Floristic Study of the Mangroves of the Sassandra-dabégo Complex

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Abstract

Mangroves are tropical coastal ecosystems of great ecological, climatic and socio-economic importance. They protect the coastline against erosion, provide the local populations with natural resources and maintain important biodiversity. In Côte d'Ivoire, the Sassandra-Dabégo complex, classified as a Ramsar site in 2005, represents one of the most important mangrove complexes in the country. However, it is under anthropogenic pressure from logging, agriculture, artisanal fishing and urbanization. This study aims to assess the conservation status of the mangroves of five sites (Groudou, Batélébré 2, Gaoulou, ÎIsland and Dabégo) of this complex through the analysis of the floristic richness, similarity, overlap and distribution of species. The inventories of these five sites using the itinerant method and the Braun-Blanquet phytosociological approach made it possible to identify a total of 40 plant species. Of these species, 37 have been inventoried in Batélébré 2, and only 17 in Gaoulou. The mangroves of Groudou, Island, Batélébré 2 and Dabégo still contain mangrove species such as *Rhizophora racemosa* G.Mey., *Avicennia africana* P.Beauv. and *Acrostichum aureum* L., indicating a relatively good state of preservation. In addition, Gaoulou has a total absence of these mangrove species and a strong dominance of *Chromolaena odorata*, reflecting an advanced degradation. The results reveal a conservation gradient within the complex, ranging from relatively stable sites, Groudou and the Island, to highly degraded areas, Gaoulou. This raises the urgency of strengthening sustainable management measures, in particular the reforestation of mangrove species and the regulation of human activities, in order to preserve these ecosystems in the southwest of Côte d'Ivoire.

INTRODUCTION

Mangrove ecosystems occupy a fundamental place in tropical areas because of their ecological, socio-economic and climatic importance. On a global scale, mangroves provide the functions of protecting coastlines against erosion, sequestration and storage of blue carbon, as well as maintaining a particularly rich biodiversity (IPCC, 2022). They provide riparian communities with essential ecosystem goods and services, including fisheries resources, wood energy and various non-timber forest products. All of this contributes to food security and poverty reduction (UNEP, 2021).

Despite their strategic importance, mangroves remain among the most threatened ecosystems in the world. According to FAO (2020), their overall area is estimated at about 14.8 million hectares, with a general trend of regression under the combined effect of anthropogenic pressures and climate change. In West Africa, these formations develop on hydromorphic, muddy soils rich in organic matter, subject to tides and variable salinity gradients. The vegetation is dominated by mangroves of the genera *Rhizophora* and *Avicennia*, as well as the species *Conocarpus erectus* L. (Combretaceae), forming favourable habitats for many species of fish, crustaceans, molluscs and waterbirds.

In Côte d'Ivoire, mangroves are located along the coast and in lagoon complexes in the south and west of the country. To encourage the protection and sustainable use of wetlands of international importance, the Ivorian State has acceded to the Ramsar Convention adopted in 1971. However, between the 1980s

and 2000s, the surface area of these areas decreased sharply due to population growth, intensive use of wood energy and coastal development (Ajonina *et al*., 2008). The Sassandra-Dabego mangrove complex, classified as a Ramsar site on 18 September 2005, is no exception to this reality. Indeed, over the past decade, this site has been subject to an intensification of anthropogenic pressures, such as logging, agricultural expansion, artisanal fishing and urbanization. Yet, it is one of the most representative and ecologically important wetlands in the country. It is characterized by the coexistence of several major species of mangroves, including *R. racemosa*, *A. africana* and *C. erectus*, giving the site a significant ecological interest (N'Douba *et al*., 2005). However, despite its status as a Ramsar site and the threats to which it is subject, up-to-date knowledge on the floristic composition, the structure of the stands and the dynamics of natural regeneration of the Sassandra-Dabégo complex remains limited. In this context, the present study aims to assess the state of degradation of the mangroves of the Sassandra-Dabego complex, by characterizing the floristic composition and the structure of the stands, then by analyzing the spatial distribution of the species and their regeneration dynamics, in order to guide sustainable management and ecological restoration strategies.

MATERIALS AND METHODS

1. Study area

The Sassandra–Dabégo complex is located in the southwest of Côte d'Ivoire, straddling the departments of Sassandra and Dabégo, between 4°56'40" and 5°1'40" north latitude and 5°58'20" and 6°8'20" west longitude. (Fig. 1). It covers an area of 10,551.1 ha and is a wetland of international importance (N'Douba *et al*., 2005). This complex rests on a Precambrian basement composed of migmatites, gneiss, amphibolites, pyroxenites and granites (Kouamélan *et al*., 2015).

