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RESEARCH ARTICLE

THE MANAGEMENT AND EXPLOITATION OF MANGROVES IN SONFONIA BAY CONAKRY-GUINEA

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Abstract

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The mangrove area in Guinea decreased from 350,000 hectares in 1965 to 296,000 hectares in 2006. The average annual regression was 450 hectares, meaning that the regression rate was 4.2%. The primary uses of the mangrove zones in the Sonfonia region include logging, farming, salt farming, and smoking fish.The purpose of this study is to investigate the dynamics of mangrove exploitation and management at the Port of Sonfonia in order to introduce sustainable management practices for this ecosystem and suggest remedial actions.The subsequent approach was used: Frameworks and archives (CERESCOR, Communal Directorate of the Environment, Communal Directorate of Fisheries and Aquaculture of Ratoma) are consulted; the study area is mapped; cartographic data from 1994 to 2019 is analyzed and processed; stakeholders (loggers, fish smokers, and salt farmers) are surveyed; the reasons behind mangrove overexploitation are identified; and corrective measures are suggested.The mapping that was done showed that the mangrove area has decreased. The area of Sonfonia's mangroves decreased from 48.87 hectares in 1994 to 35.09 hectares in 2016 and 24.60 hectares in 2019. According to loggers surveyed, 10% only cut dry wood, 23.4% exercise selectivity, and 66.6% clear-cut. Each month, the port of Sonfonia unloads an average of 200 trunks of Avicenia and 30,400 trunks of Rhizophora trees, totaling 106.4 tons. Approximately 65% of smoking is done with rhizophora, and the cost of wood ranges from 15,000 to 45,000 fg per day and every smoker, for an amount of wood that ranges from 7 to 15 kg. The causes of mangrove wood overexploitation are primarily economic, accounting for 96%. Eight exclusive mangrove species are found in the Sonfonia area, includingAcrostichumaureum, Avicenia marina, Aviceniagerminans, Conocarpus erectus, Laguncularia racemosa, Rhizophoraharrisonii, Rhizophoraracemosa, and Rhizophora mangle.

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Introduction:-

The mangrove ecosystem serves a dual protective purpose by shielding the land from the sea's influence and the sea from terrestrial influences. It is frequently referred to as an essential transitional environment. A significant part of this system are the mangroves' extensive aerial roots, which serve a variety of purposes and have significant ecological ramifications. These roots not only support biodiversity but also serve as a natural barrier against maritime erosion, which is a crucial line of defense against the negative consequences of climate change, such as sea level rise. In this regard, mangroves serve as a vital barrier to protect coastal communities from flooding brought on by severe weather conditions.

In connection with the global dynamics of climate change and rising sea levels, mangroves also play a role as settling basins. They capture sediment-laden waters carried by rivers before they are discharged into the sea, thus contributing to the preservation of the quality of coastal waters[1]. This feature is of crucial importance.in maintaining ecological balance, preserving marine biodiversity and limiting harmful impacts on adjacent marine ecosystems.

In Guinea, the mangrove, whose estimated surface area was 350,000 hectares in 1965, is witnessing a severe loss, covering an area reduced to 296,300 hectares in 2002. This decline, which is mostly attributable to ongoing human pressure, causes an average yearly regression of 450 hectares or a concerning rate of 4.2%. [2] This circumstance emphasizes how vulnerable this priceless environment is becoming to human activity, which emphasizes how urgent conservation and sustainable management strategies are.

Due to its strategic location between the sea and the land, the mangrove has become a target for various human activities, jeopardizing its survival. Every year, hectares of mangroves disappear due to the expansion of destructive practices, thus compromising the associated biodiversity. It becomes imperative to better understand the importance of the mangrove and the crucial role it can play in the future, not only for the conservation of biodiversity, but also for the servicesecosystem services it provides, such as climate regulation and coastal protection[3]. In the specific area of Sonfonia, logging, agriculture, salt production and fish smoking are identified as the main anthropogenic activities carried out in the mangrove areas. These practices have significant consequences on the coastal mangrove vegetation in this region. Preservation initiatives and means of controlling excessive logging remain insufficient, leaving anthropogenic activities to exert continuous pressure on the surface of the mangrove vegetation. Currently, it is reduced to a narrow strip of forest along the coasts and inlets.

