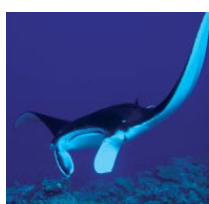
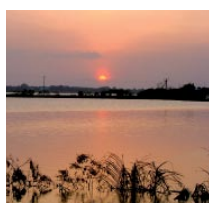


# Coastal Ecosystems



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## Valuing coastal ecosystems



coastal inhabitants through the service provision of fisheries nurseries, habitat and water quality yielded.

In essence, coastal ecosystems are valuable because people – living both near coasts and those far away – depend on them for a variety of reasons to support their well-being. Therefore, coastal ecosystems merit investment. But here is the irony, although coastal ecosystems are tremendously valuable to people, investment in coastal ecosystems is not a given and is something about which there is still much argument. At present,

Following the recent spate of natural disasters, focus is turning increasingly to the conservation of ecosystems and indeed the role of natural resource management in both mitigating the sheer quantum of damages as well as rehabilitating lives, livelihoods and economies. To a large extent, the focus on coastal ecosystems and their constituent resources has been brought to centre stage by the sobering effects of the Indian Ocean tsunami on the coasts of several South Asian, East African and Southeast Asian countries.

Interestingly, investing in the conservation and management of coastal ecosystems is being offered as a key element of disaster management, vulnerability reduction and sustainable livelihoods and economies. Yet it would be far from unwarranted for someone to ask why this is so, and what the value is of investing in coastal ecosystems.

Coastal ecosystems – containing mangrove forests, estuaries, coral reefs, dunes and beaches and sea grass beds – are complex and inter-dependent, and are jointly believed to yield a wide range of ecosystem goods, which are used by people for food, construction, fuel, income and other uses. More importantly, coastal ecosystems deliver ecosystem services that underpin human well-being. For example, when extreme events occur, coastal ecosystems play a major role in mitigating damage and protecting coastal inhabitants' lives, livelihoods and assets. Coastal ecosystems also provide food security, livelihoods and good health to

ecosystems remain the 'forgotten' values in coastal investment and development planning.

The reality is that many of the products and services generated by coastal ecosystems miss detection because they are not traded in markets and therefore do not come with a price tag. Thus, they remain underappreciated and undervalued. Because of this, it is difficult to determine what people lose when coastal ecosystem become degraded or are damaged or in contrast, how people benefit from improvements to coastal ecosystems. In this setting of undervaluation and partial information, investments in coastal ecosystems are traded-off for seemingly more profitable and important uses such as coastal developments including hatcheries, aquaculture, infrastructure, that simultaneously impair and degrade these ecosystems.

If coastal ecosystems are to compete against these alternative uses, there is a need to properly value the varied products and services provided so they become viable investment options. Therefore it is important to value coastal ecosystems so that monetary comparisons between maintaining ecosystems or using them for other purposes can be made, in order to evaluate whether tradeoffs that bias coastal ecosystems are sound investment options. In short, we value in order to evaluate.

*Mangroves in southern Sri Lanka © Thushara Ranasinghe  
Thumbnails top © Sriyanie Miththapala; middle © IUCN;  
bottom © Jerker Tamelander, IUCN*

# The framework for valuation

Without quantitative measures for appraising ecosystem loss and environmental damage, it becomes almost impossible to assess the real environmental and livelihoods impacts or overall societal utility from investment projects.

Until now most investment projects such as infrastructure development or agricultural expansion have failed to include the environmental costs of the proposed land conversion. Although Environmental Impact Assessments (EIAs) of large infrastructure and agricultural projects are, in many countries, obligatory, the negative environmental impacts are often only described qualitatively and not transformed into economic costs that can be compared directly to, for example, the economic benefits of improved market access, reduced transportation time or even increased agricultural production. As a response to this gap in analyses, the concept of Total Economic Value (TEV) was presented almost two decades ago as a framework to identify these environmental costs and benefits, which, in an ideal world, would enter into mainstream project appraisal methods such as Cost-Benefit Analysis (CBA) and EIAs.

