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Mangrove Restoration: A Potential Tool For Poverty Eradication, A Case Study (Red Sea State)

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***Abstract*—In the Red Sea State mangrove forestry suffers from; lack management plans; inadequacy in management resources; inadequate knowledge, of mangroves silviculture, of the multiple use potential of resources and of techniques and economies of natural regeneration and reforestation.**

Recent satellite images and aerial photographs reveal that much of the original mangrove area between Port Sudan and Eirim / Marsa Sheikh Sad has disappeared; mangroves are being destroyed at what appears to an alarming rate, mainly due to excessive browsing by camels.

In the Red Sea State, the major obstacles that have hitherto prevented rational uses of mangrove forests have been: the sectorial approach of mangrove resource management, lack of community inputs into management efforts, the poverty status of many indigenous coastal communities and a lack of awareness amongst decision markers about the true values of mangroves. These management problems are compounded by inadequate knowledge of silviculture of mangroves, of in multiple use potentials of resources, and of the techniques of natural regeneration and reforestation. There is no effort has been made to restore degraded mangrove system in the state. Mangrove restoration has a big potential to increase the mangrove resources, provide employment to local population, enhance biodiversity and fisheries productivity, and generate economic benefits to the poor coastal communities.

***Keywords*—Mangroves,Silviculture, Reforestation, Regeneration, coastlines.**

I. INTRODUCTION

Mangroves are defined as the characteristic littoral plant formations of tropical and subtropical sheltered coastlines. They generally consist of trees and bushes growing below the high-water level of spring tides. Their root system is thus regularly inundated with saline water, even thought, it may be diluted due to freshwater surface run-offs and only flooded once or twice a year [1].

The term mangrove is used to describe both the entire ecosystem and the individual trees and bushes comprising the ecosystem. In the Sudan, mangroves are found along the Red Sea Coast, in particular at the mouth of seasonal streams (Khors e.g,, Ashat, Hashiri, Guwab and Haul) and along water inlets and small bays (marsas e.g., Atta and Haidoub), where the coast is fringed by coral reefs acting as breakwaters and thus protecting the mangroves from the actions of waves and water currents.

The coast line, except in front of the Tokar delta, is fringed by a reef which gives way to a deep channel (generally 50- 150 m) but extending to 600 m in some locations, followed by the outer barrier reef which follows the deep channel zone extends along the coast at a distance of 2-6 miles from the shore, rising to the surface of the water or just below [2].

Natural mangrove forests cover 308 hectares in the state. Few mangrove plants are themselves consumed as food, but mangroves support marine fisheries by serving as a nursery and as feeding ground for many marine invertebrates and fish and by producing large amount of detritus for the marine food- web. In addition to a commercial fishery offshore, there is often a valuable small- scale fishery inside the mangrove area. Mangroves also support food production by acting as shelter belts and consolidating new accretions and by providing firewood and charcoal for cooking. Therefore,

the successful integrated management of mangrove wood and non- wood resources has a great role to play in alleviating poverty in the state.

II. Status mangrove forest resources in the Red Sea State:

In the Red Sea State, mangroves are found along the Red Sea Coast, in particular at the mouth of seasonal rivers and streams (Khors) and along water inlets and small bays (marsas), where the coast is fringed by coral reefs acting as breakwaters and thus protecting the mangroves from the actions of waves and water currents. A total of 19 mangrove areas have been identified. The stands comprising these areas are generally small, forming only a narrow fringe along bays, lagoons and sheltered coastlines and on near shore islets.

Recent satellite images and aerial photographs (Afro Cover 2003) reveal that much of the original mangrove area between Port Sudan and Eirim / Marsa Sheikh Sad has disappeared; mangroves are being destroyed at what appears to an alarming rate, mainly due to excessive browsing by camels.

An old navigational chart, which is based on a survey undertaken in 1884, revealed that mangroves previously covered all of the coast line between Port Sudan and Marsa Sheikh Sad south of Suakin as a dense green belt. Another map dating from 1935 indicated a mangrove area north Halaib and a more recent map showed what appeared to be an extensive area southwest of Agig. Only limited quantities of mangroves are reported between Halaib and Port Sudan due to the existing topography of this area.

Kassas'[3] reported six recognized mangrove zones at Marsa Ata (Hoshiri mangrove area). Au and Mohamed [4] found only three of these remaining, but reported the following findings regarding zonal communities near Marsa Haidoub (Guwab mangrove area): Avicennia marina. Arthro chnemum glaucum. Halopeplis perfoliata. Suaeda fruticosa. Suaeda monoica.

However, within any locality a few of these zones are represented. Avicennia marina, (which is the dominant species), as found in the Red Sea State is a small, evergreen tree, with straight or crooked trunk with white bark. When cut or browsed by camels the species regenerate by coppice.

The height of the stress ranges from less than 0.5 to 12 m, the former being stunted due to heavy browsing by camels. Natural shrubs of less than 2m in the height also occur on elevated sites. Diameters at breast height generally range between 10 to 15 cm but a few older trees are often found within the stands reaching around 30 cm.