To address this situation, in-depth studies on water quality, marine biodiversity and anthropogenic impacts are imperative. Research initiatives to map pollutant distribution, assess mangrove health and understand the specific hydrological dynamics of this region must be undertaken. This scientific data will be crucial to guide conservation and ecosystem restoration actions, integrating multidisciplinary approaches and evidence-based solutions. The aim would be to develop sustainable management practices that preserve both biodiversity and socio-economic activities in this vital region [4].

Materials and Methods:-

Presentation of the study area (Sonfonia)

Together with the Bouramaya and Soumba Rivers, the Sonfonia River forms a complicated hydrological system that empties into Sangaréya Bay. Because two rivers coexist, a significant amount of fresh water is continuously released into the bay, impacted by the tides and tides of the sea. The tidal mechanism works as a vital "engine" of tidal movement, ensuring regular mixing of the waters and thereby preventing sedimentation off the bay.Anthropogenic pressures, including industrial activities and unsustainable agricultural practices, contribute to this degradation, compromising the stability of the mangrove.

At the same time, the accumulation of dissolved pollutants and plastic waste in this area constitutes a major challenge. The work of Keita (2012) [5]highlights the urgency of understanding the nature and extent of this pollution. An in-depth analysis of the types of pollutants present, their source and their impact on the local ecosystem is necessary to develop effective preservation strategies.

Table 1:- List of equipment used.

No.	Designation	Quantity

1	Investigation sheet	49
2	Camera	1
3	Canoe	1
4	Centimeter	1
5	Polyester rope	1
6	Plastic	8

Biological material

Mangroves are the most dominant aquatic plants in the investigation area, the dominant species of which are: Rhizophora mangle, Avicenniagerminans, Lagunculariaracemosa, Conocarpuserectus. The objective of this work is to study the dynamics of exploitation and management of mangrove wood landed at the port of Sonfonia, in order to propose corrective measures and provide methods of sustainable management of this ecosystem.

Methods:-

In order to suggest remedial actions and offer sustainable management techniques for this ecosystem, the aim of this work is to investigate the dynamics of exploitation and management of the mangroves that were landed at the port of Sonfonia. The following approach was used: executive consultation and archive analysis (CERESCOR, Ratoma Municipal Directorate of Fisheries and Aquaculture, Municipal Directorate of the Environment); mapping the research area; cartographic data processing and analysis from 1994 to 2019; stakeholder survey (loggers, salt producers, and fish smokers); Finding the reasons for excessive mangrove exploitation; cataloging mangrove species; identifying certain places where mangroves are exploited; and suggesting some corrective actions [6.7].

Results:-

Consultation of executives and analysis of archives

The consultation of executives showed that human activities have negative impacts on the coastal environment. They contribute to the regression of the mangrove while promoting the destruction of the ecological niches of many aquatic organisms but also to the destabilization of the soil.

Mapping of the study area

To get an idea about the different variations and dynamics of the Sonfonia mangrove during the following years: 1994, 2016 and 2019, we made maps of the study area (Sonfonia) using satellite images from Google Earth and Qgis software.

Image integration and processing in QGIS

Using QGIS 2.18.10 Las Palmas de GC release, we created a new project where we imported the pre-downloaded satellite images as raster data to produce a map for each year.

