# Application of Digital Mapping (GIS) to the Study of Anthropic Impacts in the Environmental Problem in Northern Maritime Guinea

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## ABSTRACT

*The coastal zone is a small area characterized by considerable linearity and significant human pressure. It is home to many environmental, economic and human issues. In recent years, the coastline has been "maritimised" by a growing concentration of uses in the coastal sea (Gourmelon and Robin, 2005). The need for a more dynamic and integrated approach to the coastal zone, through the land-sea interface, has been reflected since the 1970s by the international concept of Integrated Coastal Zone Management (ICZM), which expresses the need for acting collectively on the natural and anthropogenic processes likely to threaten the sustainable maintenance of the quality of the environment and activities (Cicin-Sain and Knecht, 1998). The prerequisite for effective management of this complex space involves a thorough knowledge of the processes that take place there and a conceptual approach to its operation through coastal geographic information systems (GIS). This study proposes a diagnosis on the evolution of the land use in the taking into account of the problems of integrated management during the last thirty years of 1987,2007 and 2017 in the zone of study (Boké- Boffa).*

**Key words**: *Geographic Information System (GIS), Study, Impacts, Anthropics, Management*

## 1. Introduction

In the context of global changes and ever-increasing human pressure on marine ecosystems, the assessment of the functional status of these ecosystems and the monitoring of their evolution over time are now crucial importance. However, the urbanized territories in the coastal environments engendered by processes of socio-economic and cultural transformations of societies concentrate almost all the environmental and socio-political problems on a fragile, complex, often degraded and heavily solicited space [1, 2]. In fact, this environment is experiencing a progressive deterioration that has a negative impact on its ecosystem. The main causes are mangrove deforestation, overfishing, illegal fishing, uncontrolled shoreline occupations, dumping of toxic products, waste and population pressure [3]. Maintaining biodiversity and actions to avoid fragmentation or extinction of species and depletion of natural resources are essential conditions for the protection of the environment. The use of GIS technology as a tool to monitor habitat changes, monitor the changing demographics of wildlife, and predict future uses of soils and natural resources is an essential element in achieving the goals. and conservation practices [4, 5].

The spatial and thematic characteristics of GIS technology allow users to overlay different data to present and predict the future of resources, land, oceans, flora and fauna. This geoprocessing allows decision-makers to put in place laws and programs to protect and preserve the environment and natural resources. GIS is a tool that can manage, analyze and model environmental data. Thanks to the information it provides, it makes useful decisions to preserve these resources and protect biodiversity. The delicate balance between industrial development and the preservation of the environment requires modeling tools and analytical tools for spatial data [6, 7].

## 2. Material and methods

### 2.1 Hardware and database

As part of this anthropogenic study, we used: LandSat images from the 1987,2007 and 2017 remote sensing program (NASA and USGS) of the study area (Boké-Boffa) during the summer period, ArcGIS in version 10.3, ArcView, ArcInfo. A database has been created for this purpose where all information has been placed, LandSat georeferenced images in geographical coordinates WGS 1984 UTM Area 28 North ArcMap 10.3 which covers the Lower North Guinea entirely. This US program in remote sensing space (NASA and USGS) was the first civilian satellite earth observation program. It

began with the launch of the first LANDSAT in 1972 and continues with Landsat 8, still operational. Since January 2009, all Landsat archive images are available free of charge (Earth Explorer U.S. Geological Survey). This study, which targets anthropogenic factors, was carried out using satellite images of "LandSat 7" for the northern zone of Maritime Guinea.