A vast number of studies species pattering ("zonation' [8], salinity and flooding tolerances, and basic autecology of [5] [6] individual mangrove species . These data could be used much more effectively to guide the spatial placement of different species in restoration projects and could reduce the emphasis on single- species or low- diversity plantings. However, observed species zonation patterns do not represent successional sequences[7]. Consequently, assumed successional trajectories based on zonation patterns of unmanaged mangrove forests should not be used as assessment benchmarks in mangrove restoration projects'[8].

III. Valuable of Mangrove Ecosystem:

Mangrove wetlands are multiple use systems that provide protective, productive and economic benefits to the coastal communities. The economic values of mangrove resources stems from:-

1) availability of fishery products and other aquatic products;
2) availability of wood products such as timber, poles, posts and firewood;
3) availability of non-wood products such as fodder, honey, medicines and dayes; and
4) more recently mangrove have been managed for integrated fish culture [12] and for eco tourism [3]

Mangrove forests are vital for healthy coastal ecosystem. The forests detritus, consisting mainly of fallen leaves and branches from the mangroves, provides nutrients for the marine, environment and supports immense varieties of sea in intricate food webs.

A recent study on the relationship between mangroves and fish in the Sudan Red Sea evaluated two mangrove sites compared with two control sites without mangroves. Over 30 different species of fish were recorded from the mangrove area compared to only 9 species from the open shore of the species dependent upon the mangroves as nursery grounds, Mugil spp, Chanos chanos, Acanthopagrus berda, Crenidens crenidens and pomadasys commersonni are commercially important fish caught in their adults stage in areas adjacent to mangroves'[2].

Shrimps are also dependent upon mangrove for part of their lifecycle. Eight species of shrimps have been reported from the Red Sea. Twenty different species of crabs have been collected from mangrove areas. Echinoderms such as sea cucumbers (Holothuria and Actinopyga spp) are also found in the shallow waters around [13] mangrove areas as seen near Khor Ashat.

Report on a study on crabs undertaken in the same mangrove areas as the above study on fish. Twenty species of crabs were collected belonging to four families (Portunidae, Xanthidae, Ocypodidae and grapsidae). Detailed studies were carried out on the most common species (Metopograpsus messor).

In Queen land (Australia) [12] for example, the seafood industry in the fifth largest primary industry, with an annual commercial catch worth several hundred million dollars. An estimated 75 percent of commercially caught fish and prawns depend directly on mangroves at same time in their lives or feed on food chains leading back there. Since those species making up the remainder of the catch probably also owe much to nutrients exported from the mangroves, therefore these coastal forests can be seen as one of our major assets.

In many countries, mangroves play an important role in protection of the coasts and hinterland against the actions of waves, winds and water currents.

In the Red Sea State, the role of the mangroves as a protection against waves and water current is limited due to the fringing reef found parallel to the coast, which acts as a breakwater. Storms and strong winds are also not common. However, the mangroves fulfill a very important role in trapping silt and sediments brought to the Red Sea by the seasonal rivers and stream (Khors). If the mangroves were to suddenly disappear this silt and mud would be deposited on the sea grass beds and coral reefs, in some instances killing them. As the coral reefs of the Red Sea are world renewed for their beauty and are expected to attract a considerable number of scuba divers and other tourists to the state in the near future, the disappearance of the mangroves would result in an economic as well as an ecological disaster. It is thus of paramount importance that the existing belt of mangroves at the outlet of major Khors be kept intact and the area of mangroves be extended. No stands should ever be clear felled.

IV. Rehabilitation of Mangroves forests, how? And why?

In the Red Sea State mangrove forestry suffers from; lack management plans; inadequacy in management resources; inadequate knowledge, of mangroves silviculture, of the multiple use potential of resources and of techniques and economies of natural regeneration and reforestation.

Field [8] distinguished between rehabilitation of an ecosystem- the partial or full replacement of the ecosystem‘s structural and functional characteristics- and total restoration of an ecosystem- the act of bringing an ecosystem back to its original condition. In the Red Sea State, restoration is one possible end-point of a successful rehabilitation effort, but there are many others. Forestation projects that provide forest cover and initiate a succession sequence can be seen as successful rehabilitation projects [10]’ [11], as can multiple- use systems for high and sustainable yield. Because there is little evidence to support the notion that mangrove silviculture alone can provide high and sustainable yield [9], and because the rapid rotation times of mangrove plantations do not allow for development of structural and functional characteristics of a mature forest, mangrove silviculture alone does not appear to be a good candidate for either rehabilitation or restoration of ecosystem. However, the wealth of well- developed techniques for mangrove planting derived from silvicultural operations lend themselves well to rehabilitation of degraded coastal lands. This observation is in notable contrast to the highly variable and non directional pathway seen in many wetland restoration[14]projects.