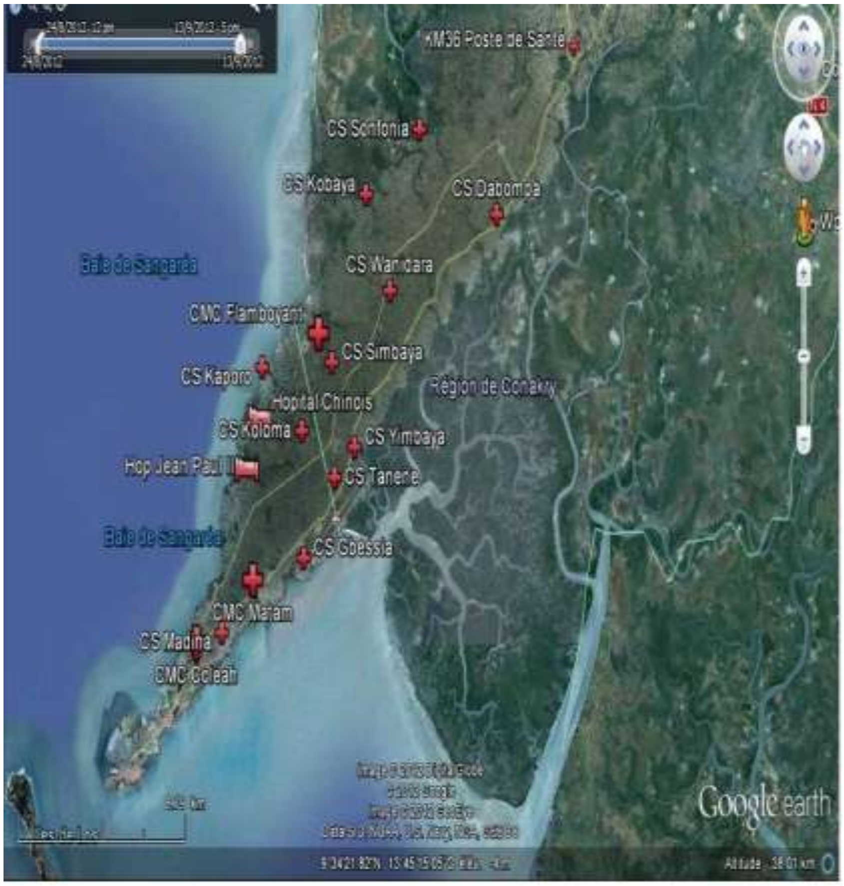

Figure 1: Study area

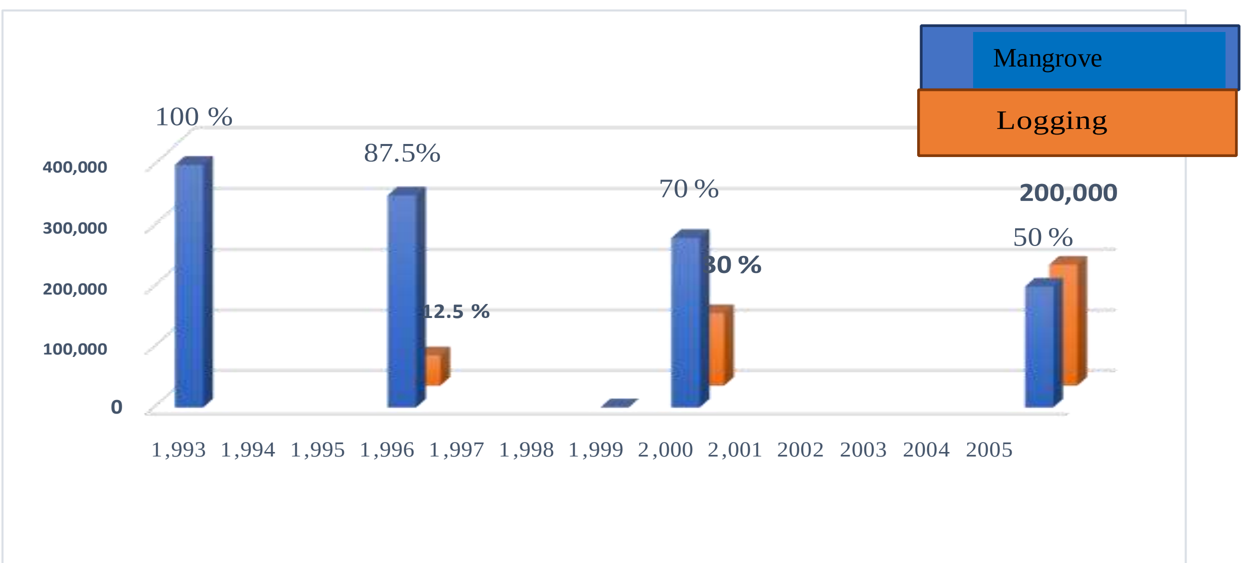

Figure 2: Evolutionof mangrove forest cutting from 1993-2005.