TEV is now one of the most widely used conceptual frameworks and covers **direct values** (benefits derived from the use of environmental goods either for direct consumption or production of other commodities); **indirect values** (benefits provided by ecosystem functions and services); **option values** (premium placed on maintaining an environmental good or service for possible future use); and **non-use values** (includes existence value - satisfaction from just knowing that a species or ecosystem is present,

## Most commonly used valuation techniques and methods

**Market prices:** This approach looks at the *market price* of ecosystem goods and services.

**Production function approaches:** These approaches, including *effect on production*, attempt to relate changes in the output of a marketed good or service to a measurable change in the quality or quantity of ecosystem goods and services, by establishing a biophysical or dose-response relationship between ecosystem quality, the provision of particular services, and related production.

**Surrogate market approaches:** These approaches, including *travel costs* and *hedonic pricing*, look at the ways in which the value of ecosystem goods and services are reflected indirectly in people's expenditures, or in the prices of other market goods and services.

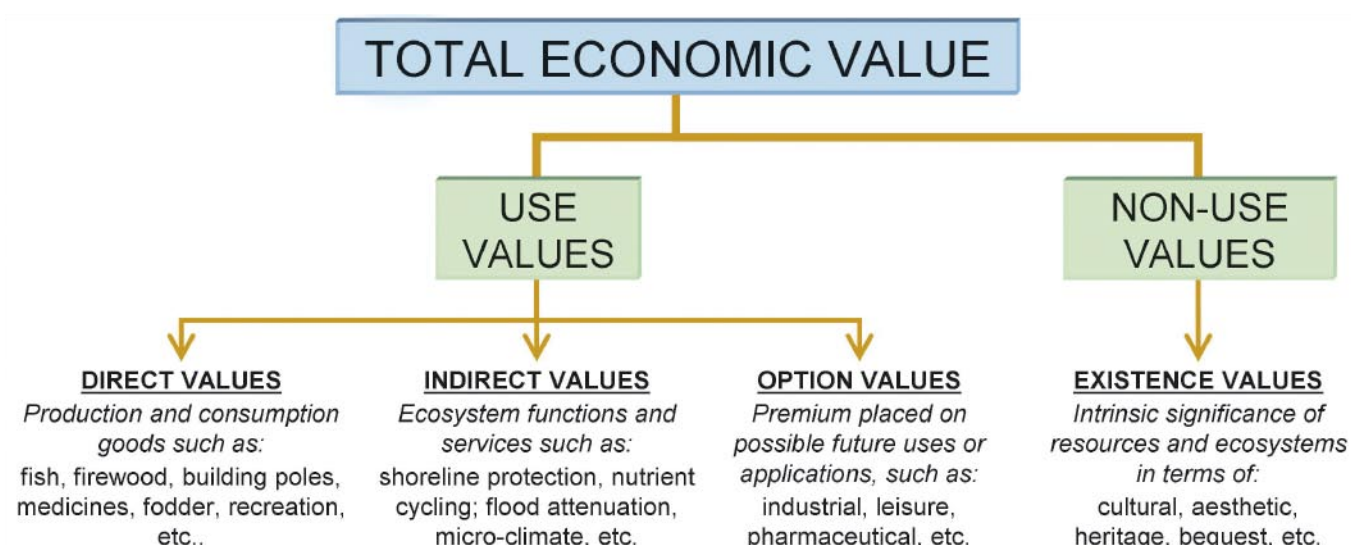
**Cost-based approaches:** These approaches, including *replacement costs*, *mitigative or avertive expenditures* and *damage costs avoided*, look at the market trade-offs or costs avoided of maintaining ecosystems for their goods and services.

**Stated preference approaches:** Rather than looking at the way in which people reveal their preferences for ecosystem goods and services through market production and consumption, these approaches ask consumers to state their preference directly. The most well-known technique is *contingent valuation*, while less commonly-used stated preference valuation methods include *conjoint analysis* and *choice experiments*.

bequest value -willingness to pay to ensure that future generations inherit a particular environmental asset and intrinsic value -the value of a species or ecosystem in its own right independent of any value placed on it by humans).

Parallel to these advances in establishing a conceptual framework that distinguishes and categorises environmental benefits, techniques and methods for quantifying these values in monetary terms have also moved forward. A wide range of valuation techniques and methods now exist (Box). The valuation techniques and methods rely on an anthropogenic approach, so that values are determined by people's preferences.