The relief is not very rugged, except for the coastal approaches where there are hills with relatively steep slopes. There are four seasons: two dry seasons, one of which is from December to April and the small one from August to September, and two rainy seasons with a large one from May to July and the small one from October to November. The average annual rainfall is 1,600 mm and the average annual temperature is about 26°C (Soro *et al*., 2021).

The complex is watered by the Sassandra river, its tributary the Davo and by the Dabego lagoon. Secondary rivers, in particular Blézo and Gnoudolo-zalo, converge in the north before feeding the lagoon with fresh water. The mouth of the river is home to estuarine mangroves, about 60% of which are preserved, subject to hydro-sedimentary dynamics controlled by the interaction between marine and inland waters. This mixed influence modulates the physicochemical parameters (salinity, turbidity, nutrients), determining the distribution of aquatic organisms.

The study was carried out in the mangroves of Groudou, Batélébré 2, Gaoulou, Island and Dabégo.

2. Data collection

Floristic data were collected by combining the itinerant inventory and the phytosociological method of de Braun-Blanquet (1928), two complementary approaches widely used in tropical plant ecology and vegetation analysis. The itinerant inventory consists of systematically travelling through the study environment in different directions in order to identify all the plant species encountered. This method makes it possible to obtain an exhaustive floristic list of heterogeneous environments. The Braun-Blanquet method, based on the visual estimation of the abundance-dominance of species within plots, makes it possible to assess the abundance and recovery of species using a scale that assigns species an index of abundance dominance, ranging from 1 to 5 according to their average recoveries (Table 1). The abundance-dominance index includes the number of individuals of a species (abundance), its spatial cover, area and volume (dominance). The percentage of specific overlap is then estimated from the median of each abundance-dominance class, in accordance with methodological recommendations in quantitative phytosociology (Dengler *et al*., 2021). This conversion results in an average overlap value that can be used for statistical and comparative analyses of plant communities.

Table 1
Recoveries evaluation table adopted for this study

Dominance abundance index	Cover class	Recovery percentage (%)
5	]75 ; 100]	87,5
4	]50 ; 75]	62,5
3	]25 ; 50]	37,5
2	]5 ; 25]	15
1	]1 ; 5]	3
r	]0 ; 1]	0,5

4. Data processing and analysis

4.1. Determination of the floristic richness of the mangroves of the Sassandra–Dabégo complex

Floristic richness is the number of species recorded within the boundaries of a given territory, regardless of their frequency, abundance or any other quantitative measure. In the framework of this study, the analysis of the floristic richness will make it possible to quantify and compare the number of taxa present in the different mangroves of the Sassandra-Dabégo complex, which will provide a solid basis for discussing the conservation status of these ecosystems. The mangroves of this complex are divided into five sites, namely: Batélébré 2, Dabégo, Groudou, Gaoulou and the Island.

4.2. Analysis of the floristic similarity between the mangroves of the Sassandra-Dabégo complex

In order to evaluate the floristic similarity between the different mangroves of the Sassandra-Dabégo complex studied, the similarity coefficient of Sørensen (1948) was used. This coefficient makes it possible to assess the degree of proximity between two environments taken two by two. This coefficient only takes into account the presence or absence of species (Chao *et al*., 2005; Legendre & Legendre, 2012). Among various valid formulas, Sørensen's (1948) remains one of the most robust and most widely used in studies of mangroves and recent tropical forest ecosystems (Bohoussou &, Dibi, 2025). The mathematical formula is defined as follows:

$$\varvec{C}\varvec{s} = \left(\frac{2\varvec{C}}{\varvec{A} + \varvec{B}} \right) \times 100$$

Cs: Sorensen coefficient of similarity in percentage; A: number of species present in list I; B: number of species present in List II; C: number of species common to both lists.

A high coefficient of similarity (≥ 50%) indicates a strong proximity of floristic compositions between the two environments compared (Magurran, 2013; Legendre & Legendre, 2012).

