacts of these decisions. In the past, the traditional approach was to conduct financial and economic cost-benefit analysis of the "priced" goods and services. Natural resource inputs were ignored because scarcity was not an issue then and because of the difficulty of assigning values to these services and functions.

Resource valuation provides an interface between economics and the physical sciences such as ecology, engineering or agronomy. While the hard sciences provide the physical relationships, economics provides the concepts and methods behind the valuation process. This enables biophysical goods and services to be reduced to a common unit understood by all stakeholders: money.

It is necessary to understand the basic concepts of resource valuation, economic value and methods to conduct valuation. The valuation techniques presented here are based on the research of selected economists[14, 43, 76].

What is resource valuation?

Resource valuation is the process of assigning a measurable value, usually monetary, to a particular resource, product or activity. The valuation process uses a number of monetary valuation methods to account for use and non-use values of resource systems.

The valuation of natural resources is not the same as the valuation of ordinary goods and services. The value or worth of a particular good is equivalent to the price determined by the market based on supply and demand conditions. Natural resources such as forest and coastal resources can also be priced according to the market goods they produce. However, this value can only reflect the partial value of the resource because natural resources provide other and oftentimes, more significant values, on top of those already priced in the market. For example, forest resources are traditionally valued according to the amount of timber, logs or plywood produced and coral reefs are valued according to the quantity of fish caught. This is convenient because only timber, logs and fish are bought and sold in the market. What we have missed among other things is that forests and coral reefs provide services by minimizing the costs associated with coastal erosion. For example, forests stop floods by retaining water while coral reefs serve as buffers against wave action. In these cases, a cost avoided is a benefit. Some common "goods" and "services" of coral reefs and mangroves are shown in Table 1.3.

Biodiversity conservation is one of the most important benefits (services) attributed to coastal ecosystems in their natural state. Biodiversity in the broad sense is a driving force of marine conservation activities in the Philippines as indicated by the existence of the Philippine National Biodiversity Strategy and Action Plan and the International Convention on Biological Diversity. Biodiversity can be equated with the continued healthy existence of these valuable marine ecosystems. The associated biological resources provide food, medicine, chemicals and other products used by society. In addition to the already well known uses of these resources such as food, it is the still undiscovered uses such as for new medicines and their overall role in the continued viability of the system into the future which really make "biodiversity" so valuable to humans. An example is the ongoing research for anti-cancer chemicals from some coral reef

Table 1.3. Selected economically valuable "goods" and "services" of coral reefs and mangroves.

Ecosystem	Goods (Consumptive or direct use values)	Services (Non-consumptive or indirect use values)
Mangrove forest	Wood Fish Crustaceans Mollusks Medicinal products	Sediment sink Nutrients for fisheries Habitat Support roots Water filter Biodiversity
Coral reefs	Fish Crustaceans Mollusks Coral rock Marine plants	Recreation opportunities Coastal protection Research venue Education outlet Biodiversity

organisms. Thus, this benefit, although often difficult to value economically beyond the marketable products it produces, cannot be ignored in the valuation process for coastal resources.

Two procedures in measuring environmental costs and benefits are: (1) determining the physical impacts and relationships; and (2) valuing the benefits and impacts in monetary terms[76]. The first establishes the impacts or potential impacts of a particular management option on the natural resource base. Management options cover the broad spectrum of resource use options from pure conservation to various forms of development. This procedure is usually performed by engineers, ecologists and other experts. Valuing the benefits and impacts economically requires economic analysis and skills and often entails discounting costs and benefits which will occur in the future so they can be measured in the present. Both are dealt with in this book.

What are the components of value?

Total economic value (TEV) consists of use and non-use values[44]. Use value measures the consumptive value (direct use values) of tangible natural resources such as fish, timber, water, as well as non-consumptive (indirect use values) ecological and recreational uses of natural resources such as diving, swimming, boating, bird-watching and picnicking (Figure 1.2). Use value consists of direct, which can be classified as "goods" and indirect use values, which can be classified as "services".

Non-use (or vicarious) values may still be derived even if individuals do not use the resource directly. Existence value, which is also known as preservation value, may be denoted as the value to a human of knowing that a resource, that he or she never intends to consume, is protected. However, existence value is also frequently defined as option value (the value of natural resources for future generations) or bequeathment value (the value of endowing a natural resource to posterity). Option value is the willingness-to-pay (WTP) for the option of using/consuming the resource in the future. Option value also represents the willingness-to-pay for future use of yet undiscovered qualities such as medicinal use of a plant or marine organism.

Valuation efforts should attempt to aggregate both use and non-use values of natural resource systems to assess the total economic value as indicated in Figure 1.2.

