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Mangrove forest ecosystem utilization for sustainable livelihood in Calabar South, Nigeria

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ABSTRACT

The mangrove forest ecosystem plays a very dominant role in livelihood sustainability. This ecosystem abound several resources, which could be harnessed for man's use. It is the intention of this paper to examine various ways in which the mangrove forest ecosystem has been utilized in the study area. Five communities identified with mangrove exploitation were chosen for the study. 400 copies of questionnaire were distributed to the communities. Descriptive statistics was used to analyze the data collected from the field. The result of the analysis shows that mangrove wood was used for cooking, fish smoking, building, bakery, charcoal making and staking. The mangrove ecosystem was being used for farming, fishing, poultry keeping and livestock farming. Also, it was found that between 1989 and 2009, a total of ₦13,633,140 and ₦27,591,120 was generated as revenue to both the government and the people from cutting a total of 130,724 mangrove trees. Between 2010 and now, there is no record on income generated and the volume of mangrove wood cut because of the ban on logging in the state.

Keywords: Mangrove, forest, ecosystem, utilization.

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INTRODUCTION

The utility of the mangrove forest ecosystem, which may be direct on the consumers, is without any doubt very high. The importance of these direct functions that the mangrove forest ecosystem renders defines its critical position in the rural community livelihood. The higher the perceived value of the mangrove forest ecosystem, the more it is exposed to various forms of utilization and exploitation. The mangrove forest ecosystem is very critical to survival of some rural communities inhabiting the area in the sense that they depend on this ecosystem for their daily survival in the form of income, food, building and healthcare. To them, life without the mangrove forest is unimaginable.

Generally, the importance of mangrove cannot be over emphasized. Mangrove trees remained the most efficient photo synthesizers than almost any other plant, forming a bridge between land and sea for much of the world's tropical coastal marine life (Russell, 1986). Quarto (2001) reported that mangrove served as fish nurseries and breeding grounds for fishes, crabs, shrimps, Mollusks, and other sea life. Mangrove ecosystem is also an essential habitat for many endangered species such as manatees, American alligators, Bengal tigers and dark headed cuckoo. They constitute prime nesting sites for monkeys, fishing cats and jaguars, monitor lizards and mud-skippers. Chan (1986) in his study of human habitation and mangroves in Peninsula Malaya maintained that Mangrove plays an essential role in enhancing water quality being that they are effective at filtering inshore pollutants and protecting fresh water sources from salt water intrusion. He further stressed that mangrove ecosystem remain a source of valuable resources essential for the livelihood and survival of indigenous coastal people, which may include: sea food, fuelwood, construction materials, medicines, soaps, honey, oils, and tannins. Mangrove ecosystems are the greatest and often the only protein sources for millions of traditional villagers worldwide (Chan, 1986).

In a related development, Mantra (1986) in the study of socio-economic problems of the Kampung Laut Community in Central Java also indicated that mangrove serves in the protection of shorelines from erosion, flood

regulation, violent storms and hurricanes.

It is interesting to note that despite the natural resilience, mangrove ecosystem is threatened on a worldwide scale with unprecedented widespread and long-term damage. The harmful consequence of human activities is worthy to be noted. The most disturbing aspect is the uncontrollable rapid commercial exploitation of raw materials from the mangrove, thereby converting the ecosystem to some uses that are not compatible with regeneration of the ecosystem. A case in point in the study area is the establishment of Aqua Vista Farm through the granting of concessionary right by the natives, which claimed nearly 3.5 hectares of the mangrove forest. By implication, the change in mangrove ecological landscape may bring about overall changes in the ecosystem.

Objectives

1. To examine various ways in which mangrove forest ecosystem is being utilized.
2. To determine the income generated from the sales of mangrove in the area.

Study area

Calabar South Local Government is located along the Nigeria-Cameron Coast between Latitude 4° 55′ N and Longitude 8° 16′ E being part of the Calabar Mangrove Estuary under West African mangrove sub formation (Ukpong, 1995). Locally, it is bounded to the North, East and West by Calabar Municipality and Odukpani Local Government Areas. It is bounded to the South by Akpabuyo Local Government Area.

The area is flanked on its eastern and western borders by two rivers, the Great Kwa and Calabar River respectively and to the south by the Atlantic Ocean.

