Environmental Changes on Inhaca Island, Mozambique: Development versus Degradation?

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ABSTRACT

Inhaca archipelago is located ca. 32 km east of Maputo City, the capital of Mozambique. Inhaca Island (42.5 km²) and Portuguese Island (3.7 km²) constitute the small archipelago. Shoreline changes and sheet erosion are serious environmental problems affecting the archipelago today. Shorelines are constantly moving and changing. During rain season (October-March), strong winds, violent surf and stormy weather cause large powerful waves that induce changes on shorelines. As these waves pound the beach, sand erodes and is deposited offshore and the beach narrows. In dry season (April-September), waves and winds wash over the beach, bringing back the sand and gradually, the beach becomes wider. The major problems of Inhaca and Portuguese islands fringing shorelines is its dynamic environment that experience a slow or fast rate of erosion, but also, experience slow or rapid accumulation of sediment and accretion. The shoreline changes have taken place more rapidly than our understanding of the dynamic itself due to global environmental changes and human activities such as clearing of vegetation on coastal ridges for agriculture, clearing coastal forest and mangroves for housing. Furthermore, goat rearing on eastern ridge has aggravated environmental changes due to blow-up on Inhaca Island.

RESUMO

O Arquipélago da Inhaca está situado a cerca de 32 Km a leste da cidade de Maputo, a capital de Moçambique. As ilhas da Inhaca (42,5 Km²) e dos Portugueses (3,7 Km²) constituem o pequeno arquipélago. Mudanças de linha de costa e erosão laminar são problemas ambientais que hoje afectam o arquipélago. A linha de costa está constantemente a mover-se e a mudar. Durante a estação chuvosa, (Outubro – Março), ventos fortes, rebentamento violentos e o tempo tempestuoso resultam em ondas grandes e poderosas que induzem mudanças na linha de costa. A medida que estas atacam as praias, areia é erodida e depositada “offshore” e as praias tornam-se estreitas. Na estação seca (Abril – Setembro), ondas e ventos lavam as praias, trazendo de volta a areia e gradualmente, as praias tornam-se largas. Um dos maiores problemas da orla costeira das ilhas de Inhaca e dos Portugueses é a dinâmica ambiental que experimenta uma taxa de erosão lenta e rápida, mas também, experimenta uma acumulação e acreção lenta ou rápida de sedimentos. As mudanças de linha de costa ocorrem muito rapidamente do que a nossa compreensão sobre a dinâmica em si, e isso deve-se às mudanças globais e actividades humanas tais como o corte de vegetação nas cristas costeiras para machambas, o corte de florestas costeira e mangal para habitação. Mais ainda, a pastagem de caprinos na crista leste tem agravado as mudanças devido ao “blowout” na ilha da Inhaca.
1 Description of the study area

1.1 Location

Inhaca archipelago lies in the Indian Ocean, about 32km off Maputo City, the capital of Mozambique. Inhaca and Portuguese islands are located between the latitudes 25° 57’ 49” and 26° 05’ 00”S and, the longitudes 32° 53’ 00” and 33° 00’ 00”E.

Inhaca Island has a form of a distorted H or N covering an area of about 42.5km². The island extends up to 12.5km from Ponta Mazondue (NE) to Ponta Torres (SE).
and it is about 7km across the widest central area. The smaller Portuguese Island covers an area of about 3.7km². The annual temperature average is variable (22° - 23°C) being the maximum 37°C and the minimum 12°C. There are only two seasons: rain and warm season (October-March) and dry and cool season (April-September). The annual rainfall is usually about 600 mm. The annual relative humidity is about 76% (Moura, 1969). Therefore, the islands are in tropical climate.

1.2 Geology

Inhaca archipelago is a natural barrier that separates Maputo Bay from the Indian Ocean. According to several studies (Hobday 1977; Kalk 1995 & Macnae & Kalk 1958; 1969), Inhaca and Portuguese islands are results of marine transgression at the end of the Pleistocene. Portuguese Island is plain with calcareous sandstone base. Inhaca comprises a calcareous sandstone base overlain with very high dune ridges. The eastern dune ridge reaches 115m above sea level at Mount Inhaca. The western dune ridge has the maximum altitude of 80m at Barreira Vermelha. The dune ridges have a north-south trend. Hobday (1977) reported that the dunes became stabilized with forest vegetation during the Pleistocene. There are tidal plains off the sheltered shorelines.