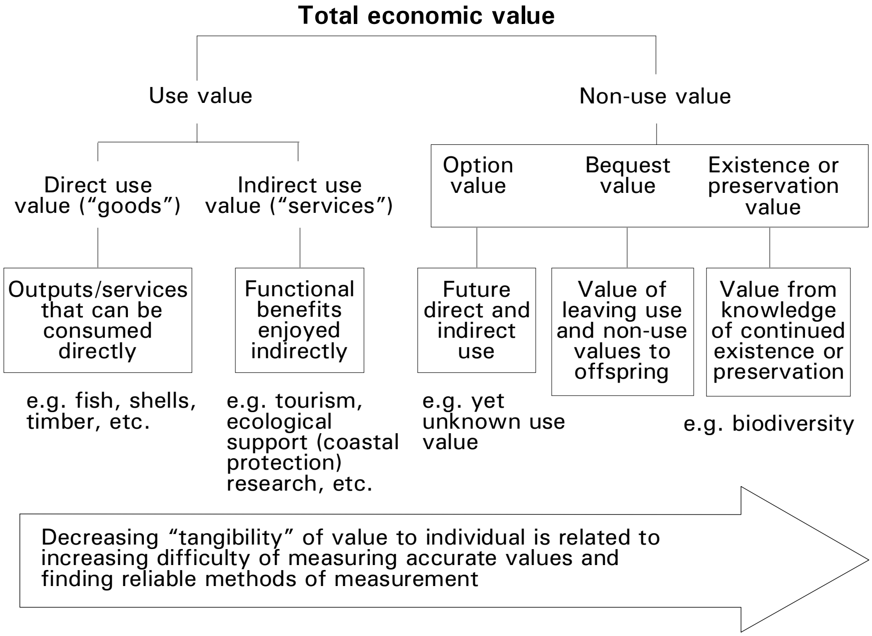
Valuation techniques

The common valuation techniques in use are few and only the most important are discussed below. The purpose of understanding these techniques is to know when they can be used appropriately. They are the means to finding the common denominator of value: money.

A. Conventional or direct valuation methods

Direct valuation methods are used when changes in production or productive capacity of a certain good or service can be measured. Here, willingness-to-pay is taken to be equal to market price. Surrogate prices and opportunity costs are used in lieu of market prices when non-competitive markets exist.

Figure 1.2. Types of resource values[76, 104].



- **Change in productivity** estimates changes in production arising from a particular intervention or natural resource state and is most often used for coastal resource valuation. We need "before" and "after" or "management versus no management" production estimates with the same parameters and assumptions used to measure the changes. The values captured are direct use values derived from extractive uses of outputs from the natural system. Most case studies on coral reef and mangrove valuation involving fisheries and wood production use this technique[10, 25, 58, 64, 92, 100, 104].

- **Loss of earnings** estimates foregone earnings arising due to morbidity or mortality associated with changes in environmental quality and is used in estimating impacts of pollution and industrial hazards. A direct dosageresponse relationship must be established between the pollutant and the human or environmental health problem for this method to be effective. This technique needs an assessment of the "before and after" scenarios and requires health care data as well as epidemiological studies.

- **Opportunity cost approach** estimates the costs of foregone development benefits as criteria for decision-making. It is most appropriate in evaluating conservation versus development options, i.e., large infrastructure projects which may require conversion of natural coastal systems. It requires estimating the non-use values associated with preservation of natural habitats. It uses a conventional cost-benefit analysis to determine net benefits of development options in relation to benefits of preservation. Various studies have used this method to illustrate the tradeoff between different development options[16, 36, 46, 64].

- **Actual defensive or preventive expenditures** measure the value people are prepared to spend on preventing damage to themselves or the environment. Examples are expenses incurred to avoid or reduce unwanted environmental impacts such as coastal erosion or water pollution. This approach provides only a minimum estimate of the value of environmental services, since it cannot be higher than an individual's ability and willingness-to-pay (WTP), which is usually constrained in developing countries[133].

B. Indirect or hedonic market methods

No market exists for most environmental goods and services. However, these commodities can be related to market commodities. Recently, resource economists have expanded the border of markets by estimating environmental functions and indirect economic goods using surrogate prices and by "constructing" hypothetical markets. This technique is often called surrogate price technique because the price of market commodities is "borrowed". For example, potable water from an upland stream does not have a price but what can be used in the valuation process is the charge imposed by the utilities firm for water access and use. We can also value ecological benefits of mangroves such as litter and flood prevention. For example, the "cost" of maintaining mangrove biodiversity can be estimated by determining fees students or tourists are willing to pay to study the site while the "cost" of litter and other organic matter can be taken as the price of shrimp feed. The tendency to incorporate "new" ecological attributes, such as biodiversity and energy values, has increased the total economic value of mangrove forests and other ecosystems.