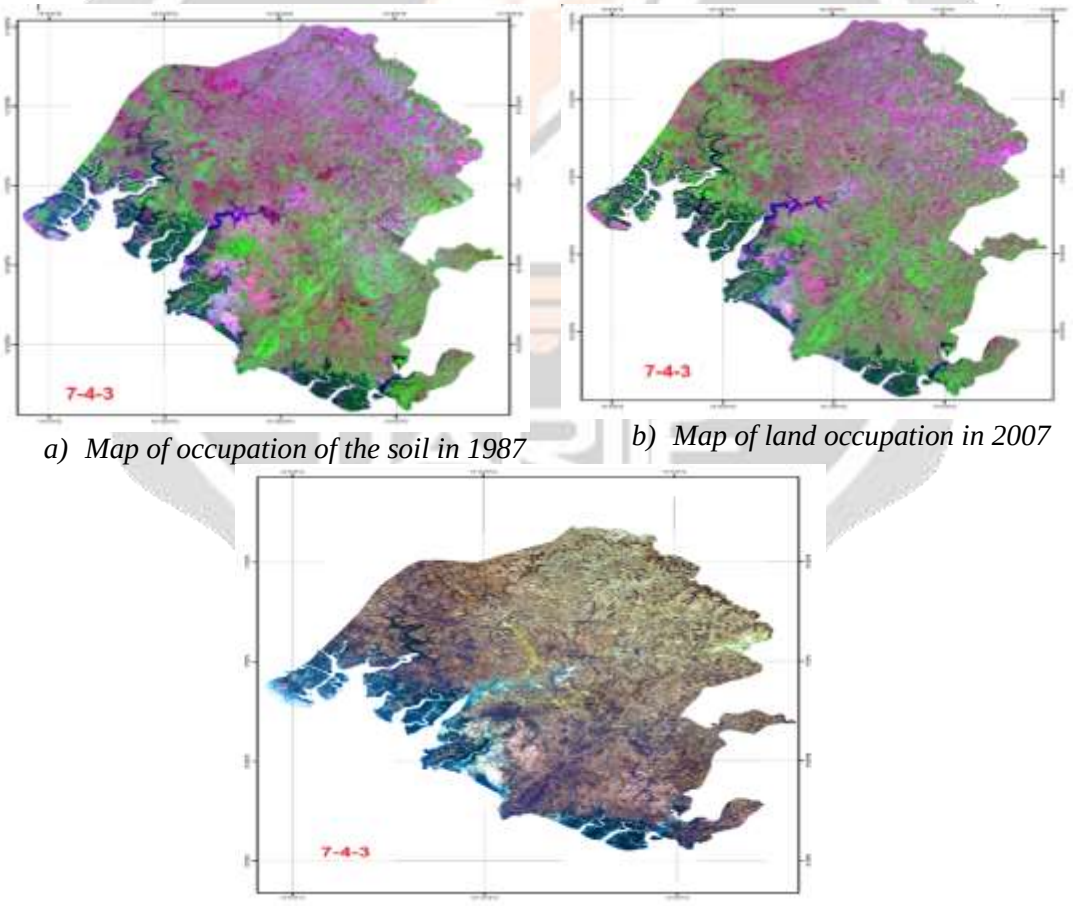
### 2.2 Methods

The methodology of the data processing is based on the modeling treated by the software ArcMap 10.3 and this, in order to extract and to compare the cards of occupation of the ground for last thirty years (1987, 2007, 2017). In order to carry out this study, we have created a project that includes all the steps to be completed, under a file "ArcMap", according to the different incriminated years of 1987, 2007 and 2017. After defining the project, we sent all "Landsat .tif " image files via NASA USGS, downloaded in "Arcgis 10.3". The objective of this approach is to verify if the initial data cover exactly the study area; if this is the case, we can process the information in order to obtain image 1 in the 7-4-3 configuration of the visible limit. The second step was to rework the 7- 4 -3 configuration of the visible boundary by first transforming it into the WGS 1984 UTM Zone 28 North coordinates and then categorizing it into different desired land-use parameters (mangrove, forest, shrubby savannah, grassy savannah, grassy bow, bare soil, and racks), as shown in Figure 2. The last step was the extraction of attribute tables associated with maps in Microsoft Excel format, representing each pixel of the different maps for processing and interpretation.

