Environmental Studies
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FOREST PRODUCTION

Case Study: Mangroves & Cost-Benefit Analysis

Introduction

All over the world mangrove ecosystems are threatened with destruction. Mangroves are a unique tropical ecosystem which occur most often along protected coastal shores with muddy or sandy bottoms. These shores are alternately covered and uncovered by tides and receive brackish or fresh water from rivers draining the tropical forests or hillsides behind them. The mangroves are unique in forming a forest ecosystem in an intertidal zone.

Mangroves differ from other forest ecosystems in that they receive large inputs of material and energy from both the land and the sea. As a result, the flora and fauna that live there must have broad physiological tolerance and many species are highly dependent upon the mangrove ecosystem.

Threats

Mangroves face a number of threats *(Table 1)*.

Table 1 Threats to the mangroves.

Threat	Reason
Conversion to crops/fruit	Population pressure to cultivate more food despite the fact that mangrove soils are not very fertile
Conversion to shrimp ponds	Huge international market for shrimps
Felling for fuel wood	Population pressure
Felling during offshore oil prospecting	Oil companies offer significant compensation/ infrastructure deals to governments
Felling for salt extraction plants	Salt as a means of preserving food increasing
Felling for coastal development	Harbours stimulate general development – urbanisation etc.

The International Tropical Timber Organisation (ITTO) has provided funding to encourage the conservation and sustainable management of mangroves. In areas where mangrove is under threat, the ITTO has conducted **cost-benefit analyses (CBA)** to identify whether the proposed change from mangrove to alternative land use would be economically beneficial.

In a cost-benefit analysis economists and scientists try to put a monetary value on all of the beneficial functions and processes that occur in a habitat or ecosystem and then compare this total value with the monetary value of the proposed change.

Carrying out a CBA is actually very difficult; a monetary value has to be calculated for things which don't normally get valued in this way. For example, one of the benefits of mangrove ecosystem is that the tree roots and mud help stop coastal flooding.

The question for the CBA team is:
How much is this flood-protection worth?

To try to calculate it, the team have to consider the following:

1. If the mangrove is destroyed, how often will damaging floods occur?
2. How much damage would be caused by each flood?
3. Over how many years should the floods be considered – 5, 10, 50?
4. How much does it cost to repair the flood damage?
5. Flood damage might include: drowning, washing away of homes, death of livestock or crops and soil erosion. Do all of these get considered? How much is one human life worth?

As you can see, just calculating the monetary value of flood protection is difficult. But mangroves do a lot more than just decrease flooding. Aspects such as the value of the lost wildlife that live there, the lost income from tourism etc, need to be added to the costs. When all the costs are added up, the total needs to be compared to the total monetary value of the benefits of destroying the mangrove – hotels, harbours, crops, shrimp sales etc.

Calculating all the costs and benefits in a CBA may take years. However, once the total monetary value of the costs and benefits have been calculated, the decision can then be made whether to go ahead with the proposed development.

If the costs outweigh the benefits then the proposal should not go ahead and the mangrove should be preserved. Alternatively, if the benefits outweigh the costs then the proposal should go ahead.

Mida Creek lies 90km North of Mombasa in Kenya *(Fig. 1)*. In 1968 the area was designated a Marine National Reserve and in 1988 the area was made a Biosphere Reserve. In 1998 a South African businessman submitted a proposal to clear part of the mangrove in order to dramatically increase the size of an adjacent tourist lodge complex and to develop a small shrimp farm. This was opposed by some local villagers, politicians and conservationists. *Table 2* shows the results of a CBA carried out at Mida Creek.

Fig. 1 Mida Creek, Kenya.