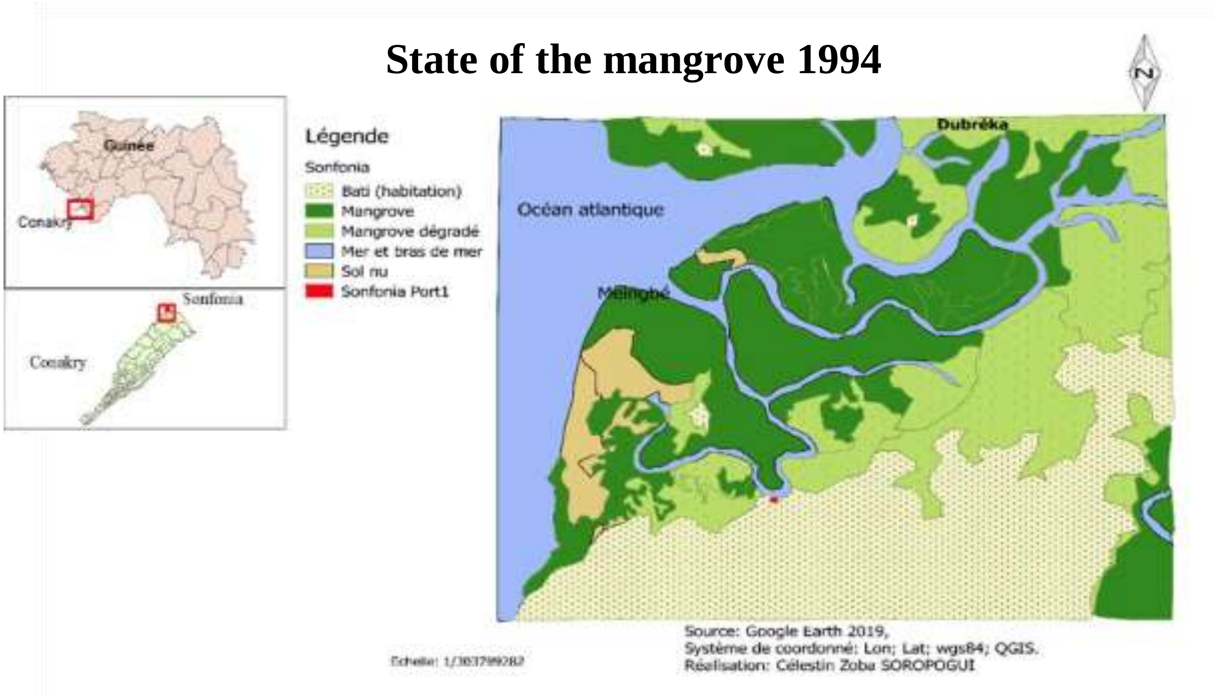

Figure 3:-State of the mangrove in 1994.

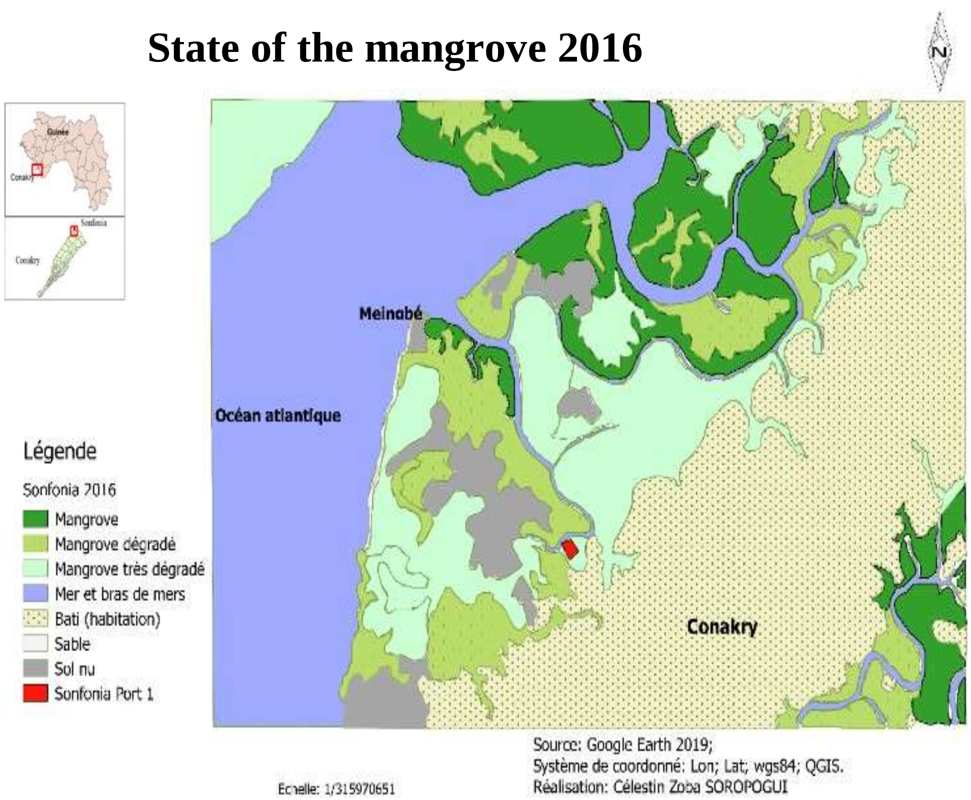

Figure 4:-State of the mangrove in 2016.