- **Property value** measures to what extent real estate is affected by environmental quality parameters. The basic process is to compare the prices of houses in polluted areas with similar neighborhoods endowed with a better environmental quality so that we can determine price differentials attributed to environmental parameters. This approach has been applied to wetlands valuation in Florida fisheries[15] and could be applied in Philippine coastal areas to show the relative worth of clean versus polluted beach front property.

- **Travel cost** determines the value people ascribe to recreational sites. It quantifies the total value of a site by calculating transportation costs, entrance fees, food, hotel as well as opportunity cost of travel time which considers lost time at work and foregone income. It assumes that the demand for recreation at the particular site is a function of environmental quality. The travel cost method is often used to support or cross-check other methods such as willingness-to-pay and could be used to value Philippine coral reefs among foreign scuba divers [34, 47, 59].

C. Contingent valuation or methods using surveys to determine potential expenditures or willingness-to-pay

These methods determine willingness-to-pay or willingness-to-accept of individuals for certain environmental goods/services which are not priced. These techniques are also thus categorized under "constructed or hypothetical" markets, because questions posed regarding some environmental attributes presume that such a market exists.

- **Willingness-to-pay** refers to questions about certain attributes of the environment and its value to people. Collection of data is usually through a direct questionnaire and survey. This method estimates individual willingness-to-pay and then aggregates values for the target population. It is a useful tool and indicator of value and is used in the Philippines to determine what people will pay for entrance fees to parks, how much they might donate for conservation activities (existence value) and other environmental services[11, 18, 34, 107, 128, 130]. The travel cost method can also be used to measure willingness-to-pay for certain use values such as recreation.

- **Compensation payments** estimate how much payment people are willing to accept as compensation for loss or declining quality of environmental goods or services. Willingness-to-accept values are always greater than willingness-to-pay values. This method has been used in the valuation of losses of marine product resources caused by coastal development in Tokyo Bay[44].

How do we compare benefits and costs to make decisions?

The various valuation methods listed above are normally applied in particular situations depending on the type of information available and the desired outcome of the valuation effort. Some valuation problems are matched with appropriate valuation techniques in Table 1.4.

One of the main reasons for valuing benefits of coastal resources is that once we are able to quantify the benefits derived from the resources, we can perform a benefit-cost analysis of the intervention being proposed to manage or protect the resource. Benefit-cost analysis compares the present value of all benefits (environmental, financial and social) with all costs associated with achieving a proposed outcome. It can give valuable insights into the economic efficiency of management and regulatory actions. The more benefits exceed the costs, the better off society is in economic terms as a result of the activity.

Table 1.4. Valuation techniques appropriate for certain benefits and costs of coral reef and mangrove protection[90].

Benefit/cost category	Suggested valuation technique(s)
I. On-site benefits	
A. Extraction	
1. Commercial fisheries	Market values of unprocessed fish
2. Local consumption	Value of labor input for collection or value of substitute good
B. Ecotoursim	
1. Tourism revenues	Value of services, e.g. expenditures by tourists
2. Recreation	Willingness-to-pay through contingent valuation or travel cost method surveys
C. Scientific or education	Project costs or value of research outputs
D. Biodiversity improvement	
1. Gene resources	Patent values of genetic species
2. Species protection	Production value of species of concern
E. Ecological or ecosystem support	Market value of incremental catches
F. Non-consumptive benefits	
1. Existence	Willingness-to-pay estimates
2. Option value	Willingness-to-pay estimates
II. Off-site benefits	
A. Coastal protection	
1. Erosion control	Replacement cost, preventive expenditure
2. Local flood reduction	Replacement cost, preventive expenditure
3. Beach enhancement	Property value, replacement cost
B. Enhanced recruitment of fish	Market value of fish in other areas
III. Costs (on and off site)	
A. Management of area or resource	Project costs, opportunity cost approach
B. Losses from damage to system	Change in productivity (market value), loss of earnings, compensation payments

In this book, we evaluate the benefits of protecting coastal resources by establishing values for the various resources. The tradeoff of protecting and managing coastal resources with the alternative of not managing the resources and allowing them to be destroyed or degraded can also be evaluated using benefit-cost analysis. The methods summarized in this chapter can be used to perform most benefit-cost analyses and to determine the values of the resources of concern. Now let us explore the coastal resources and their values in greater detail in the succeeding chapters.