The climate of the area is humid tropical although rainfall occurs throughout the year. The place experiences double maxima rainfall regime in July and September (1880 mm), the lowest rainfall of 240 mm occurs from December to February (Ukpong, 1994). The temperature is uniformly high with a maximum of 30°C and minimum of 23°C. The area has a high relative humidity usually between 80 and 100% and an average vapour pressure of 29 millibars. High salinity (3.8 ± 0.4%) is limited to the dry season, while lower salinity (0.5 ± 0.6%) occurs in the rainy season (Ukpong, 1995). Tidal amplitude in the estuary ranges from 2.01 m at spring tides to 1.07 m at neap tides (Nigerian Navy, 1986).

The settlement starts from the mouth of estuarine coastline and projects to the hinterland and its extension to the south is limited by the mangrove swamps. Fallow land is available only eastwards up to the Great Kwa River and northward. The area is an inter fluvial settlement, typical in this part of the country built on high area between two adjacent rivers. This locational advantage permits easy access especially through waterways for intending migrants who are mostly fishermen and traders in wood and craft items to the area. However, the swamp as a whole varies by less than 1 in 500 m in elevation except on the upland forest ecotone where abandoned levees may exceed 1 in 500 m (Ukpong, 1995).

The settlement pattern following the order above takes the linear shapes except within the extending 20 km of the mangrove forest area to the Atlantic Ocean, some clustered fishing settlement pattern are identified otherwise known as ‘Ine’ (Fishing Port). The pressure of these fishing settlements in the area provided and facilitated easy access into the mangrove forest for rapid exploitation of its resources leading to increased deterioration of the ecosystem.

Geologically, the area is composed of tertiary sandy deposits of fluvio-marine origin. These are overlain by quaternary silt and clayey alluvium eroded from massive pre-Cambrian rocks of Oban Hills in the outskirts. This characteristics poorly consolidated, non cohesive and porous rock formation permits large accumulation of water through constant and occasional flooding of the ecological zone. Floodwater recession or tidal retreat permits deposition of alluvial fans and levees quite supportive of plant growth. It accounts for occupational engagement in market gardening among dwellers. The soils are sandy; light hued in some location, but clayey, muddy, dark grey in water logged and boggy.

Here, saline mangrove soils, developed on mud, sand or peat at the mouths of estuaries inundated by tropical tide water’s (Ukpong, 1995). Also, more acid soils are identified to be associated in the zonation of *Nypa fructican, Rhizophora* species dominance (Ukpong, 1995).

The predominant vegetation type is mangrove. The mangrove flora consists of trees and shrubs of few species. The common genus is *Rhizophora* with the family *R. racemosa, R. harisonii* and *R. mangle.* The dominant feature of mangrove is the stilt roots of Rhizophora species. Associated with these species are *Avicennia Africana* and *Laguncular racemosa*. There are also palms, *Prodococcus bateri, Ancistrophyllum opacum* and the gregarious and aggressive *Nypa fruitican.* Salt marshes and sea grasses interact with the mangrove forest to support the entire coastal zone. Hence, because of its status of composition and structure, it is known to be part of the most complex vegetation, which is the northernmost limits of the Mangrove growth in the Cross River estuary (Ukpong, 1995).

This complex plant community of wetland origin formed an ecological niche for reptiles, monkeys, birds, fishes, shrimps, mollusks and other wildlife. Thus, it is often harvested for wood, fuelwood, tannin, leaves, fibers and

Table 1. Sampled communities, their population sample size.

S/n	Communities	Population 2008	Approximated sample population	Proportion of sample size for analysis
1	Anantigha	20,574	206	120
2	Duke/Cobham Town	13,460	135	79
3	Efut Obufa Esuk	3,801	38	22
4	Henshaw town (Edibe-Edibe inclusive)	5,813	58	34
5	Mbukpa/Akani Esuk Orok	24,707	247	145
	Total	68355		400

Source: National Population Commission (1991), Author's Field Report (2013).

dyes. Mangrove ecosystem in particular is important for inland fisheries, serving as highly productive habitat for shell and finfish. These inform the migration of fishermen from Delta, Akwa Ibom and Akpabuyo to settle and take advantage of the rich supply at this point (Nest, 1991).