This newsletter provides some examples which show how environmental valuation has been applied to coastal ecosystems in several countries and has provided information vital to project appraisal and assessment.



Total Economic Value of Ecosystems

# Coastal Ecosystems

## Counting the costs of tsunami-related damages to coastal ecosystems in Thailand

Well-protected mangroves have been dubbed the 'supermarkets' of coastal areas. Communities living next to a good mangrove patch require minimal cash for things that are essential for living, and a wide range of goods obtained from mangroves (such as food, fiber and medicines), at times, keep the poor away from the worst effects of poverty. Equally importantly, such coastal ecosystems also provide valuable life support services (such as the fisheries nursery and habitat, coastal protection role of reefs and mangroves, or water quality services yielded by coastal wetlands). What is evident is the tight interconnection between coastal ecosystems such as coral reefs, mangrove forests and sea grasses and their provision of joint benefits to human populations. In turn, these economic benefits accrue to local, national, and global populations.

Concerns about coastal ecosystems were heightened following the devastation of the Indian Ocean tsunami. Damage to coastal resources could mean that local, provincial and national economies will be affected severely for the near and medium term future.

A rapid assessment of coastal ecosystems in Thailand revealed that coastal ecosystems had been impacted by the tsunami to varying degrees of damage. For example, out of a total coral reef habitat of 4,622 ha, 15.5% (about 716 ha) were damaged; of a total sea grass habitat of 5,923 ha, 3.5 % suffered damage from tsunami-related siltation and sand; and 395 ha of mangrove (only 3% of the total) were affected. However, in the last two decades, large-scale degradation of mangroves has been going on in Thailand, with devastating economic impacts.

Four provinces of Andaman Sea coast of Thailand (Trang, Krabi, Phang Nga and Ranong) impacted by the tsunami were selected for the rapid economic



Tsunami damage to mangroves, Ranong Province Thailand © Ranong Coastal Resources and Research Station

assessment with the following results. The results of this evaluation showed that there are significant economic costs related to damages to coastal ecosystems but that these costs often remain undetected. For example, Phang Nga, which suffered the highest damages to its coastal ecosystems, also suffered highest economic costs ranging from about 11 –11.8 million USD; and the costs associated with the direct use of mangrove forests in Phang Nga from damages to mangroves amounts to about 0.66 million USD. These costs will most likely be borne by coastal communities that are heavily dependent on these ecosystems for their livelihoods. Damage to these resources means that livelihood and subsistence options for these communities and households have been restricted severely.

Large scale degradation of mangroves has been going on in Thailand for decades. The impacts of the tsunami highlighted this degradation, and reinforces the need for an economic rationale to investing in ecosystem maintenance and rehabilitation as part of the coastal defenses of the provincial economy, particularly of impoverished coastal communities.

Source: <http://iucn.org/places/asia/coastalinfo/valuation.htm>

Province	Damage to mangrove non timber forest products	Damage to reef fisheries	Loss of coastal protection		Total Economic Cost in Year 0 (USD)
			Coral reefs	Mangroves	
Trang	0.05	0	0	0.14	0.19
Krabi	0	1.19-4.31	67.07	0	68.26-71.38
Phang Nga	20.64	8.91-32.05	313.23	13.14	355.92-379.06
Ranong	2.51	1.66-6.00	99.94	3.81	107.92-112.26

## Maintaining wetlands in Sri Lanka's coastal cities

The south west coastline of Sri Lanka represents one of the most densely populated, intensely urbanised and heavily industrialised parts of the country. There is extreme pressure on the natural environment, and wetland ecosystems, in particular, are under severe threat. Land use planning processes have paid little heed to the need to maintain green spaces for Sri Lanka's city-dwelling populations, and have almost always resulted in development decisions which have taken place at the cost of the few remaining urban and peri-urban conservation zones.

