

THE MANGROVE GUINNEENNE AN ENDANGERED ECOSYSTEM IN THE SANGAREAH BAY

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ABSTRACT

Guinea is home to a unique heritage in terms of biodiversity in West Africa, especially in its relics of dense humid forests classified as areas of high biodiversity. Mangroves, coastal forest ecosystems, mainly tropical, constantly changing, are generally located around areas with high population density. The objective of this study was to assess the degradation of the mangrove in the bay of Sangaréyah, by estimating the decrease in its area, to identify the main sources of pressure on the ecosystem of the bay. This present work, based on previous work carried out in the different countries, is based on a large bibliographic inventory aimed at assessing the state of mangrove degradation in Guinea. The results obtained allow us to conclude that the scale of the exploitation of firewood, the extraction of salt and the production of rice are the main causes. The consumption of a large quantity of wood would also explain, by the fact, that all the smoking techniques practiced in the Bay use *Rhizophora* (Kinsi) as firewood. It has been established that the "pani" method is one of the factors of degradation of the vegetation in the bay. This degradation concerns more the *Avicennia*, used for crystallization, but also the use of other species release large spaces for obtaining areas for scraping the saline soil. Overall, the standing capital experienced a significant decrease from 691,500 m³ in 1994 to 566,900 m³ in 2001. Initiatives to preserve the bay must be pursued through the establishment of a policy of better management of the area.

Keywords : Ecosystem, Mangrove, Degradation, Conservation, Resources.

INTRODUCTION

At the end of the twentieth century, environmental protection became a priority subject at the scientific and political levels, both nationally and internationally. Intergovernmental conferences, international conventions and other treaties on the conservation and protection of the environment have been organized by the community of nations to counter the degradation of the natural environment.

This degradation particularly affects the coastal areas, in this case the bay of Sangaréyah, which is located between the prefectures of Boffa, Dubréka, Coyah and the municipalities of Ratoma, Dixinn and Kaloum (Conakry). With an area of 38,000 ha of mangrove forest, the bay constitutes an important reserve of natural resources for the country [Diané, I., 2005]. The ever-increasing demand for fuelwood, salt, fish and cultivable rice land leads to human pressure which degrades resources and disrupts the normal functioning of ecosystems. Anthropogenic withdrawals often do not take into account the natural regenerative capacity of available resources. As well, the absence of an effective tool for coordinating harvesting efforts and activities does not allow an increase in productivity. Two management methods have existed in the bay: a management method inspired by traditions (main source of degradation) and another method initiated by the Mangrove Project [Fontana, A. et al., 1995]. The lack of coordination between these two management methods and the fragility of the ecosystems have caused a reduction in the biotic and abiotic resources of the bay of Sangaréyah. In view of this very worrying situation, we have chosen the theme: "the Guinean mangrove, an endangered ecosystem".

This article aims to study the mangrove ecosystem of the bay of Sangaréyah, for the sustainability and development of its economic, ecological and social functions. Specifically, it aims to: (i) estimate the evolution of the mangrove area during the period 1980-2005; (ii) identify the main sources of pressure on the bay's ecosystem; (iii) attempt to take stock of the bay's forestry, and (iv) propose initiatives to preserve the bay.

MATERIAL AND METHOD

Study zone

Sangaréyah bay is located to the west of the capital from the islands of Loos to the estuary of the Konkouré watershed and 50 km from the national road N ° 2 (Conakry, Dubréka). The facade of the bay of Sangaréyah which opens onto

the Atlantic Ocean is made up of a long strip of coastal plains. It is bounded to the north by the Konkouré river, to the east by the sub-prefecture of Korira, to the south by the village of Sonfonia [Ruë, O., 1999].

The bay of Sangaréyah (cf. figure II) is part of the continental shelf of Guinea, between 9 and 100 north latitude 13 and 140 west longitude. It covers an area of 38,000 km² for a population of 23,480 inhabitants with a density of 28 inhabitants / km². It includes the prefectures of Dubréka, Boffa (Koba) and certain communes of Conakry such as Ratoma, Dixinn, and part of Kaloum. These two prefectures and the special zone of Conakry located in the coastal zone of the continental domain of the Bay are directly concerned by the exploitation of the resources of the study zone [Ruë, O., 1995].