There are several advantages of using artificial regeneration. The species composition and distribution can be controlled, genetically improved stocks could be introduced and pest infestation can be controlled. Transplant saplings are collected either from the nurseries or scooped from the natural forest (wildings). It is important to protect the roots when collecting and planting saplings. This is normally achieved by scooping the saplings with root ball diameter half the height of the sapling. In a mangrove plantation experiment in Kenya, Kaito’[2] found that the survival of the transplanted saplings or prop gules was better (80-100% of 70 000 after 24 months) than for transplanted small tress (5% after 12 months). Planting of nursery saplings gave a higher survival rate (80-1005 after 24 months) compared to transplanting of wildings.

The present condition of the remaining stands and the current alarming rate of degradation, it is recommended that a strategy for the rehabilitation, conservation and management of the mangrove resources be implemented, with the following immediate objectives:

1) Protection of mangroves against flirt her destruction and degradation.

2) Extension of the area presently covered with mangroves through rehabilitation of degraded and denuded areas formerly covered by mangroves either by securing natural regeneration or by planting.

3) Integrated resource management of the mangrove ecosystem to ensure sustainable utilization of mangrove products and to enhance the services provided by the ecosystem.

Mangrove restoration and managers, who normally work in isolated conditions must collaborate with each other and have access to current data and evolving concepts in mangrove ecology to improve restoration programs. This idea is not new; reports issued since the early 1970s have repeatedly called for international databases, mangrove information clearing houses, and improved communication among basic researchers, managers, planters, and residents (15). The potential of the world wide web, increasingly accessible via low- technology means such as cable television, affords new hope for better communication and information sharing among parties involved in mangrove restoration. Such a mangrove web would at the very least minimize the repeated rediscovery of planting (16) methods, virtually unchanged since Waston , first described them, on a project- by- project basic (7’8). The coastal development not proceed without conscious attention to restoration. Information, expertise, and technology exist to guide and support the restoration of mangrove wherever the political will exist.

Sociopolitical and economic constraints to further mangrove restoration may be ameliorated by incorporating multiple stake holders in the planning process and by focusing on restoration and management programs that have multi uses and serve multiple constituencies.

Another essential factor in determining the success of a restoration project is the level of co-operation of the local community and their leaders. The pressure of the local population will influence the structure and functions of mangrove systems that surrounds them. Environmental education can contribute to active involvement and greater public participation in issues related to mangrove conservation and management.

When management decisions incorporate local inputs they will succeed, and political support will be greater when the public sis satisfied that it has been heard and had an opportunity to become involved.

V. CONCLUSSION:

Mangroves are defined as the characteristics littoral plant formations of tropical and subtropical sheltered coastlines. They generally consist of trees and bushes growing below the high- water level of spring tides.

Given the importance of the mangrove not only in terms of present and potential wood and non-wood forest products which can be obtained (e.g., wood products and fodder) but also in terms of the services provided by the mangrove ecosystem (e.g., provision of detritus for the marine food web; trapping of silt and sediments from seasonal streams; habitats for marine life, avfauna and other wildlfe; a source of genetic biodiversity; and the educational and recreational value of mangrove. Over 30 different fish species are reported from the mangrove areas of the Red Sea State coast, several of them of commercial importance and dependent upon the mangroves for at least part of their lifecycle.

The major current use of the mangroves is as a sources of camel fodder for part of the year and degradation and depletion of mangroves, and to excessive browsing by camels, is taking place in all mangrove area found along the coast.

In the Red Sea State, the major obstacles that have hitherto prevented rational uses of mangrove forests have been: the sectorial approach of mangrove resource management, lack of community inputs into management efforts, the poverty status of many indigenous coastal communities and a lack of awareness amongst decision markers about the true values of mangroves. These management problems are compounded by inadequate knowledge of silviculture of mangroves, of in multiple use potentials of resources, and of the techniques of natural regeneration and reforestation. There is no effort has been made to restore degraded mangrove system in the state. Mangrove restoration has a big potential to increase the mangrove resources, provide employment to local population, enhance biodiversity and fisheries productivity, and generate economic benefits to the poor coastal communities. Artificial planting of mangroves well help to solve the problems of limited supply of mangroves wood products as well as maintaining the overall balance of the costal ecosystems. Planting mangroves does not require deep knowledge or heavy financial commitments. It is recommended however that before one embarks on planting mangroves, studies on zonation and site classification be made in order to determine the most appropriate silvicultural treatment to apply, the species to use in reforestation and site potential.

"Fig. 1," even at the beginning of a sentence.

TABLE I. MANGROVES AREA AT THREE LOCATIONS:

Location / Date	Klanaeib Km^2	Feddans	Halaout Km^2	Feddans	Kilo Tammania Km^2	Feddans
(+) 1958	0.9696	231	0.0548	13.0	0.0787	19.0
(+)1966	0.7992	190	0.0378	9.0	0.0850	20.0
(+)1978	0.6738	160	0.0305	7.0	0.0064	2.0
(+)1996	0.6452	153	0.0260	6.0	0.0361	9.0
*2003	0.6400	152	0.0263	6.2	0.0272	6.4

SOURCE: (+) BASHIR (1998) * SATELLITE IMAGE, AFRO- COVER PROJECT (2003)

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