The Muthurajawela marsh, extending alongside the Indian Ocean and located between 10-30km north of Colombo, Sri Lanka, covers an area of 3,068 ha. It is listed as one of 12 priority wetlands in Sri Lanka and in 1996, a little more than half of this marsh was declared a sanctuary under the jurisdiction of the Department of Wildlife Conservation. This sanctuary contains a high diversity of both flora and fauna, including several endemic and nationally threatened species, and also provides an important area for migratory birds. Muthurajawela is also a popular recreational destination, primarily attracting educational day visitors from Colombo. In addition, more than 300,000 people live in the surrounds of Muthurajawela and just under 5,000 people occupy the marsh itself. About 80% of industries in Sri Lanka are concentrated in Colombo and Gampaha District where Muthurajawela lies.

North of the marsh is the Negombo lagoon, which together with the marsh, serves multiple uses including fisheries, agriculture, trade, shipping and habitation since historical times. This lagoon has a high productivity for fisheries with an estimated 150 kg/ha/year, involving more than 3,000 families from 26 villages. Livelihoods are based mainly on fishing, farming and natural resource harvesting, with a minority of residents earning income from employment and small-scale trade. The area is characterised by high levels of poverty, and in 1998, nearly 80% of households living around the wetland earned less than 50 USD /month, and a third earned less than 30 USD. In addition, more than 60% of labour force is unemployed and the majority of those with paid work are engaged in low-paying manual labour.

As well as harboring important biodiversity and providing resources, Muthurajawela provides a range of ecological and hydrological services. It receives and retains high loads of domestic and industrial wastes as well as sediments and silt loads from both surrounding and upstream areas. Wetland plants facilitate sediment



Purple Coot in Muthurajawela Marsh © Sriyanie Miththapala



Negombo fish market © Sriyanie Miththapala

deposition before water enters into Negombo lagoon. They also act as filters for through-flowing waters and assist in the removal of nutrients and toxic substances. During the rainy season, the marsh buffers floodwaters before they reach the lagoon.

These functions are particularly important for local households, many of whom lack a piped water supply and rely on shallow dug wells. Water quality and fisheries production in downstream Negombo lagoon area are also heavily dependent on these wetland services. Muthurajawela acts as a source of water to the tidal delta, and is critical in moderating salinity and pollution levels.

### The impacts of land use zoning around the wetland

The location of Muthurajawela Wetland Sanctuary in a rapidly developing urban area makes it an extremely vulnerable ecosystem. Large parts of the freshwater marsh system have been altered, and a variety of canals, drains, bunds, sluices and culverts present evidence of various attempts to manage waterflow, combat flooding and prevent saltwater intrusion. There is a long history to these human modifications, dating back as far as the 15th century.

# Coastal Ecosystems

Today, the marsh is subject to intense pressure from surrounding industries and settlements. Low-cost housing borders, and in some case encroaches upon, the wetland. A large industrial zone lies to its east and a new industrial area has been developed at the southern end of the wetland. The International Airport and Negombo town (with an estimated population of 150,000 people) are both located to the north of Muthurajawela. An expressway, linking Colombo with the industrial areas and airport, is in being built and will cut across the borders of the Wetland Sanctuary.

As a result of these activities, there have been considerable changes to the biodiversity, ecology and hydrology of the marsh area. Large amounts of wastes now enter the marsh from adjacent households, fishing boats, tourist facilities, agriculture and industries. It is estimated that the marsh and lagoon area receive raw or partially-treated sewage from a population equivalent to 200,000 people. Of the 150 or so industries east of the marsh, only 13 have any kind of treatment facility. Land filling and reclamation in the marsh area for industry, infrastructure and settlement has also increased local erosion and siltation. By 1999, annual sediment loads entering the marsh were estimated at a total of 209,000 tonnes annually.

As Muthurajawela has been degraded and reclaimed, hydrological linkages to appropriate discharge points have been cut off, meaning that excess water and peak flows cannot move easily into Negombo Lagoon. Today, floods occur in adjacent settlements at least two times a year during the rainy seasons, and during every rainfall period more than 1,000 households in the marsh area are affected by flooding. Important breeding habitat for freshwater, brackish water and marine fish species has been reduced and water quality has fallen, with especially high levels of BOD and COD around industrial and residential areas indicating organic loading and pollution.