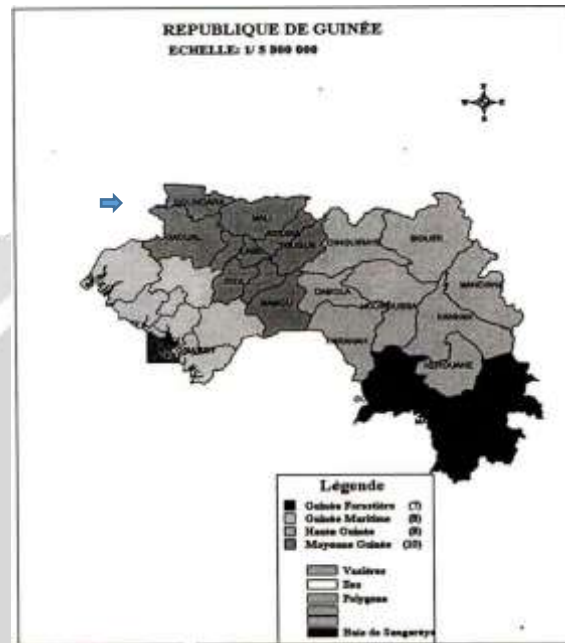


Figure I: Presentation of the bay of Sangaréyah

The bay of Sangaréyah was selected so as to represent different mangrove formations in Guinea including, the formations in mangrove zones with very strong potentialities and vocations and on the seafloor, with a vegetation cover greater than 65%, the formations in rear mangroves, the characteristics of which deteriorate as one moves away from the coast and eventually disappear. Based on the definition by Lugo, AE in 2002, coastal mangroves are forests along the coastline with elevations higher than the average high tide levels. Coastal forests reach a maximum height of 12 m [Lugo, AE in 2002]. In Guinea in the mangrove zone, tall *Rhizophora* forests develop along the mouths of coastal rivers and can reach a stand height of over 18 m [Ruë, O., 1995; Georges, R. et al., 2002].

Methods

The methodology combined the following steps in a complementary way: data collection through documentary research, data processing and the proposal of preservation initiatives for a sustainable management of mangroves in the bay of Sangaréyah.

In order to present all the information available on the extent of mangrove areas in the country, the national estimates collected have been presented in specific tables. Only the most relevant and reliable estimates (indicated in the “Trend” column of the table) were taken into account. For the calculation of the estimates, logarithmic regression and linear regression were used.

The data accepted as being the most recent and reliable is underlined in the table “National estimates” and indicated in the diagrams.

The formulas applied to analyze trends were as follows:

Linear: let $y = mx + b$ where m is a constant slope and b is the y -intercept;

Logarithmic: let $y = c \ln x + b$ where c and b are given constants and \ln is the natural logarithm function.

RESULTS AND DISCUSSION

Mangrove resources in Sangaréyah Bay include plant and forest resources, land resources, wildlife resources and tourism resources [Bazzo, D. et al., 2001; Georges, R. et al., 2002].

National level estimates

The different methods used, in particular the classification and the cartographic scales, showed disparities in the statistics.

The estimate for 1997 (see figure II) was calculated by logarithmic regression analysis, the estimates for 2000 and 2005 were calculated by linear regression from the most recent and reliable data as well as the estimate for 2010 (ie 275,571 ha). Information presented as part of the thematic study on mangroves for the assessment of global forest resources [FAO, 2005].