## 3. Results and discussions

### 3.1 Results

Spectral band of the visible in 1987, 2007 and 2017. These images result from a pretreatment they are presented under the spectral band (7-4-3) which allows to have a natural sight of the various components (figure 1, 2, 3, 4 et 5).

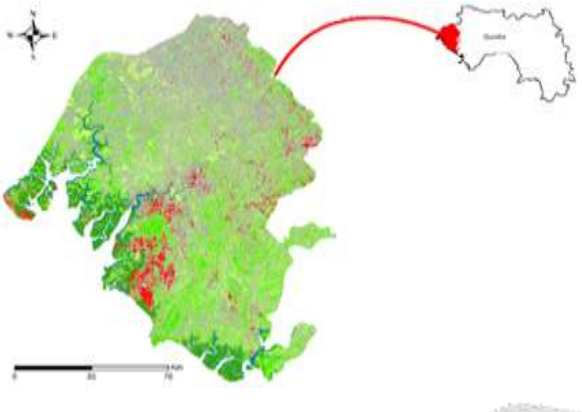



*a) Map of occupation of the soil in 1987*

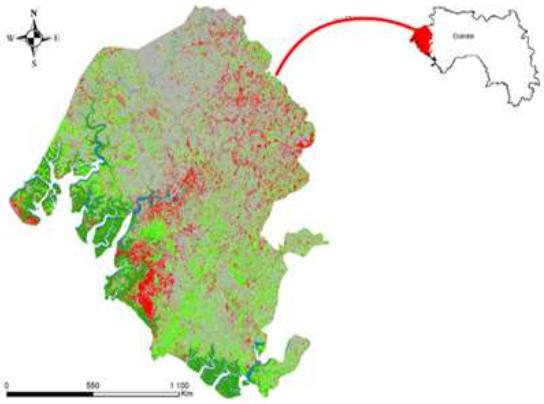