Its estimated population in 2007 stood at 191,515 (NPC, 2006); in-migration has formed the major source of the population growth. The immigrant communities include Ibibio, Oron, Ibo, Ijaw, Anang, Urhobo and other tribes within and outside Nigeria. Despite the ethnic intermix, a fraction of indigenous population mostly of the Efik/Efut extraction are found in the locality. This wave of migration brought along changing perception of interaction with the mangrove ecosystem. This scenario contributed immensely in the remarking of the greater part of the mangrove ecosystem (Okpiliya et al., 2013).

The rural people engage in artisan fishing and cultivation of vegetables, cassava and maize at commercial and subsistence level. Fishing is done using small nets to catch even fingerlings. Shrimp farming is also in vogue. It involves clearing/cutting down the available mangrove forest of aquatic fauna for making ponds. Logging and lumbering of fuelwood for charcoal production sales and also for timber are common practices. The fish species are Ibat/Ekpai (*Ethmalosa fimbrata).* The 'bonga' and 'flat Cameroon Sardine' (*S. Cammeronesis).* Commercial shrimps and prawns found here are: Pink shrimp (*Penacus duorarum)*, salt water prawns (*Newmatopalaema* spp.) among others.

Economic wood species harvested are: mangrove, Achi gum (*Oxystigma spp),* Owen (*Mitragyna* spp.), Camwood (*Pterocarpus* spp.), Mkpanek (*Uapaca* spp.) and so on (Fayemi et al., 2005).

METHODOLOGY

The study sample size was determined by statistical calculations using the Yamane (1980) formula, which is given as:

$N = 1 + N (0.05)^2$

Where:

n = sample size

N = sampled population

e = level of precision or confidence level at 0.05 significance

Hence:

N = 68355

$n = 1 + 68355 (0.05)^2$

N = 400.00

Questionnaires were distributed to the sample of 400. The content of the questionnaire covered demographic characteristics of the respondents, income, various forms of utilization of the mangrove forest ecosystem, farm sizes, frequency of trips for fuelwood, area of fish farms and the species of fish stocked. Descriptive statistic was used to analyze the data from both the primary and secondary sources (Table 1).

RESULTS AND DISCUSSION

Table 2 indicated the demographic characteristics of respondents in the study area. Here, 279 respondents (69.75%) were males, while 120 respondents (30.25%) were females. Those in the age bracket of between 33 and 39 years from the bulk of the population with 189 respondents (47.25%), followed by the respondents whose ages were above 40 years. 142 respondents had their ages ranging between 26 and 32 years were 65 (16.25%), while those between 19 and 25 years were only 4 (1%). There was virtually no respondent between 12 and 18 years age bracket. Information from the respondents on their marital status revealed that a greater percentage of the respondents were married. This group of persons number 244 (61%). The respondents that were single were 104 (26%), while the divorcees were 46 (11.5%). The respondents whose marriages were separated were 6 (1.5%). The occupational profile revealed that majority of the people were involved in mangrove fuelwood extraction and selling as 258 respondents (64.5%) attested to this fact. This was followed by fishing with 68 respondents (17%), farming 44 (11%) and civil servant 30 (7.5%).

Table 3 shows that the utilization of mangrove wood for commercial bakery top other users as 290 respondents (representing 72.5%) attested that they use mangrove for

Table 2. Demographic characteristics of respondents in the study locations.

Socio-economic characteristics	Anantigha		Efut Obufa Esuk		Cobham Duke Town		Henshaw Town		Mbukpa Akani Esuk Orok		Aggregates	
Sex												
Male	96	80	13	59.09	47	59.49	7	20.59	116	80	279	69.75
Female	24	20	9	40.91	32	40.51	27	79.41	29	20	121	
Total	120	100	22	100	79	100	34	100	145	100	400	100
Age (years)												
12-18	-	-	-	-	-	-	-	-	-	-	-	-
19-25	-	-	4	18.18	-	-	-	-	-	-	4	1
26-32	-	-	9		-	-	27	79.41	29	20	65	16.25
33-39	48	40	-	40.91	47	59.49	7	20.59	87	60	189	47.25
>40	72	60	9	-40.91	32	40.51	-	-	29	20	142	35.5
Total	120	100	22	100	79	100	34	100	145	100	400	100
Marital status												
Married	94	78.33	8	36.36	47	59.49	8	23.53	87	60	244	61
Single	26	21.67	14	63.64	16	20.25	20	58.82	28	19.31	104	26
Divorced	-	-	-	-	16	20.25	-	-	30	20.69	46	11.5
Separated	-	-	-	-	-		6	17.65	-	-	6	1.5
Total	120	100	22	100	79	100	34	100	145	100	400	100
Occupation												
Civil servant	24	20	-	-	-	-	6	17.6	-	-	30	7.5
Farming	-	-	-	-	15	19	-	-	29	20	44	11
Mangrove fuel woodselling/extraction	72	60	18	82	31	39	21	61.8	116	80	258	64.5
Fishing	24	20	4	18	33	42	7	20.6	-	-	68	17
Hunting	-	-	-	-	-	-	-	-	-	-	-	-
Total	120	`100	22	100	79	100	34	100	145	100	400	100