As a result of growing concern about these sources of ecosystem degradation and biodiversity loss, the government decided in 1989 to freeze all public and private sector development proposals until an environmentally sound Masterplan was developed for the Muthurajawela Marsh. The publication of the Masterplan for Muthurajawela Marsh and Negombo Lagoon in 1991 led to a land use strategy being proposed and implemented for the future, based on dividing the Muthurajawela-Negombo area into various development and conservation zones.

## Valuing the benefits of Muthurajawela Marsh

Despite the existence of a management plan for Muthurajawela conservation zone, there remains serious concern about the future of the Wetland Sanctuary. Encroachment

## Economic value of Muthurajawela marsh

	Value (USD/year)	Value (USD/ha/year)
Flood attenuation	5,394,556	1,758
Industrial wastewater treatment	1,803,444	588
Agricultural production	336,556	110
Support to downstream fisheries	222,222	72
Firewood	88,444	29
Fishing	69,556	23
Leisure, recreation and recreation	58,667	19
Domestic sewage treatment	48,000	16
Freshwater supplies	42,000	14
Total	8,072,111	2,631

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and degradation continues, and infrastructural developments and industrial expansion are still occurring close to - and sometimes within - the marsh area. Clearly an assessment of environmental valuation was essential to provide a credible economic rationale for conservation actions, showing that continued conservation of the Wetland Sanctuary would yield considerable benefits.

Direct use values that depend on the Muthurajawela Marsh, including sustainable local resource use and recreation, are worth more than half a million dollars a year. The provision of localised ecosystem services such as flood attenuation, industrial and domestic wastewater purification and year-round surface and sub-surface water supplies have an annual value in excess of 7 million USD a year. The wetland's support to downstream fish productivity in Negombo Lagoon contributes a value of almost 225,000 USD. Together these translate into economic benefits of just over 2,600USD/hectare/year for the whole of Muthurajawela Marsh, or non consumptive use benefits of 4.4 USD million for the Wetland Sanctuary. More than 30,000 people, most of them poor slum dwellers and fishing households, gain from these economic goods and services.

The valuation study's findings underlined the high economic benefits that can accrue from wetland restoration, and provides an economic rationale for maintaining and even increasing investment in this Wetland Sanctuary because there is clear development return in doing so.

Source: [www.iucn.org/dbtw-wpd/edocs/2005-047.pdf](http://www.iucn.org/dbtw-wpd/edocs/2005-047.pdf)

## The economic costs of upstream freshwater flow loss: Indus Delta, Pakistan

Pakistan's vast irrigation network comprises three major storage reservoirs, 19 barrages or head works, 43 main canals 57,000km long, and 89,000 watercourses running length more than 1.65 million km. This system feeds more than 15 million ha of farmland, affording Pakistan the highest irrigated to rain-fed land ratio in the world. This impressive irrigation system is, however, exacting a heavy toll on the environment. In particular, there is concern that the upstream abstraction of large volumes of water from rivers has, in many cases, left insufficient flow to meet the needs of downstream ecosystems. Coastal and marine regions, because they lie at the end of rivers, have been affected most heavily by this upstream abstraction.