4.3. Determination of species cover in the mangroves of the Sassandra-Dabégo complex

The study of the cover of the species of the different mangroves was carried out on the basis of the overlap coefficient (CR), derived from the phytosociological method developed by Braun-Blanquet (1928). The overlap coefficient consists of distinguishing between dominant or abundant species and those whose individuals are scattered or rare in an environment. This coefficient was used to highlight the most abundant species in the mangroves investigated. It is worded as follows:

$$\varvec{C}\varvec{R} = \left(\frac{\varvec{\Sigma}_{\varvec{R}\varvec{m}} \times 100}{\varvec{N}} \right)$$

CR: recovery coefficient; Rm: average cover of a species; N: Total number of readings.

4.4. Analysis of the spatial distribution of species in the mangroves of the Sassandra-Dabégo complex

To characterize the distribution of species according to the different sites, principal component analysis (PCA) was chosen. Principal component analysis (PCA) is one of the multivariate analyses generally used to highlight correlations between species and ecological variables or relationships between plants and environments taken into account simultaneously. The PCA has highlighted the preponderance of species within each mangrove. It was carried out using the XLSTAT 16.0 software.

RESULTS

1. Floristic richness of the mangroves of the Sassandra–Dabégo complex (dup: abstract ?)

A total of 40 plant species have been recorded in all five (05) mangroves of the Sassandra-Dabégo complex (Table 2). These species are distributed as follows: 37 (35 genera and 24 families) inventoried in the Batélébré 2 mangrove, 23 species (22 genera and 17 families) in the Dabégo mangrove, 21 species (20 genera and 17 families) in the Groudou mangrove, 17 species (17 genera and 12 families) in the Gaoulou mangrove, 17 species (17 genera and 14 families) in the island's mangrove.

The floristic richness of the five (05) mangroves of the Sassandra-Dabégo complex is made up of two groups of species. These are typical mangrove species and companion species (Table 2). Among the five (05) sites inventoried, no characteristic species of mangrove was observed in Gaoulou. On the other hand, in the mangroves of the Island, Groudou, Batélébré2 and Dabégo, three (3) plant species of mangroves have been identified. These are *R. racemosa, A. africana* and *A. aureum* (Table 2). Concerning companion species, *Dalbergia ecastaphyllum* (L.) Taub (Fabaceae), a species characteristic of degraded tropical coastal environments, as well as *Ormocarpum verrucosum* P.Beauv. (Fabaceae), typical of degraded dry tropical zones, have only been inventoried in the Gaoulou mangrove. These results indicate that the Batélébré 2 mangrove of the Sassandra-Dabégo complex remains relatively rich in floristics. On the other hand, the mangroves of Gaoulou and the Island appear to be floristically poor.

Table 2
List of species recorded in the mangroves of the Sassandra-Dabégo complex

Types of species		Mangroves of the Sassandra-Dabégo complex				
	Species	**Gaoulou**	**Dabégo**	**Batélébré 2**	**Island**	**Groudou**
Mangrove species	*Acrostichum aureum*	-	1	1	1	1
	Avicennia africana	-	1	1	1	1
	Rhizophora racemosa	-	1	1	1	1
Total number of mangrove species per site		**0**	**3**	**3**	**3**	**3**
Companion species	*Acridocarpus alternifilus*	1	1	1	-	-
	Agelaea pentagyna	-	-	1	1	1
	Alchornea cordifolia	1	1	1	1	1
	Baphia nitida	-	-	1	1	1
	Berlinia occidentalis	1	1	1	-	-
	Bussea occidentalis	1	1	1	-	-
	Chassalia kolly	1	-	1	-	-
	Chromoleana odorata	1	1	1	-	-
	Chrysobalanus ellipticus	-	1	1	-	-
	Commelina erectus	1	-	1	-	-
	Dalbergia escatapyilum	1	-	-	-	-
	Dialum aubrevillei	-	-	1	1	1
	Drepanocarpus lanatus	-	-	1	1	1
	Drypetes aframensis	-	1	1	-	1
	Drypetes laciniata	-	1	1	-	-
	Eugenia coronata	1	-	1	-	-
	Ficus trichopoda ;	-	-	1	1	1

