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The value of mangroves

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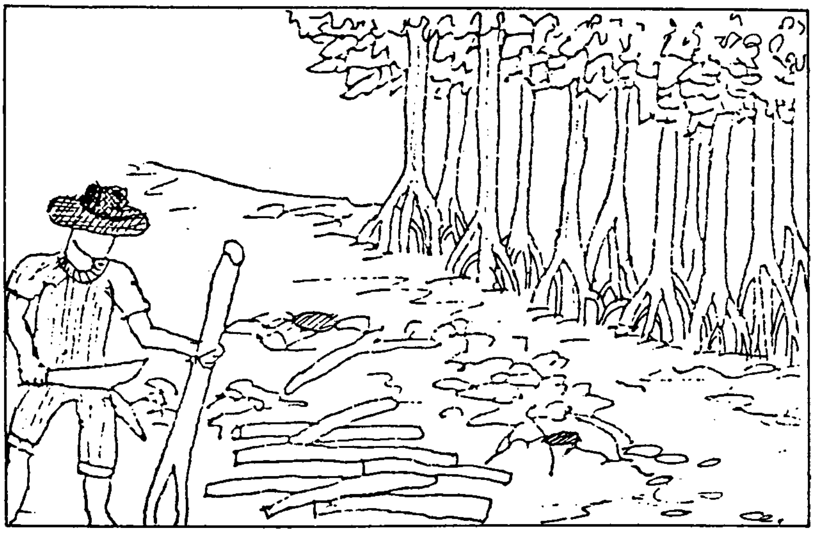
The value of mangroves

Before one could think of converting mangrove areas into another resource, the values should first be considered. The following values of mangroves make it among one of the most productive resources of the aquatic system:

• **Forestry values.** Mangrove species offer benefits similar to those derived from upland forests like wood which are ideal for house materials because they are hard and durable. Families of timber-producing mangrove are *Rhizophoraceae, Sterculiaceae, Sonneratiaceae, Combretaceae,* and *Avicenniaceae.* Many other



non-timber products are also derived from the mangrove forest. Among these are resin for plywood adhesive manufacture, fuelwood and high grade charcoal, tea from leaves of some species, tanning for dyeing; viscose rayon for textile fabric manufacture, livestock feed supplement, medicine and wine (*lambanog*), and vinegar from nipa. Nipa shingles, a popular product from nipa palm find their use in the construction of nipa hut.

• **Fishery values**. Mangrove forests support the fishery resources within the ecosystem, while mangrove swamps serve as a nursery ground or as a permanent habitat for some species. In some mangrove areas, most fishes feed on mangrove detrital material. Other groups of aquatic organism depend on planktonic or benthic organisms - a food supply generated within the mangrove creeks, rivers and estuaries comprise fish, crustaceans, and mollusks. It was reported that the influence of the mangrove ecosystem also extends beyond the mangrove forests limits into the coastal waters. Large quantities of organic detritus are produced in the mangrove and are exported into the coastal zone to support the productivity or organism in the coastal waters.

• **Ecological values.** Mangrove aside from minimizing soil erosion also minimizes pollution of sea water. Its extensive air root system traps eroded soil and industrial pollutants especially during strong rains. Mangrove also aids in reclaiming considerable land area - eroded soil is trapped in the root thickets and later, soil stabilizes and becomes a permanent land area.

Mangrove forests can hardly be uprooted because of their extensive root system. These, therefore, serve as strong shelterbelt against tidal waves, typhoons, and strong winds.

Mangrove forests also serve as habitat of some wildlife such as, birds, rodents, reptiles, amphibians, mammals, and insects. This faunal component helps maintain ecological balance within the mangrove ecosystem.

Values of commodities are determined by the market just as some of the products that can be extracted from a mangrove forest: so many dollars per hundred poles or per kilogram of crabs. Unfortunately, the directly marketed goods (or services) produced by a mangrove ecosystem represent only a fraction of the total array of goods and services that yield benefits to individuals and societies. Mangroves because they are considered as low-value ecosystems becomes prime candidates for conversion to other uses such as aquaculture ponds, infrastructure (e.g., ports, marinas, coastal roads, etc.), agriculture, housing and even garbage dumps.

Direct and indirect costs and expected benefits should be considered when assesing the "development" alternatives being proposed for mangrove areas.