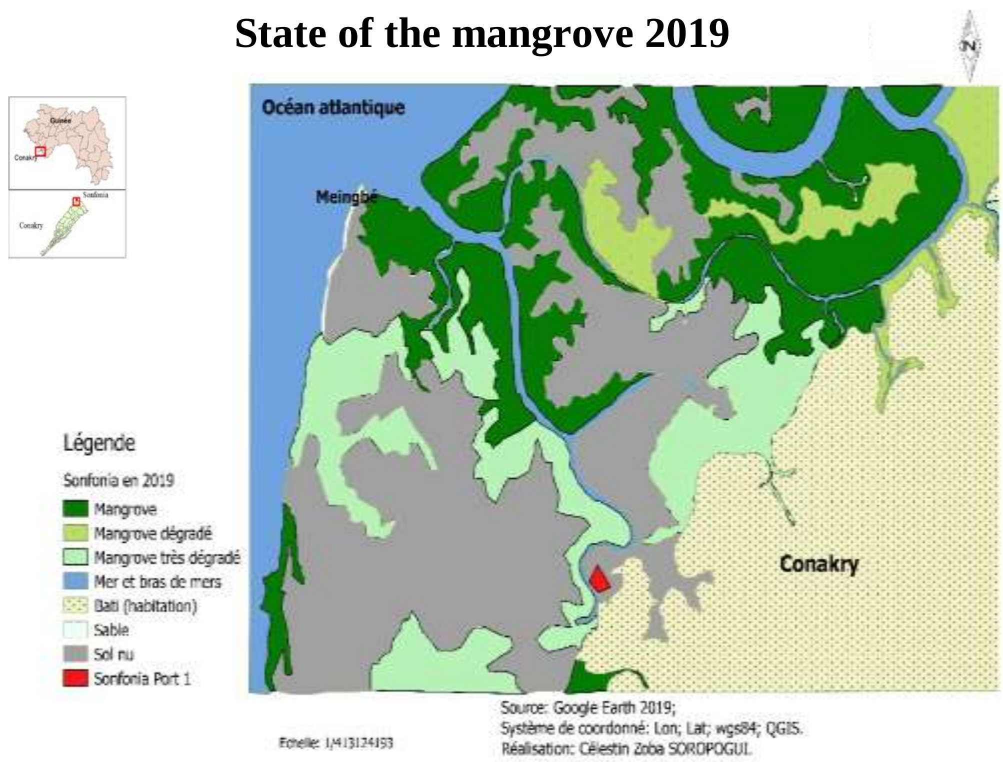

Figure 5:- State of the mangrove in 2019.