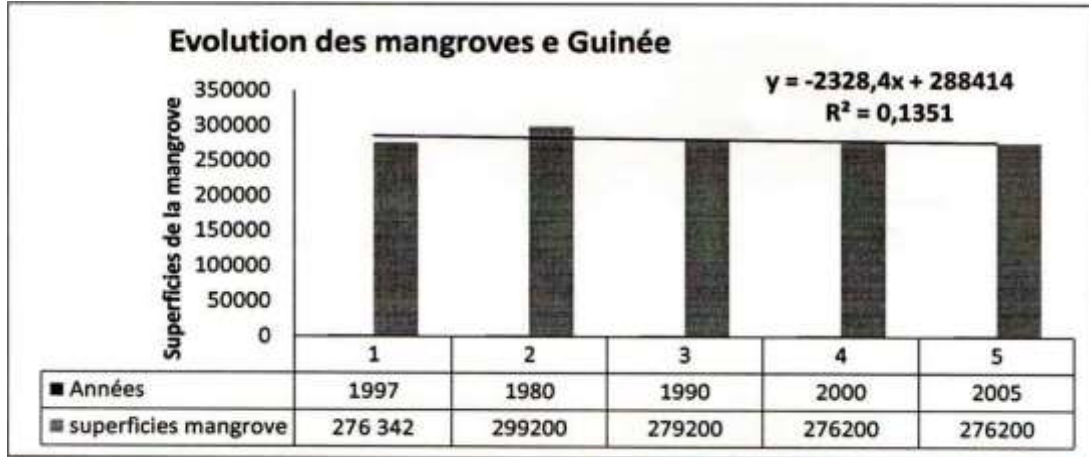


Figure II: Summary of the situation of the extent of mangroves over time

Degradation of the Guinean mangrove

The field visit and the synthesis of the literature made it possible to identify the main sources of pressure on the ecosystem of the bay of Sangaréyah, which are: (i) excessive cutting of mangrove wood, (ii) extensive rice cultivation , (iii) mangrove clearing for the installation of saline soil scraping areas, (iv) massive use of fuelwood for salt extraction and fish smoking, (v) overexploitation fishery resources, (vi) destruction of spawning areas as a result of the use of non-selective gear, (vii) and coastal erosion. Figures (IV, IV, V and VI) illustrate the degree of degradation due to human activities, including ancient techniques of salt and wood exploitation.

Abusive cutting of Mangrove wood

The main woody plants encountered were Rhizophora, Avicennia and Laguncularia. Due to its multiple uses and its proximity to large cities such as Conakry, the mangrove wood in the study area is subject to excessive exploitation which has progressively affected its regeneration rate. The most exploited species was Rhizophora because of its energetic values.

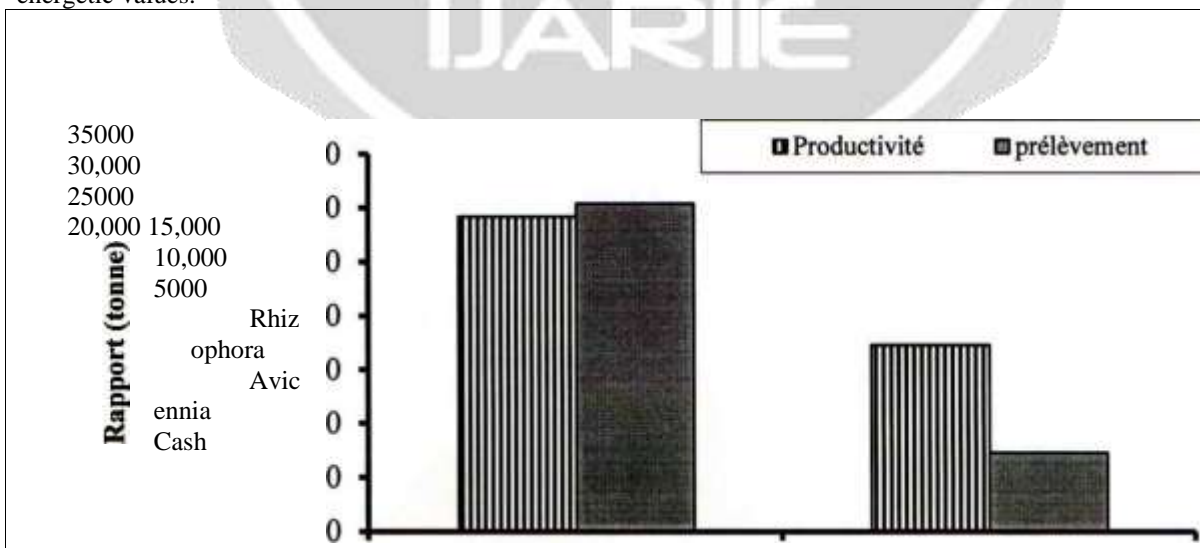


Figure III: supply by demand of wood in the bay of Sangaréyah by season

The management plan put in place by the Mangrove project, based on the empowerment of loggers in the exploitation of wood resources, created at the level of each logging port a group of loggers. The entire bay has been subdivided

into development units (LTA) which are allocated to each group of loggers. Thus, timber exploitation in the UA is measured by the landings recorded in the timber port on which it depends. The list of these AUs is presented in Figures IV and VI. Modern salt extraction techniques are currently being applied to reduce human influence on ecosystem functioning and resources.