1: presence of the species; **-** : absence of the species

Types of species	Mangroves of the Sassandra-Dabégo complex				
	Species	**Gaoulou**	**Dabégo**	**Batélébré 2**	**Island**	**Groudou**
	Flagellaria guineensis	1	-	1	-	-
	Hexalobus salicifolus	-	1	1	-	-
	Hibiscus comoensis	-	1	1	-	1
	Hibiscus tiliaceus	-	-	1	1	1
	Ipomoea pes-caprae	-	1	1	-	1
	Ixora laxiflora	-	-	1	1	1
	Lonchocarpus deniceus	1	1	1	-	-
	Millettia zechiana	1	-	1	-	-
	Musanga cecropiodes	-	-	1	1	1
	Napoleonacaea vogelii	1	1	1	1	1
	Ormocarpum verrucosum	1	-	-	-	-
	Philanthus reticulatus	-	1	1	1	1
	Phoenix reclinata	-	1	1	1	1
	Pterocarpus santalinoides	-	1	1	-	-
	Rauvolfia vomitoria	1	1	1	-	-
	Rhaphiostylis beninensis	1	1	1	-	-
	Rhinchospora corymbosa	-	-	-	1	1
	Securinega vrosa	1	1	1	-	-
	Tabernaemontana crassa	-	1	1	-	1
	Uapaca heudelotii	-	-	1	1	1
Total number of companion species per site		**17**	**20**	**34**	**14**	**18**
Number of species by site		**17**	**23**	**37**	**17**	**21**
1: presence of the species; **-** : absence of the species						

Types of species	Mangroves of the Sassandra-Dabégo complex				
Species	Gaoulou	Dabégo	Batélébré 2	Island	Groudou
Total number of species in the complex	**40**				
Gender Membership	**17**	**22**	**35**	**17**	**20**
Botanical family numbers	**12**	**17**	**24**	**14**	**17**
1: presence of the species; **-** : absence of the species					

2. Floristic similarity between the mangroves of the Sassandra-Dabégo complex (dup: abstract ?)

The analysis of the floristic similarity carried out between the five mangroves of the complex indicates varying degrees of floristic similarity depending on the site (Table 3). A maximum similarity of 100% was observed between the mangroves of Groudou and the Island, reflecting an almost identical floristic composition. High similarities were also recorded between Gaoulou and Batélébré 2 (66.67%), between Groudou and Dabégo (59.26%), as well as between Batélébré 2 and Dabégo (55.56%). On the other hand, between the mangroves of Groudou and the Island and then of the other mangroves, the coefficient of similarity varies from 22.22 to 48.15%, indicating a weak floristic resemblance.

Table 3
Coefficient of floristic similarity between mangroves (%)

Gaoulou	Gaoulou	Batélébré 2	Dabégo	Island	Groudou
	100				
Batélébré 2	**66,67**	100			
Dabégo	**59,26**	**55,56**	100		
Island	22,22	33,33	48,15	100	
Groudou	22,22	33,33	48,15	**100**	100

3. Species recovery in the mangroves of the Sassandra-Dabégo complex (dup: abstract ?)

The study of the species cover in the mangroves of the Sassandra-Dabégo complex showed that the overlap coefficient of *Chromolaena odorata* (L.) R.M.King & H.Rob. (Asteraceae) reached 62.5% in the Gaoulou and Batélébré 2 mangroves (Table 4). Similarly, *A. africana* has a recovery rate of 62.5% in the mangroves of Batélébré 2, Dabégo, Groudou and Île. For *R. racemosa*, the overlap coefficient is 52.5% in

Batélébré 2 and 54.2% in the mangroves of Groudou and the Island (Fig. 2). Finally, *A. aureum* shows an overlap of 62.5% in the mangroves of Groudou and Island.

These results indicate that *R. racemosa*, *A. aureum* and *A. africana* remain particularly abundant species in the Groudou and Island mangroves, reflecting their ecological importance. The high rate of *C. odorata* recovery in the Gaoulou mangrove indicates a disturbance of its vegetation (Fig. 3).

Table 4
Species coverage coefficient for each location in the complex (%)

Species	Localities				
	Gaoulou	**Batéléblé 2**	**Dabégo**	**Island**	**Groudou**
Acridocarpus alternifilus	37,5	37,5	37,5	-	-
Acrostichum aureum	-	-	-	**62,5**	**62,5**
Agelaea pentagyna	-	15	-	15	15
Alchornea cordifolia	20,6	15	15	15	15
Avicennia africana	-	**62,5**	**62,5**	**62,5**	**62,5**
Calamus deerratus	37,5	-	-	37,5	37,5
Chassalia kolly	37,5	37,5	-	-	-
Chromoleana odorata	**62,5**	**62,5**	-	-	-
Commelina erecta	-	15	-	-	-
Dalbergia escatapyilum	15	-	-	-	-
Drepanocarpus lanatus	-	37,5	-	37,5	37,5
Eugenia coronata	15	15	-	-	-
Flagellaria guineensis	37,5	37,5	-	-	-
Hibiscus tiliaceus	31,9	-	33	-	-
Ipomoea pes-caprae	15	12,0	15	-	-
Lonchocarpus deniceus	37,5	37,5	-	-	-
Millettia zechiana	37,5	37,5	-	-	-
Napoleonacaea vogelii	37,5	37,5	37,5	37,5	37,5
Ormocarpum verrucosum	7,5	-	-	-	-
Phoenix reclinata	-	37,5	-	-	-
Phyllanthus reticulatus	37,5	37,5	37,5	-	-
Rauvolfia vomitoria	37,5	37,5	37,5	-	-
Rhapiostylis beninensis	37,5	37,5	37,5	-	-
Rhinchospora corymbosa	-	-	-	37,5	37,5
Rhizophora racemosa	-	**52,5**	3,8	**54,2**	**54,2**
Securinega vrosa	37,5	37,5	37,5	-	-