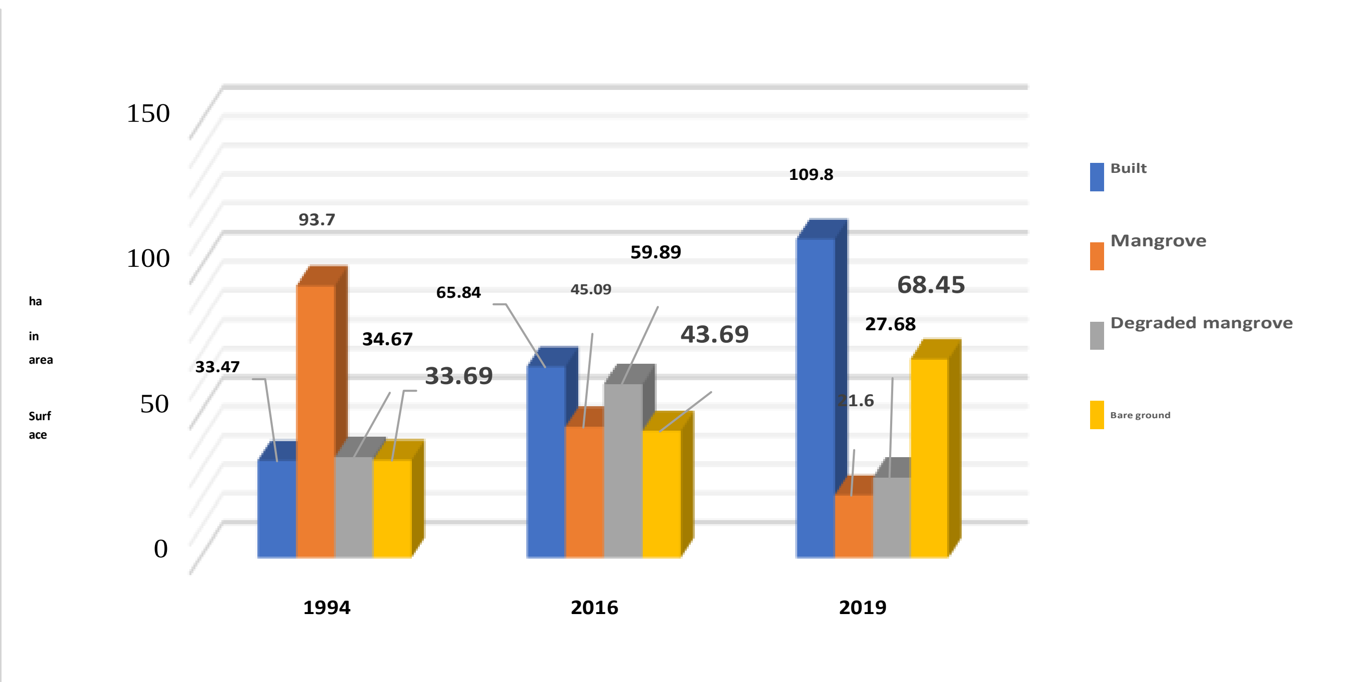

Figure 6:- Variation of land use classes in Sonfonia from 1994 to 2019.

Table 2:- Land use area in 1994, 2014 and 2019.

Classes	Class area in ha		
	1994	**2016**	**2019**
Built	33.47	65.84	109.80
Mangrove	93.70	45.09	21.60
Degraded mangrove	34.67	59.89	27.68
Bare ground	33.69	43.69	68.45

These maps show that, as a result of population growth, urbanization along the coasts, and an increase in human activities that are detrimental to the coastal environment, the mangrove surface area is gradually declining over time, making way for barren soils and urbanization. Despite having the maximum surface area (93.7 ha) in 1994, the mangrove had already started to regress, and the surface area of the damaged mangrove was 34.67 ha. Human activity is to blame for the 2016 increase in the surface area of bare soils. The overexploitation of wood continues to expose soils to all climatic conditions, and certain mangrove regions are clearly damaged. The surface area of the mangrove is continuously decreasing (45.09 ha in 2016) while the built-up area is taking up more and more surface area (65.84 ha, in 2016) according to Keita(2019)[8]. For the representation of the variations of the different land use classes of Sonfonia from 1994 to 2019, the values representing the different areas of the maps are displayed in the following histogram.

This histogram's research demonstrates that the mangrove's regression is consistent with population growth, going from 93.7 hectares in 1994 to 21.6 hectares in 2019, whereas the area occupied by urbanization increased from 33.47 hectares in 1994 to 109.8 hectares in 2019. Only the Avicenia and Rhizophora mangroves in the Sonfonia region are subjected to the most severe cutting. Rhizophora and Avicenia have a calorific content of 4,500 kcal/kg, which is why these two species were chosen for their solidity in construction. being aware that a pole's value ranges from 3500 to 4500 fg. The average quantity of wood ofRhizophoracut per logger is 400 logs of wood/day which corresponds to 44.8 tons of wood/month/logger. From these results, we deduce that logging is a factor accelerating the massive loss of mangroves in Sonfonia. During these various interrogations, it was brought to our attention that there are three types of exploiters of the wood resources of the mangrove represented in the histogram below:

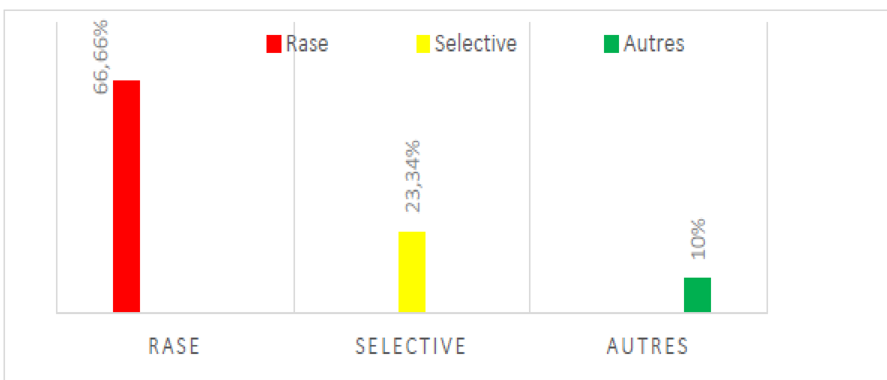

Figure 7:- Operators of mangrove wood resources.