Among the timber harbors, Dixinn and Sonfonia receive the most per year. The development units controlled by the logging groups of these ports correspond to the most productive zones (Kansè and Bondabon zones). Indeed, the ports of Dixinn and Sonfonia are the most important supply points for the population of Conakry in wood of any kind (firewood, service wood). But their wood reserves are decreasing from year to year because of the anthropogenic pressures exerted on them. The mangrove wood harvested in Sangaréyah Bay is used for domestic energy, timber, baking bread, smoking fish, etc.

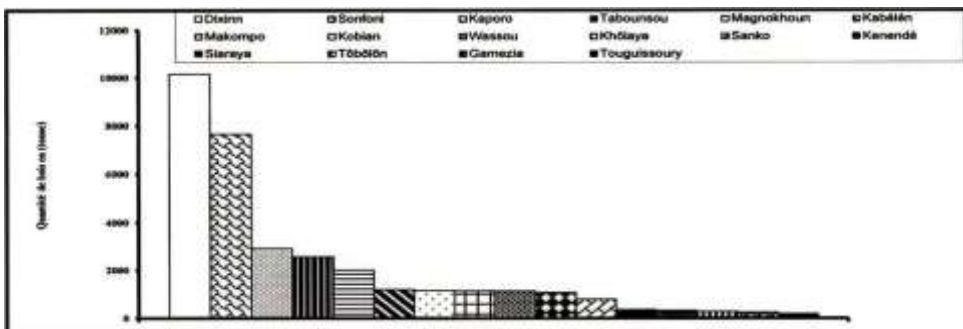


Figure IV: Amounts of timber per port and per year

Pressure from rice cultivation and salt extraction

The figure below shows that in the whole bay, the increase in rice production is more related to the increase in cultivated area than to yield. The yield of rice production declined slightly from 1994 to 1995, before starting to grow in 1996-1999. It is likely that this revival is linked to the mangrove project interventions through the introduction of new varieties and new water management techniques. Like rice cultivation, salt extraction is one of the main sources of pressure on mangroves.

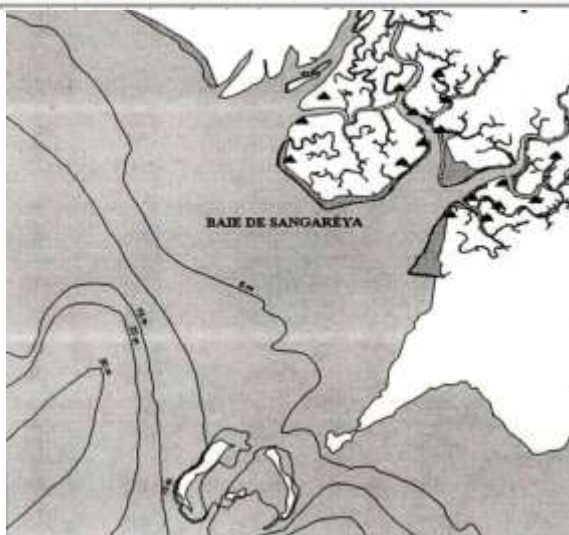
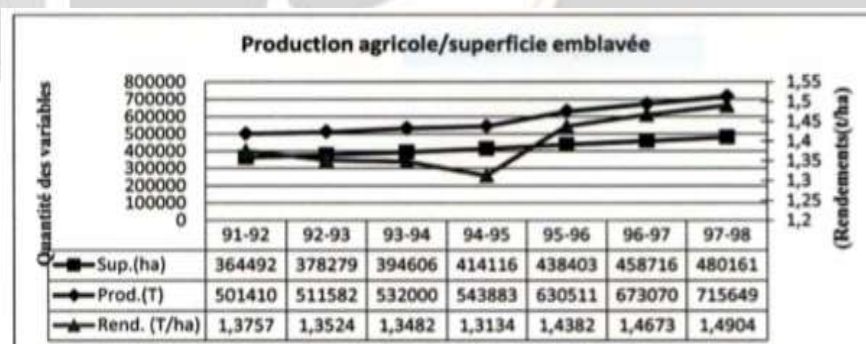