Wind erosion is seriously affecting the eastern ridge while the western one (Barreira Vermelha) is being degraded by water erosion causing land slides during rain season (October – March). Portuguese Island is plain and being affected by erosion caused by strong surf or spring waves. The fringing shorelines of Inhaca and Portuguese islands have a dynamic environment that experiments a slow/fast rate of erosion and sedimentation. The sand dunes are very helpful during the erosion/accretion events. These become a sand account, providing extra sand. When this sand saving reserve is not available, the waves rush upland, causing the shoreline to retreat. The vegetation must be able to withstand large blasts and accumulation of sand and salt spray. Some of these changes may be easily recognised in the field, while others will need careful examination and measurements over a long period of time to yield useful data. To understand processes that operate in stable or eroding shorelines, one must understand the basic principles that govern sediment transport, deposition and conservation.

Shoreline changes are expected to increase with projected sea level rise and inappropriate practices in developmental programmes. The impact of recent changes in sea level and the effects of sheet erosion have not yet been very well documented.

2 Development versus degradation?

2.1 Background

Study visits by international researchers from 1900's to 1960's not only propelled the acknowledgement of Inhaca and Portuguese islands as a home of tropical rich biodiversity but also as a ground for tourism. Several studies carried out on Inhaca and Portuguese islands demonstrated the existence of high level of biodiversity (de Boer & Bento 1999; Kalk 1995; Macnae & Kalk 1958; 1969; Mendonça 1954; Moura 1969; Sousa 1966). Several species of corals, seagrasses, seaweeds, mangroves, fish,
crustaceans, sea mammals and turtles, birds and other organisms were observed and identified.

According to Kalk (1995) and Macnæ & Kalk (1958; 1969) the scientific endeavour (1911-1950) raised great awareness about the tropical marine animals and plants of Inhaca and Portuguese islands. Study visits from international research institutions propelled the acknowledgement of the islands as a source of tropical biodiversity. As a result, the Marine Biological Research Station of Inhaca was founded in 1951. The Research Station comprised laboratories, a herbarium and a museum, research rooms, a library and accommodation facilities. The aim of the Research Station was to use the facilities for teaching biology and ecology during vacations by universities, teacher-training colleges from mostly Mozambique, South Africa and Rhodesia.

An influx of tourists visiting the islands led to construction of Inhaca Hotel in 1962. The steady tourism boom then threatened the environmental quality and stability of the islands' ecosystems such as coastal forests, mangroves and coral reefs. Excessive exploitation of natural resources as well as overcrowding on beaches of the small archipelago was then threatening the environment (Moura, 1969). As a consequence, Forest and Marine Reserves were established in 1965 to protect the ecosystems and biological richness. However, population increase, extreme poverty among local communities, poor soils due to their sandy nature, reduced land for agriculture purposes caused by the establishment of forest reserves, uncontrolled developmental programmes increased the demand for resources aggravating the conflict in natural resources utilisation (Figs. 1 & 2). Both human activities and global climate changes have been threatening environmental quality of Inhaca archipelago.

2.2 The role of the biological environment


2.2.1 Coastal forests

The forests covering the eastern and western dune ridges on Inhaca Island and the woodland on both islands protect the archipelago from sheet erosion. The dunes covered with vegetation along the eastern coastline are barriers against waves or wind-blown sand. They also provide nesting sites for both birds and four endangered sea turtle species. The associated back and frontal dunes are reservoirs of sand that is supplied to the beaches during periods of erosion (Carter, 1988; Chapman, 1976; Longhurst, 1987; Muachnia, 1999).