The magnitudes of expected benefits from mangrove conversion can be calculated. For some uses, particularly infrastructure such as ports, industrial sites or housing, the conversion is permanent and the economic benefits from use of the mangrove area is the difference between the costs of conversion (e.g., ports); the value of such uses is very large and the conversion is clearly justified.

In Singapore, for example, the major industrial estate and port of Jurong is partially built on reclaimed mangrove areas. In Malaysia, the new port at Kelang is also built on reclaimed mangrove forest. The justification for other infrastructure developments many not always be as clear because in some areas the final costs of creating dry land from mangrove have been higher than initially projected. In Kelang, for example, a large area of mangrove adjacent to the new port was also converted for industrial development and housing. Due to a variety of economic, locational and engineering factors, this land, reclaimed at considerable expense, lies largely unused; traditional mangrove ecosystem products have also been lost, thereby compounding the economic costs of the project.

For other types of conversion, however, the benefits may be both smaller than anticipated and less permanent. Mangrove soils have proved difficult to manage in some areas on a sustained basis, both for agriculture and aquaculture. In some places, this has led to what was earlier referred to as "shifting aquaculture". Acid sulfate soils are common in mangrove areas and are a major cause of these problems for human-made structures, property damage may be caused by storm surges or typhoons. In either case, the net benefits from conversion are smaller than expected.

Expected benefits are usually documented in any proposal for mangrove conversion . What are often not documented at all , are the opportunity costs of achieving those benefits. Man-

next page ...

Resource or product	**Location**	**Year**	**US$/ha/yr**
Complete mangrove ecosystem	Puerto Rico	1973	1,550
	Trinidad	1974	500
	Fiji	1976	950-1,250
	India	1985	11,314
Fishery products	Trinidad	1974	125
	Fiji	1976	640
	Various	1977-1990	538
	Indonesia	1978	50
	Thailand	1982	30-100 (fish) 200-2,000 (shrimp)
Forestry products	Trinidad	1974	70
	Indonesia	1978	10-20 (charcoal, wood chips)
	Thailand	1982	30-400
	Malaysia	1980	25 (charcoal, firewood, poles)
		1986	11,561 (sustained harvest)
Matang Forest Reserve	Malaysia		
Fisheries			750
Forestry			225
		Total	975

Values placed on mangrove systems. From "Mangrove conversion and brackishwater pond culture in the Philippines. JH Primavera. 1992. Phil. Wetland Workshop Proceedings. p. 82.

grove-derived goods and services that would be lost by conversion should be assessed in full range.. This is the true "opportunity cost" of conversion, that, what society must give up to use the mangrove for a port, an aquaculture pond or a housing estate. Measuring this opportunity cost, however, has proved very difficult.

Measuring Economic Values

The difficulty in measuring the true economic value of a mangrove stems from two factors: (1) some products or services do not have market prices; and (2) the goods and services produced occur both within the mangrove and outside of it. To a large extent, the within-mangrove, on-site goods and services are land-based, while the off-site effects are usually aquatic or coastal, reflecting the mangroves' role as a bridge between the sea and the land. The wide variety of goods and services produced by a mangrove ecosystem, from the tangible production of poles or crabs to less tangible aspects like nutrient flows or breeding habitat. The production of goods and services and the interaction of both fresh- and saltwater result in dispersed locations for mangrove products.

When the value of an existing mangrove forest is assessed, the analysis traditionally has included only those marketed items like poles, charcoal, woodchips and mangrove crabs.The value of these products is frequently small compared to the expected benefits from conversion; consequently, extensive mangrove areas are converted each year in the name of "economic efficiency." As knowledge has been gained of the ecosystem interactions in mangroves, greater attention has been paid to those that occur off-site but are marketed. These largely consist of fish and shellfish caught in adjacent waters.

Goods and services without market prices are usually ignored. For some of these goods and services, the valuation problem is due to its subsistence role in the local economy (e.g., traditional medicine, minor mangrove forest product). For others, identification and quantification of the effect are sometimes a problem (e.g., storm surge protection) and placing monetary values may therefore be difficult. Nevertheless, these contributions of the mangrove may be quite important in terms of the total benefits produced by the mangrove system.

Thailand. A case study in Chanthaburi Province in southeast Thailand examined a traditional mangrove-based economy and presented annual values for a variety of products including forest products, nipa thatch, fisheries, oyster culture, shrimp farming and agriculture.