Species	Localities				
	Gaoulou	Batéléblé 2	Dabégo	Island	Groudou
Tabernaemontana crassa	11,3	12	6	-	-

4. Spatial distribution of species in the mangroves of the Sassandra-Dabégo complex (dup: abstract ?)

The study of the spatial distribution of plant species between the mangroves of the Sassandra-Dabégo complex has identified four distinct groups (G) according to their relative abundance in the different sites investigated (Fig. 4).

The G1 group is composed of the most abundant species in the mangroves of Groudou and the Island. These are *R. racemosa, Drepanocarpus lanatus* (L.f.) G.Mey. (Fabaceae), *Agelaea pentagyna* (Lam.) Baill. (Connaraceae), *Rhinchospora corymbosa* (L.) Britton (Cyperaceae), *Calamus deerratus* and *A. aureum*.

Group G2 contains the species abundant in the mangroves of Gaoulou and Batéléblé 2. It includes *C. odorata, Millettia zechiana* Harms (Fabaceae), *O. verrucosum, Eugenia coronata* Vahl ex DC. (Myrtaceae), *Tabernaemontana crassa* Benth. (Apocynaceae), *Dalbergia escatapyilum* (L.) Taubert (Fabaceae), *Chassalia kolly*, *Flagellaria guineensis*, *Phoenix reclinata* Jacq. (Arecaceae), *Lonchocarpus sericeus* (Poir.) DC. (Fabaceae), and *Commelina erecta* L. (Commelinaceae).

Group G3 is made up of the most abundant species in the Dabego mangrove, namely *Hibiscus tiliaceus* L. (Malvaceae), *Ipomoea pes-caprae* (L.) R.Br. (Convolvulaceae), *Ipomoea pes-caprae*, *Acridocarpus alternifilus*, *Rauvolfia vomitoria* Afzel. (Apocynaceae), *Phyllanthus reticulatus* Poir. (Phyllantaceae), *Rhaphiostylis beninensis* (Hook.f. ex Planch.) Planch. ex Benth (Metteniusaceae), *Securinega vrosa* (Roxb. ex Willd.) Baill. (Euphorbiaceae) and *A. aureum*.

The G4 group contains the species present in almost all the mangroves of the Sassandra-Dabego complex. These are *Alchornea cordifolia* (Schumach. & Thonn.) Müll.Arg. (Euphorbiaceae) and *Napoleonaea vogelii* Hook. & Planch. (Lecythidaceae). As for the species *Avicennia. africana*, it is present in all mangroves except that of Gaoulou.

DISCUSSION

1. Floristic richness of the mangroves of the Sassandra–Dabégo complex

The inventory of the floristic composition showed that the sites of Dabégo, Groudou and Batélébré 2, retain a relatively high species diversity. This floristic richness observed in these mangroves can be explained by the monitoring carried out by the forestry services and the difficulty of access to certain

sites, thus constituting factors limiting the exploitation of wood and the conversion to agricultural land. The work of Friess *et al*. (2019) also showed that the least disturbed mangrove ecosystems in West Africa can maintain notable diversity. Concerning the degradation of the floristic composition of the Gaoulou mangrove, it may be due to its accessibility to the surrounding populations. Indeed, Branoff (2017) and Goldberg *et al*. (2020) showed that the proximity of habitats and the intensity of exploitation of wood resources strongly contribute to the destruction of mangrove flora. The total absence of mangrove species in Gaoulou, in particular *R. racemosa*, *A. africana* and *A. aureum*, reflects an advanced stage of degradation. The high presence of *C. odorata*, a pantropical invasive species that preferentially colonizes open and disturbed environments, confirms this degradation (Uyi *et al*., 2020). The high floristic richness at Batélébré 2 could reflect an intermediate stage of disturbance, where typical mangrove species coexist with secondary species, artificially increasing the total species richness. This type of situation has been described in mangroves subject to moderate exploitation (Goldberg *et al*., 2020).