However, the forests are under heavy pressure on Inhaca Island due to uncontrolled development and poverty of the local communities. The forests are being cleared for firewood, construction materials (e.g. poles and reed). Moreover, local communities encroach into the forests for agriculture purposes. These practices are jeopardising the stability of the island and degrading the ecosystems.
2.2.2 Mangroves

Several researchers (Carter, 1988; Chapman, 1976; Kalk, 1995; Macnae & Kalk, 1958; 1969; Semesi, 1998) consider mangrove swamps as transitional habitats between the marine and terrestrial ones. There are six mangrove plant species at Inhaca archipelago. They grow in the shallow tidal sea, sheltered estuarine coast of the northern wetlands, Saco da Inhaca and Ponta Raza (Fig. 2). Mangrove total land area is about 500ha (de Boer, 1999; Muacanhia & Albano, 2002) representing about 12% of the total land area of Inhaca Island. There are about 10ha of mangrove forest on Portuguese Island.

According to Carter (1988); Chapman (1976); Kalk (1996); Macnae & Kalk (1958; 1969); Muacanhia & Bhat (2001), Saket & Matusse (1994), Schleyer et al. (1999) and Semesi (1998), mangrove swamps form a natural barrier for surf and salt penetration from the sea into the agricultural land. They retain sediments from the land enhancing the protection of corals. Mangrove forests trap sediments from the sea providing soil for the microflora and large number of animal species. They are also shelters for crabs that are harvested from the muddy areas for human consumption. Mangrove swamps are nurseries for marine and terrestrial life e.g. crustaceans, fish and birds. Finally, they do also provide timber used as fuelwood, in the construction of boats and houses. Therefore, mangroves have very important ecological, biological, social, economic and cultural values.

It should pointed out that mangrove are regenerating and expanding (de Boer 2000; Muacanhia & Albano, 2002). The reasons are not yet well understood. However, it might be a temporary bonanza as construction of tourism resorts and dumping of waste in mangrove swamps is a serious threat for the stability of the seashore and the productivity of the mangrove ecosystems.

2.2.3 Coral reefs

According to Longhurst (1987), Kalk (1995), Macnae & Kalk (1958; 1969) and Schleyer et al. (1999), the coral reefs in broad context are important in coastal zone conservation, maintenance and management. They are barriers against surf or strong waves protecting and maintaining the shoreline. Coral reefs are nurseries of the sea providing ideal conditions for development of small fish and crustacean species. They are also shelters for worms, seashells, starfishes, sponges, anemones and other marine organisms. The "Comissão Nacinal do Plano" (1990) and Moura (1969) reported that the coral reefs of Inhaca are an important tourist attraction because they are the closest to Maputo city. Schleyer et al. (1999) stated that the Mozambique fishing industry depends very much on environmental quality of both coral reefs and mangroves. The coral reefs are at risk today due to trampling of speedboats, anchoring, illegal fishing, scuba diving and dumping of waste by yachts.

2.3 Environmental impact of tourism

It is reported that tourism is a growing industry and an important force for the economic development of countries and regions (Miller & Auyong, 1991; Musyoki,
Tourism leads to economic diversification and helps to stimulate economic activity and growth in isolated rural areas. Stewart (1993) and Musyoki (1995; 1996) reported that "sustainable tourism development and marine conservation regimes" could be hand in hand. Tourism may act to promote Government’s awareness and implementation of conservation policies. However, Moffat et al. (1998) and Muacanhia (1999) found that poverty is a serious constraint for tourism development and marine conservation in Eastern Africa as the local communities are not yet involved in management of the protected areas.

**Figure 2: The main land-uses of Inhaca and Portuguese islands**

It should be pointed out that tourism is an unstable source of income greatly influenced by uncontrolled factors such as political instability, weather, disease outbreaks and currency fluctuation. "Tourism may destroy tourism" due to overcrowding and environmental degradation.

There are serious problems related to tourism development on Inhaca. It does not have yet direct impact on local community welfare. At present, "sustainable tourism development and marine conservation regimes" are at risk on Inhaca archipelago.

3 Conclusions

The environmental degradation caused by uncontrolled housing along the shorelines, encroachment, bush fires, illegal fishing or poaching and collecting of marine life are evident.

The harvest of forest products (poles and firewood), the construction of tourism resorts in mangrove swamps or shorelines as well as dumping litter in these areas is endangering the stability of Inhaca and Portuguese islands. "Tourism may destroy tourism"! All these negative practices may enhance environmental changes on Inhaca and Portuguese Islands.

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References