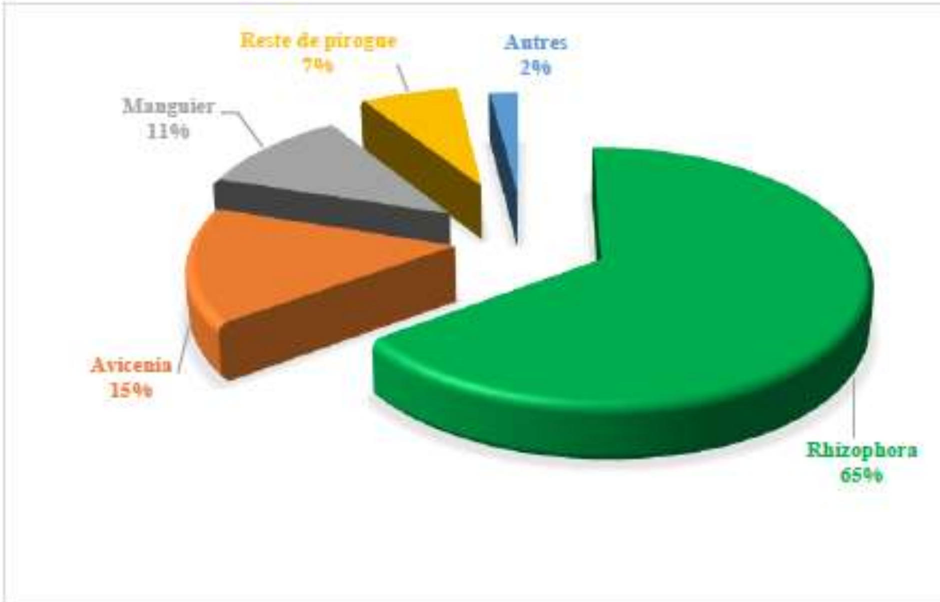

Figure 8:- Proportion of types of wood used for smoking fish.

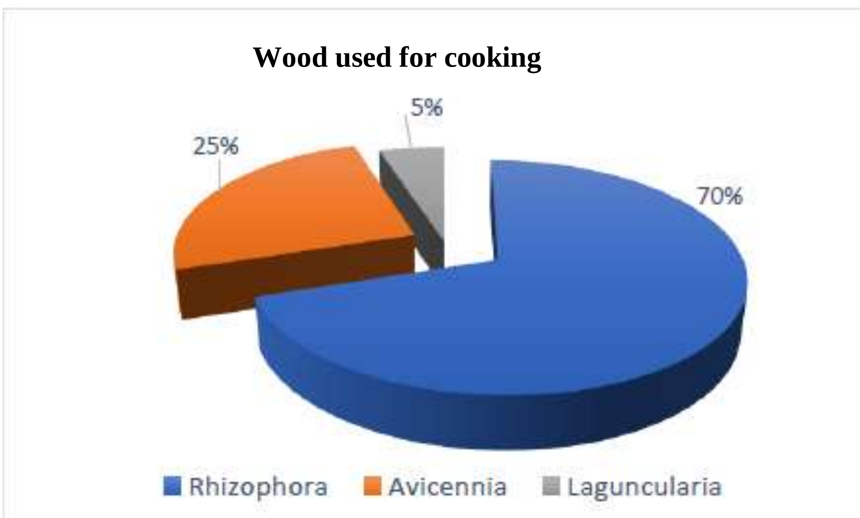

Figure 9:- Mangrove wood species used for salt cooking.

According to Figure 8, smoking fish is a major activity that indirectly contributes to the degradation of mangroves because it increases loggers' effort by paying them. The two main species of wood that loggers target are avicenia (15%) and rhizophora (65%); just as much as the fish smoked with the mango tree, the remains of canoes and other woods are meant for family consumption. 70% of the woods are from Rhizophora, 25% are from Avicennia, and 5% are from Lagunculariaracemosa. This may be explained by the fact that, as seen in Figure 9, rhizophora woods are significantly more sought after due to their low smoke emission, resistance, and combustibility.