*b) Map of land occupation in 2007*

c) *Map of land occupation in 2017*

Figure 1: Pretreatment of the Land Cover Map in 1987, 2007 and 2017



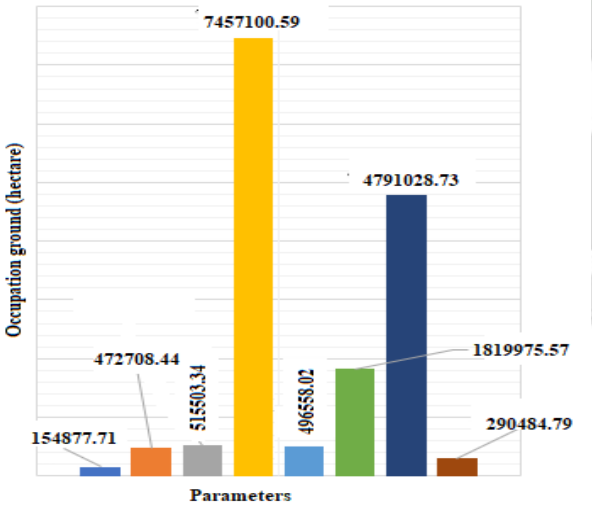
a) *Map of Land Cover in 1987*



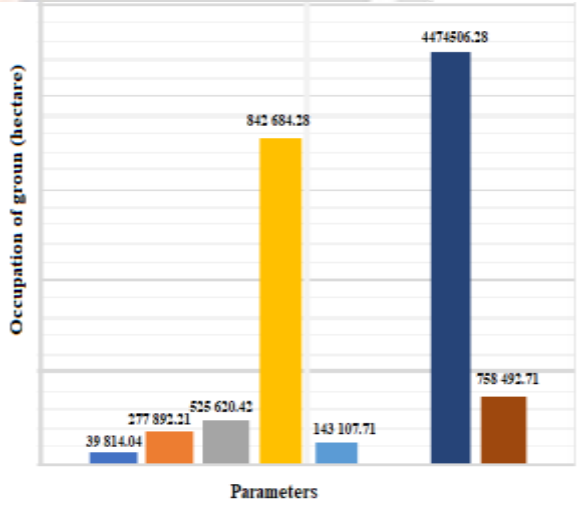
b) *Map of Land Cover in 2007*


c) *Map of Land Cover in 2017*

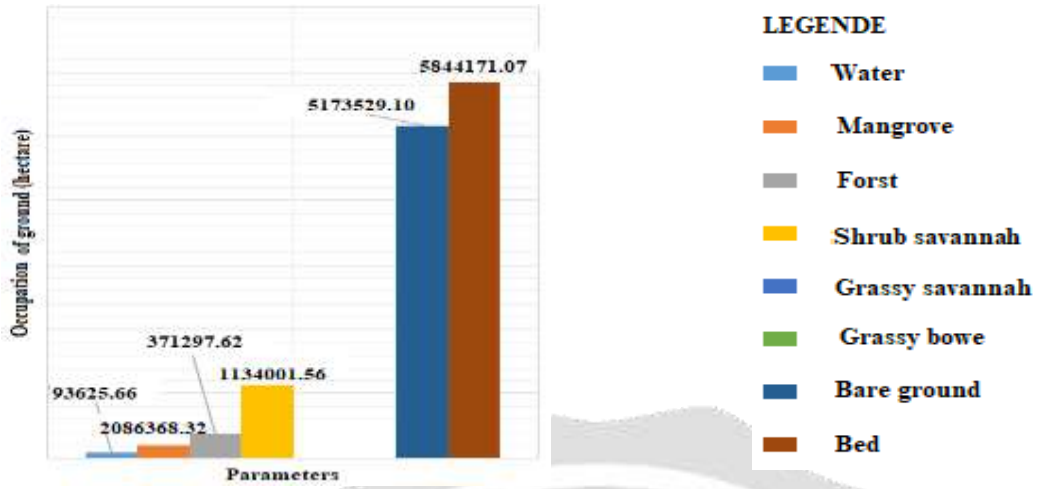
**Figure 2:** Map of Land Cover in 1987, 2007 and 2017