Values were estimated for each of the mangrove-dependent products, both for present productivity levels and for potential levels with improved management. The shrimp farming val-

	Location of goods and services	
	On-site	Off-site
Marketed	1 Usually included in an economic analysis (e.g., poles, charcoal, woodchips, mangrove crabs)	2 May be included (e.g., fish or shellfish caught in adjacent waters)
Nonmarketed	3 Seldom included (e.g., medicinal uses of mangrove, domestic fuelwood, food in times of famine, nursery area for juvenile fish, feeding ground for estuarine fish and shrimp, viewing and studying wildlife)	4 Usually ignored (e.g., nutrient flows to estuaries, buffer to storm damage)

Relation between location and type of mangrove goods and services and traditional economic analysis.

ues are large, ranging from $200 to $2,000/ha/year. These values are for commercial shrimp farms on converted land that are partially dependent on the remaining mangrove as a source of shrimp fry. Still, the total value per hectare from forest and fishery products from an intact mangrove ecosystem is substantial for over $160/ha at present to a potential of over $500/ha. When compared to one alternative use like rice farming, one sees why a broader economic analysis is needed. The expected return from agriculture ($165/ha/year) is large compared to the annual per hectare value from charcoal production ($30). However, when one adds in the present value of fishery products caught within and outside the estuary, the two uses are equivalent in value. When future increases in potential income is considered and the contribution of mangroves to shrimp farming is also included, the *in situ* value of mangrove becomes very substantial. In addition, forestry and fishery production are fairly labor-intensive and have important employment generation potential. In the Thai case, one potential production system, based on intensified management of the natural mangrove (particularly utilizing nipa palm), was about equal to shrimp cultivation in creating jobs and better than rice farming.

The estimate only included a limited number of the goods and services. As such, they are minimum estimates of the yearly value of mangrove products. And yet, the decision as to whether or not mangroves should be converted (destroyed) is made by comparing this minimum partial estimate with the total expected benefit from conversion. No wonder mangroves are being lost at such a rapid pace.

Indonesia. Similar issues to Thailand were raised in a recent report on coastal resources management (CRM) in Indonesia . Indonesia has the largest mangrove area in the world and, conversion, both to dry-land agriculture and to *tambak* (fishpond culture), is widespread. Indonesian mangroves are highly productive and diverse and are under severe pressure from overharvesting of forest products and conversion. Inspite of an official policy against further tambak extensification, the potential for sustainable production from mangrove areas was largely ignored and that "a prevailing but erroneous view among many advocates of mangrove conversion is that the swamps are wastelands with little value in comparison to 'higher' uses such as *tambak* and rice culture."

Ecuador. Large areas of mangrove forest have been converted to shrimp grow-out ponds in Ecuador. This development has been particularly rapid in the southern Gulf of Guayaquil — 16% of the mangrove forest has been lost between 1966 and 1982. In addition to the physical loss of mangrove forest, researchers believe that this has also resulted in the decline of shrimp postlarvae in Ecuadorean estuaries. This is a major concern of shrimp pond owners who rely on wild postlarvae as a stock source for their grow-out ponds. As a result, productivity falls and shrimp farmers may have to use more expensive hatchery operations to produce shrimp larvae.

Although much more detailed analysis of the economics of mangrove ecosystems is needed, the following general conclusions can be drawn from the above cases:

- Decisions on whether or not to convert mangroves to other uses are frequently based on the value of marketable forestry products produced by the natural unmanaged mangrove. These values may be quite low. Fishery and marine products, both within the mangrove and in nearby waters, are frequently much more valuable than forest products.
- A natural mangrove is a self-sustaining, productive ecosystem, many conversion-based alternative uses have proved to be expensive to construct and maintain, or have produced disappointing economic results due to low and declining productivity. Nevertheless, normal market forces will almost always favor conversion of mangroves to other uses. This is a direct result of the dispersed nature of the products of, or dependent on, the mangrove and the problem of assigning monetary values to some goods and services. Because of this "market failure," government intervention is essential if mangroves are to be used in a socially optimal manner.
- The linked land-ocean system of mangroves create complicated ecosystem linkages affecting the production of a wide range of socially valuable goods and services.

Sources: Serrano RC and Fortes M. 1989. Perspective on World and Philippine Mangrove Resources. In: *State of the Art: Mangrove Research. (2) Dixon JA.1989. Valuation of Mangroves. Tropical coastal area management. Vol. 4, No. 3. December.*