The average total amount of wood used in a year for salt production is 33,300 kg or 33.3 tonnes; and for cooking one kg of salt, 3.1 kg of mangrove wood is required. According to detailed figures from survey results obtained from

According to the actors, the quantities of wood consumed strictly by the population of Sonfonia for domestic needs are small. But those intended for sale, rice cultivation and salt production cause enormous damage. The values obtained from loggers and farmers are considered underestimated because it is very likely that the people interviewed in this survey provided lower quantities than those actually exploited.

Source of incidence	Effects	Impact	Impactedelements
Wood cutting	Deforestation, habitat destruction, marine erosion	Decrease in regeneration capacity, fish production, migration and siltation	Vegetation, fauna terrestrial and aquatic, waters
Cleaning the scraping areas	Destruction of young plants and herbariums	Soil exposure to solar radiation	Plants, soils, animals
Scraping the saltyearth	Destruction of matter organic and soil structure	Floor toning	Soils, microorganisms
Cooking the brine	Leaching of soil	Soilsterilization	Soils, microorganisms

Table 3:- The table shows the balance of the impacts of entropic activities on the mangrove.

The environmental impact of human activities on ecosystems, including salt production, rice production, forestry and wild oyster harvesting, results in harmful effects at various levels on the mangrove. This has been also observed by Ladibio (2003)[9].

The major implications are as follows:

Wood cutting for brine cooking:

Effect: Disappearance of mangrove vegetation cover, leading to a reduction in its regeneration capacity and the destruction of habitat for wildlife and birds.

Opening of new lockers for scraping salty soil:

Effect: Abandonment of old salt production sites in favor of new sites close to forests for easier access to wood, thus modifying the dynamics of use of mangrove soils.

Scraping the salty soil:

Effect: Destruction of microscopic fauna and herbaceous plants, as well as transport and leaching of salty soils leading to the destruction of organic matter and sterilization of soils.

Cooking salt:

Effect: High consumption of wood leading to the destruction of plant cover.

Proposal for corrective measures:

In light of our field investigations, consultations with experts and analysis of satellite data, corrective measures are suggested in Table 4:

Table 4:- Mitigation measures.

Activity	Corrective Measures
Wood cutting	Promotion of alternative cooking practices, such as solar ovens.
Scraping the saltyearth	Implementation of scraping practices that respect biodiversity and wetlands.
Cooking salt	Encouragement of wood-saving cooking technologies.
Opening lockers	Regulation of scraping activities and promotion of the rehabilitation of old sites.

The implementation of these corrective measures, with the collaboration of the stakeholders concerned, offers hope for a recovery of the mangrove, with the restoration of spawning and nursery areas. These solutions are based on a scientific and environmental approach, aimed at ensuring the sustainability of this precious ecosystem.

Conclusion:-

We were able to thoroughly evaluate the effects of human activity on the mangrove environment thanks to this extensive investigation. The findings emphasize how important it is to preserve this mangrove, a vital natural barrier between the land and the sea, which is severely degraded by human activity, especially as a result of logging, fish smoking, rice farming, and salt farming.

All parties participating in the mangrove-related industries, as well as the government, must pay particular attention to the ecological significance of mangroves as a rich source of natural resources that help supply the capital of Guinea with timber supplies. According to our findings, logging, salt manufacturing, and rice cultivation continue to be the most detrimental activities for mangrove ecosystems, even if loggers do not follow environmental standards because they lack the necessary knowledge and training. A further example of the extensive degradation of the coastal environment brought on by human

Recommendations:-

To the State:

1. Support NGOs working in reforestation, particularly in rural areas.
2. Invest in training, supervision and awareness-raising for loggers, salt growers and farmers on the importance of mangrove forests, thus contributing to the fight against coastal erosion, global warming and flooding.

To the environmental departments of coastal areas:

1. Carefully monitor the activities of loggers in mangrove logging sites to limit deforestation.
2. Create protected areas to ensure the sustainability of certain species of mangrove trees. **To the lumberjacks:**
3. Form groups, associations and NGOs to organize reforestation campaigns in impacted areas.
4. Train in sustainable environmental management practices and raise awareness among all those practicing this activity.
5. Actively engage in reforestation initiatives.

To farmers:

1. Limit the use of chemical fertilizers in favor of organic fertilizers to preserve spawning areas against chemical pollutants.
2. Acquire the notion of settling to compensate for the clearing of new mangrove rice-growing sites. **To the salt growers:**
3. Stop producing salt using wood and focus on developing solar salt production on tarpaulins.

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