Source: Author's field work, 2013.

various forms of baking. This was followed by the utilization of mangrove for charcoal making 50 (12.5%), cooking 25 (6.25%), fish smoking 20 (5%), building 8 (2%) and finally staking, which was represented by only 7 respondents 1(%). It is important to note that there are so many bakeries in the study area and the only source of energy is the mangrove. This has given led to much depletion of mangrove in the area.

Table 4 indicated that 192 respondents (48%) were of the opinion that they go for mangrove harvesting weekly. This was followed by those

Table 3. Utilization of mangrove wood.

S/no	Utilization of mangrove wood for various purposes	Frequency	Percentage
1	Domestic cooking	25	6.25
2	Fish smoking	20	5.0
3	Building	8	2.0
4	Commercial bakery	290	72.5
5	Charcoal	50	12.5
6	Staking	7	1.00
	Total	400	100

Source: Author's Field survey, 2013.

Table 4. Regularity of harvest trips of mangrove.

Period of harvest	Frequency	Percentage
Daily	100	25.0
Weekly	192	48.0
Twice a week	108	27.0
Bimonthly	-	-
Total	400	100.0

Source: Author's Field Survey, 2013.

Table 5. Utilization of mangrove forest ecosystem for various agricultural activities.

Agricultural activities	Frequency	Percentage
Crop farming	213	53.25
Fish/shrimp farming	104	26.0
Poultry farming	61	15.25
Livestock farming	22	5.5
Total	400	100.0

Source: Author's Field Report, 2013.

that go for the harvest of mangrove twice a week with 108 respondents (27%) and the daily harvesting being represented by few respondents (25%). No respondent for the harvest of mangrove bimonthly. As observed in the field, the harvest of mangrove is done in such a manner that the quantity harvested is so much that they could last for a reasonable time.

There is no doubt that there is high pressure on the mangrove forest ecosystem for various agricultural activities. As Table 5 indicated, 213 respondents (53.25%) make use of the mangrove forest ecosystem for crop farming. It is interesting to note that most of the food crops used in Calabar Metropolis come from this area. Crops from the ecosystem include yam, cassava, plantain, cocoyam, maize and banana. As observed in the field, there are a good number of seasonal tenant migrants from neighboring states of Akwa, Ibom and Abia who come here to cultivate these crops and sell to the public. The average farm sizes in the area ranges from less than 1 hectare to a maximum of four hectares.

As Table 6 shows, majority of the farmers (about 67.80%) own farms of between 2 and 4 hectares. Small percentages of the respondents (12.5%) have farm sizes of more than 4 hectares, while about 20% own farm sizes between less than 1 to 2 hectares. Owning a farm plot in the study area is through lease and in most cases outright purchase. There is also a way of land acquisition locally called "work and divide" in the study area. In this scenario, the farmer acquires a piece of land from the owner and then farm and thereafter share the proceed with the owner of the land.

Table 6. Farm sizes.

Area (hectare)	Frequency	Percentage
Less than 1 hectare	70	17.5
1 – 2	55	13.75
2-3	150	37.5
3-4	120	30.0
>4	5	12.5
Total	400	100.0

Source: Author's Field Report, 2013.

The mangrove forest ecosystem is also used for fish farming. As Table 5 indicated, 104 respondents (26%) use the area for fish farming. The fish farms ranges from less than 1 hectare to a little more than 4 hectares (Table 6).

As shown in Table 7, majority of the fish farms in the mangrove forest ecosystem ranges from 1 to 3 hectares. About 260 respondents (65%) have fish farms of between 1 and 3 hectares. 100 respondents have fish farms of less than 1 hectare and a negligible few, 8 respondents (2%) have fish farm of more than 4 hectares.