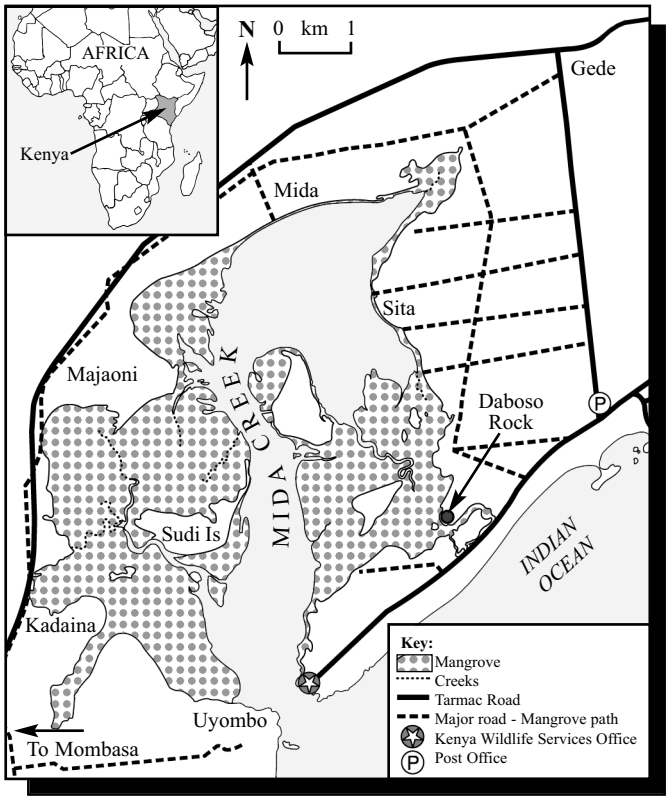

Table 2 Costs and benefits of clearing mangroves.

First 10 years following conversion			
Costs (000 Kenyan $)		**Benefits (000 Kenyan $)**	
Loss of Tourism	300.0	-	
Loss of Wildlife Habitat	210.5	-	
Increased Erosion	120.0	-	
Loss of Construction Timber	37.3	-	
Loss of Boat Making	26.5	-	
Loss of Furniture Making	21.0	-	
Loss of Charcoal	19.0	-	
Loss of Firewood	16.0	-	
Increased Water Pollution	11.4	-	
Loss of Fencing Posts	2.0	-	
Loss of Beehives	1.6	-	
Loss of Tool Making	1.3	-	
Loss of Ointments	1.3	-	
Loss of Dyes	1.0	-	
Loss of Weapons	1.0	Increased Tourism	500.0
Loss of Plates, Dishes	0.3	Increased Shrimp Sales	60.0
Totals	**770.2**	**Totals**	**560.0**

As *Table 2* shows, the estimated cost of converting the mangrove area for tourism and shrimps was 770,000 Kenyan $. Looking at *Table 2*, the economists estimated that the loss of firewood from conversion of the mangroves at Mida Creek would cost local villages 16,000 Kenyan $ over the first ten years – 1600 K$ per year. Without being able to harvest it from their local forest, the villagers would have to buy it elsewhere.

Similarly, conversion of the mangroves would mean a loss of bark which the villagers use to make dyes. Purchasing dyes would cost them 1,000 K$ over the ten years or 100 K$ annually.

The greatest cost however would be from the loss of tourism. This is despite the fact that the developer proposed to clear the mangrove precisely to increase tourism! The economists estimated that current tourists were attracted to Mida Creek partly because of the mangroves and that such tourism was worth 30,000 K$ annually. As the benefits column shows, conversion of the mangrove would increase tourism income to 50,000 K$ annually and would, in addition, generate 6,000 K$ annually from shrimp sales. But overall, the costs outweigh the benefits. The proposal was rejected. Currently the developer is appealing against this decision. The developer has argued that:

- Income from increased tourism has been underestimated because the arrival of the extra tourists will stimulate further economic development in the area which will mean more money coming into the area.

Conservationists have argued that the CBA did not give sufficient value to the coastal protection function of the mangroves, to the value of the mangrove as a wildlife corridor and to the value of the way of life of the villagers. Difficult things to price! CBA is a crude economic tool but it is one which is commonly used in assessing development proposals in both developing and developed countries.

Typical exam questions

1. Define the term 'cost-benefit analysis' (CBA). *(3)*
2. Suggest two difficulties associated with CBA *(2)*

Answers

1. Economic tool used to decide for or against a development;
   by giving monetary value / pricing;
   costs / benefits of the development;
2. Difficult to put a price on some aspects / intangibles;
   may take a long time;

Note: *Be prepared to use data given in questions to calculate a CBA.*

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