a) *Land use diagrams for 1987*




b) *Land use diagrams for 2007*




*a) Land use diagram for 2017*

**Figure 3:** Land use diagrams for 1987, 2007 and 2017

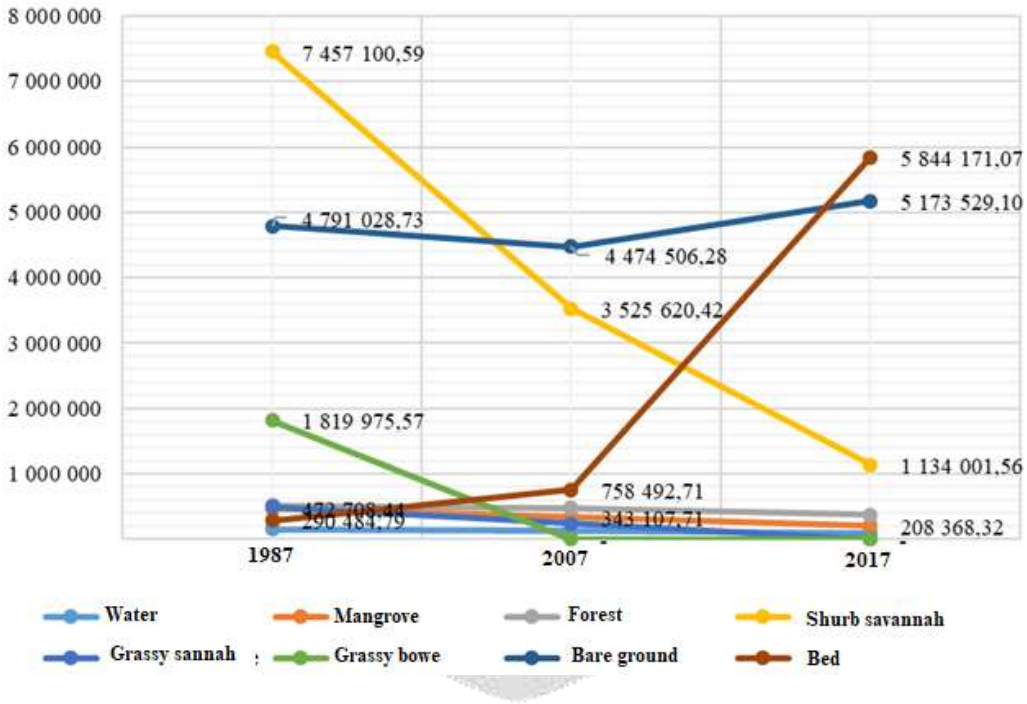



**Figure 5**: Evolution of land use parameters over the last thirty years

**III.2 Discussions**

In 1987 the building and the bare ground occupied a small percentage which explains the good distribution of the savannah shrub, the forest and the mangroves, this would be due to a low rate of wood cutting the number of low inhabitant and the three are very few extractive bauxite companies.

In 2007 we noticed an increase in the building and the almost disappearance of the grassy bowe giving way to the bare ground with a not less than 63% percentage, as for the mangrove and the forest they were moderately degraded, that would be explained by a slight increase of coastal population, urbanization, logging, agriculture and new port facilities at sea level.

In 2017, the building and the bare ground occupy almost the totality leaving disappearing the grassy savannah and the grassy bowe, as for the mangrove, the forest and the savannah shrub their declines are also considerable what would be due to the pressure of the urbanization, the galloping population and an outbreak of mining companies. The overall analysis

shows a decrease in the mangrove from 1987 to 2017, going from 2.95% to 1.61%, i.e. a loss of more than 200000 hectares and a very considerable increase in building from 1.82% in 1987 to 45.22% in 2017, i.e. more than 5000000 hectares. This increase could be due to the anarchic occupation of the littoral zones by the population and constitutes today a disturbing scourge, the destruction of the zones of mangroves, the deforestation, the uncontrolled exploitation of the bauxite through eroded soils, the proliferation extractive companies. These results are consistent with those of [8, 9] Mapping the changes in land use between 1990 and 2002 in northern Senegal (Ferlo) from Landsat images and [10] Monitoring the dynamics of land use using satellite imagery and Geographic Information Systems: Case of the Regional Directorate of Water and Forests of Yamoussoukro (Côte d'Ivoire) which also found results similar to ours in their work.

## 4. Conclusion

We observe that the pressure of anthropogenic activities on the marine ecosystem of the study area is high, the area occupied by vegetation in 1987 is higher compared to 2007; that of 2007 is also greater than the occupation recorded in 2017. The high rate of plant cover relates not only to the small population at this time, but also to their daily activities.
In 1987 the populations of Boke and Boffa consisted mainly of fishermen and farmers; these two activities took place alternately, depending on the season (dry or rainy). The proliferation of mining companies is a serious handicap for these areas, because their way of taking charge of the management of the environment is extremely deficient, often leading to dramatic consequences, in societal terms.
This anthropogenic study, based on information covering the last 30 years, proves to a certain extent, on the one hand, the effect of man on his environment on the other hand, the direct implications of climate change in this area of This study is now home to mega mining projects in Guinea.
If we take the only parameter "Mangrove" which from 1987 to 2017 has lost more than half of its surface area is 472708.44 to 208 368.32, which should enable us to make recommendations, which draw the attention of the authorities in the framework of taking into account decisions on the proper and efficient management of the coastal environment.
Therefore, we suggest: establishing marine protected areas and protecting existing ones for the protection of marine biodiversity; respect the marsh protection band; sensitize the coastal population for reforestation of mangrove areas; prohibit the dumping of toxic products and all non-biodegradable elements in the inlets; auditing environmental studies done by companies; study on a macro scale and respect urbanization plans

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