As seen from Table 8, there is a total of 23 fish farms of various sizes distributed throughout the study area. The species of fishes stocked include Clarias, Heteroles and Tilapia.

Aside from establishing fish farms, fishing is done along the creeks in the mangrove. Table 9 indicated the various types of fishes caught by the inhabitants of the area for food and sale to neighbouring areas.

Table 8. Fish farms and the species stocked in sampled communities.

Sampled mangrove communities located	Names of fish farmers/size	Total numbers of fish farms in the mangrove zone within the year	Spp stocked
Anantigha	1. Hon Eyamba Ekpenyong	1	Clarias, Hetro, tilapia erotes
Akani Esuk Orok	Uduak Ekpa	1	Clarias and Tilapia
Anantigha	Effi-Mbukpa co-operative	1	“
Anantigha Henshaw town	1. Mary Ita Ephraim 2. (2ha) Hon Chief Ekeng Ewa (iha)	2	“
Anantigha	1. Aqua vista (Dr. O. Umoh)	1	
Anantigha	1. Mr Asuquo O. Asuquo (Sukus fish farm)	1	Hetro, Clarias Tilapia
Akani Esuk Orok	1. Don Collin fish farm (1ha) 2. Alkkays farm-kar in David (1ha)	2	“
Obufa Esuk (Uwanse)	Mr. Boniface Uyim	1	“
Efut Obufa Esuk Anantigha	1. Mr Victor Abia (4HA) 2. Mr. Daniel D Usua (0.5ha)	2	
Efut obufa esuk Akani esuk orok	1. Mr. Effiom Edem (1.5ha) 2. Chief Henry Bassey (0.5ha)	2	Clarias and Tilapia
Akani esuk orok	1. Mrs. Isamo – 2HA 2. Mrs. akwa owo – 1HA	2	Clarias
Anantigha Akani esuk orok Anantigha	1.Eng Ette Akpan-2HA 2.Chief Udo Bassey – 1.5HA 3.Mr. Emmanuel Ofom	3	“ “ “
Anantigha Akani esuk orok Cobham/Duke town	1.Hon Onya Osim-2.5HA 2. Mr. Egwu Olumba E. 2.5HA 3.Mr. IniUbong – 2HA	4	

Source: Author’s field survey, 2013.

Table 9. Fishes caught in commercial quantities within the mangrove area.

Local/common name	Scientific name
Cat fish (Inaha)	*Chrysichthys* spp.
Croaker (Oniok)	*Pseudotolithus elongates*
Tilapia (Asat)	*Oreachromis* spp.
Bonga (Ibat)	*Ethmalosa fimbrata*
Bonga fingerlings (Ekpai)	*Ethmalosa fimbrata*
Snapper (Ekwe)	*Lutjanius* spp.
Sole (Ukpek)	*Cynoglossus* spp.
Shinny nose (Ofot)	*Claria* spp.
Ray (Ukpam)	*Dasyalis margarite*
Grunter	*Pomadasys* spp.
Hammer head shark	*Sphyma couadi*
Caranxt (Abia Ediene)	*Carangus* (mackerel)

Source: Author’s field survey, 2013.

Income generated from m mangrove wood extraction in the study area over the years

Income remained a major drive for the continuous extraction of mangrove wood in Calabar South. From Table 10, it is observed that from the period of 1989 to 2009 (21 years), a total of ₦13,633, 140 and ₦27,591,120 has been generated as revenue to government and income for the people respectively, from cutting a total of 130,724 trees of mangrove trees (pole and merchantable sizes). It is to emphasize that both government and the people are beneficiaries in the mangrove exploitation.

Furthermore, the result reveals that nearly 50% gain is realized as individual income annually based on tariff rate/tree purchased by the people. Thus, this explains income as a force (drive), which has made people to deplete mangrove arising from demand for fuel wood,

Table 10. Income generated from mangrove wood extracted in the study area over the years.