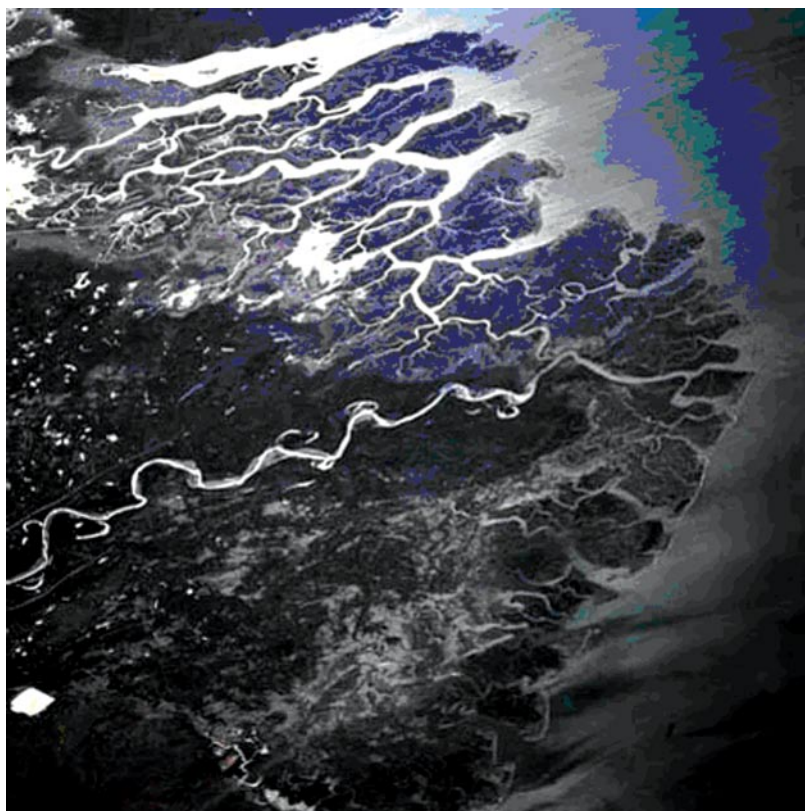
Failure to recognise the needs of downstream ecosystem has often led to decisions regarding water allocation being made that are neither economically nor ecologically optimal. Although the dominant development imperative favours allocation of water to large-scale, commercial uses such as dams, reservoirs, irrigation and hydropower schemes, it is essential to remember that Pakistan's ecosystems are also important economic users of this water. Yet, the economic benefits of water-based ecosystems are rarely factored into river basin planning, or into water allocation decisions. The economic costs and losses arising from such omissions can be immense, and often irreversible, affecting some of the most fragile ecosystems and the poorest and most vulnerable human groups.

### Managing freshwater flows in the Indus River

The Indus River has a total length of more than 3,000km and a drainage area of some 950,000 km<sup>2</sup>. Almost 90% of the water in the upper part of the river basin comes from glaciers located in the Himalaya and Karakoram mountain ranges, which border China, Pakistan and India, and the Hindu Kush, which borders Pakistan and Afghanistan. The Indus travels southwards across Punjab and Sindh Provinces in Pakistan before entering the Arabian Sea through a delta close to the border with India.

The Indus Delta is a typical fan-shaped delta, built up by the discharge of large quantities of silt washed down from upland and mountain areas. The present Delta covers an area of about 600,000ha and is characterised by 17 major creeks and innumerable minor creeks, mud flats and fringing mangroves.

The mangrove ecosystem of the Indus Delta is, perhaps, unique because it is the largest area of arid climate mangroves in the world. As annual rainfall is so low in the region, mangroves are



Indus Delta © IUCN

almost wholly dependent upon freshwater discharges from the river, supplemented by a small quantity of run-off and effluents from Karachi.

The total available freshwater flow in the Indus is about 180 billion m<sup>3</sup>, carrying with it some 400 million tonnes of silt. Over the last 60 years a series of dams, barrages and irrigation schemes have been built in upstream parts of the River Indus. Today, it is estimated that up to 60% of the Indus water is used to feed Pakistan's irrigation networks, and that the Indus watershed irrigates up to 80% of Pakistan's farmland. For some time, there has been great controversy surrounding the allocation of the waters of the Indus River, in particular between competing users in different Provinces. Recurrent disputes over water usage led the government to formulate the Indus Water Accord in 1991, which apportioned the use of the river's water among the four provinces of Pakistan. It also recognised - for the first time - the need to allow some freshwater discharge into the Delta to safeguard the ecosystem, specifying a minimum flow of 12 billion m<sup>3</sup>. In 1994, because of drought and water shortages, Punjab Province demanded and received exemption from the 1991 Water Accord and a subsequent higher reallocation.

As a result of upstream water abstraction, by the time the Indus reaches the Kotri Barrage (some two thirds of the way into Sindh Province, or 200km from the Arabian Sea), there is inadequate flow to maintain the natural ecosystems of the Indus Delta. The annual flow reaching the Delta before the 1994 break from the Water Accord was less than 43 billion m<sup>3</sup>, and quantities of silt discharged estimated to be 100 million tonnes/year. Even at this level, the amount of freshwater reaching the Delta was argued to be insufficient to maintain healthy natural ecosystems, and had resulted in severe saltwater intrusion and salinisation. With the existing reduction in flow, downstream Sindh Province already claims it is short of the minimum 12 billion m<sup>3</sup> of water needed to maintain the Delta.