Figure VI: Salt extraction sites in the bay

This activity consumes 7,530 tonnes of wood annually on average, ie a deforested area of 263 ha. Figure 6 indicates the location of the main salt extraction sites in the Bay and the size of the areas degraded by this activity. Indeed, the main widespread salt extraction method is the cooking technique, which uses fuelwood for the crystallization of brine (crystallization of 1 kg of salt consumes 3 kg of wood).

Alternative salt extraction techniques that do not consume wood are not widely popularized because of their low yield.

In 2001, salt production using the "baskets" method yielded 5 tonnes of salt per three baskets per year and 2.5 tonnes of salt for 4 tarpaulins per year for an average period of 2 to 3 months for three earth scrapings per year. A tarpaulin produces 12 to 13 kg of salt per day and a "pani" produces 30 kg of salt for two cookings per day. Thus, the "pani" method is one of the factors of degradation of the mangrove vegetation in the bay. This degradation concerns more the *Avicennia*, used for crystallization, but also the use of other species release large spaces to obtain areas for scraping the saline soil.

Pressure from smoking fish

The smoking of fish is one of the main economic activities practiced in mangroves. In the bay of Sangaréyah, out of a quantity of 3,79,160 kg of fish caught in 1993, around 368,565 kg were the subject of smoking by using nearly 1,000 tonnes of mangrove wood, i.e. the equivalent of 37 ha (Mangrove Project 1994). The consumption of this quantity of wood is explained by the fact that all the smoking techniques practiced in the Bay use *Rhizophora* (Kinsi) as firewood.

The table below presenting the forest balance sheet shows the impact of each of the pressures on the mangrove swamp of Sangaréyah bay.

Table: Forestry report for Sangaréyah bay

Désignation	Années	1994	1999	2003
Rural population (2.1 0/0)		14,490	16,080	17,840
Urban population (3.5 0/0)		8,990	10,680	12,680
Local population		23,480	26,760	30,520
Rural consumption m		3,760	4,290	4,890
Consumption of Conakry (m)		33,000	43,330	56,900
Consumption of fish smoking (m3)		530	610	710
Local consumption m3		37,290	48,230	62,500
Area of clearing for rice cultivation and salt extraction (ha) carried out since 1994, 3.00 / 0 / year			409	883
Superf. Forest. Improduc. (Ha)		13,488	13,079	2,605
Annual cutting possibility (m) Total		37,860	37,860	37,860
resources		37,860	37,860	37,860
Consumption / resource balance		570		
3				
Standing capital (m)		691,500	661,500	566,900

Overall, standing capital has experienced a significant decrease: in 1994 it was 691,500 m³; 665,500 m³ in 1999; and estimated at 566,900 m³ in 2001. These figures are consistent with forecasts according to which, in 1957, the area of mangroves in Guinea was 400,000 ha. In 1965 it was 350,000 ha whereas nowadays it is less than 250,000 ha in the whole area [Coyne, G. and Bellier, GD F, 1989].

The mangrove forest being one of the main regulatory elements of the bay ecosystem, the repercussions of its degradation on biological resources and their habitats is a logical consequence. The degradation map (situation 2001) drawn up as part of this work is illustrative of the impact of socio-economic activities on the mangrove forest and of the trend towards deforestation of the banks and channels, where the ecological conditions are favorable to reproduction of fish. Fishery resources, in addition to the impacts of excessive exploitation, are subject to the

repercussions of the degradation of the vegetation cover in the same way as the areas of concentration of migratory and sedentary birds.