S/N	Year of extraction	No. of trees extracted (merchantable/poles)	Tariff cost price (merchantable tree and pole) (₦)	Annual total sales based on tariff rate (₦)	Retail unit price (Logs 350 cm each) pole (₦)	Total annual {sales} income derived (₦)	Sales difference b/w annual sales on tariff rate and retail price (₦)	%
1	1989							
	M	152	1500	228,000	1800	273600		
	P	3640	10	36400	70	254800		
	T	3792		264400		528,400	264000	49.96
2	1990							
	M	180	1500	270,000	1800	324000		
	P	4528	10	45280	70	316960		
	T	4708		315,280		640960	325680	50.81
3	1991							
	M	183	1500	274,500	1800	329400		
	P	4550	10	45,500	70	318500		
	T	4733		320,000		647900	327900	50.61
4	1992							
	M	178	1500	267,000	1800	320400		
	P	4582	10	45,820	70	320740		
	T	4760		312,820		641140	328320	51.21
5	1993							
	M	185	1500	277,500	1800	333000		
	P	4666	10	46,660	70	326620		
	T	4851		324160		659620	335460	50.86
6	1994							
	M	190	1500	285,000	1800	342000		
	P	4702	10	47,020	70	329140		
	T	4892		332,020		671140	339120	50.53
7	1995							
	M	192	1500	288,000	1800	345600		
	P	4803	10	48,030	70	336210		
	T	4995		336,030		681810	345780	50.72

Table 10. Continues.

8	1996							
	M	198	1500	297,000	1800	356400		
	P	4990	10	49,900	70	349300		
	T	5188		346900		705700	358,800	
9	1997							
	M	200	1500	300,000	1800	360000		
	P	5010	10	50,100	70	350,700		
	T	5210		350,100		710700	360,600	50.74
10	1998							
	M	250	1500	375,000	1800	450,000		
	P	5694	10	56,940	70	398,580		
	T	5944		431940		848,580	416640	49.1
11	1999							
	M	300	1500	450,000	1800	540000		
	P	5992	10	59920	80	479360		
	T	6292		509920		1019360	509440	49.98
12	2000							
	M	400	1800	720,000	2100	840000		
	P	6886	15	103,290	120	826320		
	T	7286		823290		1666320	843030	50.59
13	2001							
	M	448	1800	806400	2100	940800		
	P	6990	15	104850	120	838800		
	T	4738		911250		1779600	868350	48.79
14	2002							
	M	460	1800	828,000	2100	966000		
	P	7020	15	105300	120	842400		
	T	7480		933300		1808400	875100	48.39
15	2003							
	M	475	1800	855000	2100	997500		
	P	7026	15	105390	120	843120		
	T	7991		960390		1840620		

Table 10. Continues.

16	2004							
	M	488	1800	878400	2100	940800		
	P	7050	15	105750	120	846000		
	T	7538		984150		1786800	880230	49.26
17	2005							
	M	500	1800	900000	2100	1050000		
	P	7061	15	105915	120	847320		
	T	7561		1005915		1897320	891405	46.98
18	2006							
	M	508	1800	914400	2300	1168400		
	P	7100	15	106500	150	1065000		
	T	7608		1020900		2233400	1212500	54.29
19	2007							
	M	522	1800	939600	2300	1200600		
	P	7115	15	106725	150	1067250		
	T	7637		1046325		2267850	1221525	53.86
20	2008							
	M	560	1800	1008000	2300	1288000		
	P	7260	15	108900	150	1089000		
	T	7820		1116900		2377000	1260100	53.01
21	2009							
	M	490	1800	882000	2300	1127000		
	P	7010	15	105150	150	1051500		
	T	7500		987150		2178500	1191350	54.69
22	2010							
	M							
	P							
	T							
				Govt. Ban on Wood Exploitation				
	Grand total	130,724		13,633,140		27,591,120		

Source: Forestry Department, Calabar South Local Government Area. Foot notes: M = Merchantable size, P = Pole, T = Total of M and P.

and timber for construction/building including canoes and as a source of livelihood.

Conclusions

Mangrove forest is seen to be an important natural resource extremely beneficial to people living within this vicinity. The indigenous populations occupying the mangrove forest ecosystem have depended on it for food, shelter, clothing and income. There are equally many direct economic benefits from mangrove resources as they are seen to be sources of energy, sites for collecting honey, a habitat for diversity of flora and fauna and an attraction site for tourism. However, it is suffice to state here that the problem of exploitation of mangrove resources within this ecosystem is increasing in recent times due to fishing, urbanization, and farming. This scenario has tend to reduce to a large extent the mangrove forest ecosystem so that if effective management of this fragile ecosystem is not taken into consideration, then the future of this ecosystem is bleak.

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