# Coastal Ecosystems

## The economic significance of the Indus Delta

Loss of freshwater flow, and consequent saltwater intrusion, has had devastating effects on the ecology and human economy of the Indus Delta. Land in the area has become unsuitable for agriculture, and potable water sources have become very scarce or have disappeared altogether. In Thatta, a predominantly agricultural District in Sindh Province, almost 1/3rd of land has been affected by saltwater intrusion. It is estimated that up to 0.5 million ha of fertile land in Thatta and adjoining areas, or about 12% of total cultivated area in the entire Province, is now affected by sea water intrusion. As well as crop losses, this has resulted in severe damage to livestock through rangeland depletion, shortage of fodder, pasture and watering areas, and a resulting mass migration of both livestock and human populations out of the area.

The human population in and around mangrove forests on the coast of Pakistan is estimated to total 1.2 million people, nearly 900,000 of whom reside in the Indus Delta. Of these, a predominantly rural population of more than 135,000 depend on mangrove resources for their livelihoods. Reductions in freshwater inflows have had tangible impacts on mangrove ecology, and on the fish populations that rely on them for breeding and habitat. At least ¾ of the Delta's rural population depend, directly or indirectly, on fishing as their main source of income, and most of Pakistan's commercial marine fishery operates in and around the mangrove creeks on the coast of Sindh Province. A large proportion of fish and crustaceans spend at least part of their life cycle in the mangroves, or depend on food webs originating there. The annual value of catch from mangrove-dependent fish species in the Indus Delta is estimated at around 20 million USD. Shrimps are also particularly important, with a domestic value of 70 million USD and an export value of about 1.5 times this figure, and the export of mud crabs contributes an additional 3 million USD to the regional economy.

Over 60% of the rural population also use the Delta's mangroves as their major source of domestic fuel, estimated to account for around 18,000 tonnes of firewood which is worth up to 460,000 USD a year. Mangroves are also used by coastal villagers as fodder for domestic animals. In addition to cattle, sheep and goats kept permanently in the Delta, it has been estimated that at certain times of the year about 16,000 camels are herded into the mangroves. In total, the Indus Delta's natural ecosystems are thought to contribute about 67,000 tonnes of leaves and 20,000 tonnes of grasses as livestock pasture and fodder each year, together worth up to 1.35 USD million.

The loss of freshwater to the Indus Delta, and consequent saltwater intrusion and natural habitat degradation, is manifest in a wide range of economic benefits foregone, including economic costs related to mangrove loss and reduction in agricultural land use opportunities.

## Using valuation to show the economic benefits of allocating water to ecosystems

Analysis of the data collected during the study showed that both aggregate crop production and fish catch had declined steadily as salinity had increased. Thirty thousand households incurred average annual losses of 70,000 USD in crop damage and 45,000 USD from reduction in fish catches as a result of saltwater intrusion. Other studies have shown that rapidly escalating mangrove loss has jeopardised seriously the livelihoods of more than 135,000 people who rely on mangrove products to a total economic value of some 1.8 million USD a year for fuelwood and fodder, and a coastal and marine fisheries sector that generates domestic and export earnings of almost 125 million USD.

These results underline the economic necessity of proposed freshwater releases downstream of the Kotri Barrage, in order to curtail the spread of saltwater into the Indus Delta. They show that this is essential not just to safeguard the flora and fauna of the region, but also to sustain the livelihoods of the Delta population. Upstream water demands from the Indus, already intense, will increase in the future. Pakistan's socio-economic development plans depend heavily on expanding land under irrigated crops, and a large number of new developments are planned, which mean that freshwater available to the Indus will continue to reduce. The status of the Delta's natural ecosystems has already become critical, and the rural economy of the region faces an emergency situation as a result.