Impacts of mangrove degradation on sites of ecological interest

The sites of ecological interest concerned by this study are spawning grounds and avifauna sites. In fact, the bay of Sangaréyah is a wetland classified as a KAMSAR site in 1971 because of the importance of its mudflats which, in addition to sedentary birds, receive a large number of migratory bird species per year and per site. . These channels bordered by mangrove forests constitute reproduction areas for several species of fish marketed and breeding grounds for their juveniles. These spawning grounds make Sangaréyah bay a base for the regeneration of the fish stock in the Guinean exclusive economic zone (ZEEG) . Thus, the degradation of spawning grounds is one of the major causes of the decrease in the fish stock by endangering its capacity to regenerate.

Threats to spawning grounds

Like woodcutting areas, spawning areas deserve efforts for their protection and their physico-chemical characterization.

One of the important results of this study was therefore the location and characterization of these areas as well as the development of the spawning grounds map (cf. figures IV and V). It is understood that the continuation of this work would be desirable for the total location and conservation of these channels and allow the extension of the covered area. This would help us to propose full protection measures in the bay.

The results of surveys and observations carried out in the study area show that these spawning grounds are the envy of many artisanal fishermen specializing in fry fishing (cut in the Soussou national language). In addition, the extension of deforested areas for rice cultivation and salt production up to the banks increasingly leads to the erosion of the latter and the disruption of the ecological conditions of the spawning grounds (increase in water turbidity, reduction of vegetation cover and humidity, etc.).

The awareness of local populations of the drop in fishing yield in the area and other indicators of environmental degradation prompted them to take a determined opposition to industrial fishing.

Threats to avifauna sites

The large mudflats of the Guinean coast are, according to the criteria of the Ramsar Convention, of international ecological importance. Indeed, some sites, such as those on the mudflats of Sangaréyah Bay on the seafront, classified as "Ramsar" reserves on wetlands, welcome each year during the boreal winter large colonies of migratory birds without counting the many resident species. The ecosystem in general is little known to the general public, let alone its avifauna. Tourist activities linked to the coastal resources of the mangrove and its landscape are currently non-existent in the area, despite the fact that the mangrove of Sangaréyah bay is easily accessible from the ports on the north shore of the peninsula of Conakry and that of Dubréka. We can attribute this lack of interest to the ignorance of this environment and a lack of tourist organization. The development of the mangrove in the bay of Sangaréyah, thanks to the preservation of the main sites of tourist interest, would constitute one of the guarantors of the development of tourism.

The degradation of the mangrove vegetation, which serves as a niche for these birds, and the erosion of the mudflats on the seafront, leads to the migration of avifauna. Knowledge of the ecology of the mudflats and the location of the predilection areas for birdlife are prerequisites for the conservation of this biodiversity and for the development of the site within the framework of ecotourism. It is in this context that we have, from the superposition of the layers of bird location and the delimitation of the mudflats, constituted the avifauna map of the Bay of Sangaréyah.

Bay preservation initiatives

The mangrove swamps in Guinea For almost thirty years, the preservation of this fragile ecosystem has been at the center of many development projects. Its degradation process is attributed to man and to some of his activities [Anonymous, 2018].

Here are some bay preservation initiatives.

- Carry out an in-depth analysis of the abiotic parameters over a year for a better understanding of the changes;
- Set up a commission to monitor and control the level of exploitation of the mangrove in the bay;
- Encourage reforestation of destroyed mangroves;
- Raise awareness among harvesters of the ecological role played by mangroves;
- Prevent dammed rice cultivation in the lower estuaries;
- Replace chemical fertilizers with organic ones and reduce the use of the latter to avoid eutrophication;
- Opt for the solar technique of salt preparation ';
- Set up protected areas in the bay;

Establish a dialogue between researchers, managers (administration) and profession (local population, actors in the field and NGOs) in a perspective of a global approach and integrated management of the bay's resources

CONCLUSION

The study of the degradation of the mangrove ecosystem of the bay of Sangaréyah, for the sustainability and development of its economic, ecological and social functions made it possible to estimate the decrease in the mangrove area, to identify the main sources of pressure on the ecosystem of the bay which are among others the extent of the use of firewood, rice production and salt extraction. As a result, the forest capital in this area is experiencing a significant decrease. Initiatives to preserve the bay must be carried out by establishing a dialogue between researchers, administrative managers and stakeholders, in particular the local population and NGOs working in the field.

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