The phenomenon of sea intrusion into the Indus River Delta has become one of the most politically-charged environmental issues in Pakistan today. Competition over water allocation within river basins, especially between upstream and downstream areas, between large-scale and subsistence-level uses, and between commercial and ecosystem uses, is becoming a source of severe economic and political conflict. In many ways, this case study epitomises a national situation which has already reached crisis point, and one which is likely to deteriorate still further in the future. For now, national policies have opted to allocate scarce water so as to maximise financial and commercial returns to agriculture - often at the cost of natural ecosystems, and of some of the country's poorest communities. Yet, there is growing concern that the failure to factor ecological economic values, or economic losses, into river basin planning is resulting in decisions being made about water allocation that are neither ecologically nor economically optimum. As long as the economic value of ecosystem needs for freshwater flows is marginalised in national decision-making, these conflicts are likely to escalate.

Source: [www.iucn.org/themes/wani/econ/CaseStudy05Indus.pdf](http://www.iucn.org/themes/wani/econ/CaseStudy05Indus.pdf)

# Valuing the costs of conservation in Kenya

Kisite Marine National Park and Mpunguti Marine National Reserve (KMNP-MMNR) are located off the south coast of Kenya, just beside the border with Tanzania. Together they cover some 39 km<sup>2</sup> of sea, islands, coral reefs, mangroves and seagrass beds.

KMNP-MMNR has an extremely high economic value, contributing fish and marine products, supporting an important tourism industry, and providing various ecosystem functions which underpin human livelihoods and economic activity. The quantified economic value of the Marine Protected Area (MPA) has been calculated to total more than 2.25 million USD a year, of which 96% accrues as direct cash revenues or income. Both these figures are far higher than the costs associated with KMNP-MMNR: its direct and opportunity costs are estimated at just under 200,000 USD a year.

Generating such high benefits, one might assume that the MPA would face few economic or financial problems. In fact this is not the case: the government authorities (Kenya Wildlife Service, KWS) continue to suffer from a severe shortage of budget to cover the operational costs of park management, and local communities for the most part remain economically unwilling and unable to bear the costs that KMNP-MMNR incurs to them.

The reason for these financial and economic problems are largely to do with the distribution of economic values between different groups. A high proportion of total income accrues to private sector tour operators. While KWS earn around 140,000 USD (in excess of the estimated 130,000 USD that is required to manage the MPA effectively) from park entry fees, the bulk of these earnings are remitted to central treasury. Less than 20,000 USD (just 15% of what is required) is returned to the MPA as an annual budget. Although local communities gain around 120,000 USD from tourism and fisheries earnings, they face substantial opportunity costs (some 175,000 USD) due to their being excluded from strictly protected areas of the MPA.

Such conservation management issues arising from an unequal distribution of value between different groups are common in marine and coastal areas. However high the total value of natural ecosystems or protected areas is demonstrated to be, there will be continuing management problems if the groups who bear the costs of conservation do not receive sufficient and tangible returns to offset the costs they bear. An important lesson learned from the example of KMNP-MMNR, and from many other similar areas, is the importance of not just calculating the total economic value of ecosystems but to also look at the costs of conservation, and to identify who gains and who loses. It is only then that coastal managers can use economic value information to design mechanisms to fill these financial and economic gaps, and ensure that conservation is economically and financially viable and sustainable in the long-term.



Kisite Island © Lucy Emerton

	KSh mill/year				Total
	KWS	External private	Communities	Local private	
<b>Direct net benefits</b>					
Fisheries			2.06		2.06
Marine products		0.35	0.07		0.42
Tourism	8.88	113.67	5.45	9.03	137.03
<b>Total benefit</b>	<b>8.88</b>	<b>114.02</b>	<b>7.58</b>	<b>9.03</b>	<b>139.51</b>
<b>Costs</b>					
Management	1.23				1.23
Opportunity			11.03		11.03
<b>Total cost</b>	<b>1.23</b>	<b>0</b>	<b>11.03</b>	<b>0</b>	<b>12.26</b>
<b>Net gain/loss</b>					
	<b>7.65</b>	<b>114.02</b>	<b>-3.45</b>	<b>9.03</b>	<b>127.25</b>

*Distribution of KMNP values*

Source: [www.iucn.org/places/earo/pubs/marine/kisite.pdf](http://www.iucn.org/places/earo/pubs/marine/kisite.pdf)

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