2. Floristic similarity between the mangroves of the Sassandra-Dabégo complex

The floristic similarity analysis highlights two distinct ecological ensembles. These are Groudou and the Island with a 100% similarity, and Gaoulou, Batélébré 2 and Dabégo with similarities ranging from 55.56% to 66.67%. The similarity between Groudou and the island can be explained by their geographical location on either side of the Sassandra river, near the mouth. This location favours a comparable hydrological regime, marked by the alternation of fresh and marine waters. Soil salinity is a determining factor in the distribution of mangrove species (Reef *et al*., 2010; Krauss *et al*., 2014). Salinity gradients influence the zonation and relative dominance of species, especially those of the genera *Rhizophora* and *Avicennia*. The differences observed with the other sites could result from a relative distance from the mouth, modifying the physicochemical characteristics (salinity, soil texture and hydromorphy). The work of Kouamé *et al*. (2009) in Côte d'Ivoire showed that the floristic composition of wetlands is strongly correlated with these physicochemical characteristics.

3. Species recovery in the mangroves of the Sassandra-Dabégo complex

The high recovery rates of *A. africana* and *R. racemosa* in the mangroves of Groudou and the Island indicate relative ecological stability. Both species play a role in sediment fixation, shoreline stabilization, and maintenance of primary productivity (Alongi 2021).

The predominance of *A. africana* in Dabégo reflects a selective exploitation of *R. racemosa*. This method of selective sampling modifies the structure of the mangrove stand (Krauss *et al*., 2014). In Gaoulou, the high rate of *C. odorata* cover indicates an advanced state of degradation of its mangrove. The reduction

of tree cover creates gaps favourable to the establishment of heliophilous and competitive species, accelerating the transition to secondary formations (Uyi *et al.*, 2020).

4. Spatial distribution of species in the mangroves of the Sassandra-Dabégo complex

The analysis of the distribution of plant species in the mangroves of the Sassandra–Dabégo complex reveals a structuring into four floristic groups, according to an ecological gradient ranging from relatively conserved mangroves (G1) to highly disturbed mangroves (G2 and G3), with a core of generalized species (G4) shared by the entire complex.

The G1 group, corresponding to the Groudou and Island mangroves, is distinguished by a strong dominance of *Rhizophora racemosa*, a species characteristic of west african mangroves. This marked presence of this species can be explained by its high tolerance to salinity conditions and its ability to colonize unstable muddy substrates quickly (Alongi 2021). The presence of associated species such as *Acrostichum aureum* and *Calamus deerratus* reinforces the hypothesis of a relatively good conservation status of the mangroves at these two sites.

On the other hand, the G2 group, represented by the mangroves of Gaoulou and Batéléblé 2, is dominated by species typical of open and degraded environments, such as *Millettia zechiana*, *Chromolaena odorata* and *Phoenix reclinata*. This floristic composition reflects an advanced ecological imbalance, associated with intense anthropogenic disturbances (Gnanazan *et al*., 2023). The marked presence of *the invasive Chromolaena odorata* is a particularly important indicator of degradation, due to its ability to rapidly colonize open and disturbed habitats (Uyi *et al*., 2021).

The G3 group, specific to the Dabego mangrove, has a distinct floristic composition dominated by species such as *Ipomoea pes-caprae* and *Hibiscus tiliaceus*, characteristic of sandy and open littoral zones (Spalding *et al*., 2010). In addition, the presence of *Rauvolfia vomitoria* and *Phyllanthus reticulatus* indicates an evolution of this mangrove towards a secondary plant formation, reflecting previous disturbances (Friess *et al*., 2019).

Finally, the G4 group includes generalist species such as *Alchornea cordifolia* and *Napoleonaea vogelii*, present in almost all the sites of the complex. These species adapt to a variety of environmental conditions. These species play an important role in the processes of ecological resilience and natural restoration of mangroves (Ellison et al., 2020; Bhowmik *et al*., 2022). Moreover, the almost general distribution of *Avicennia africana*, except in Gaoulou, is particularly interesting. Species of the genus Avicennia are known for their ability to colonize more compact substrates thanks to their pneumatophores. Their absence in the mangrove at the Gaoulou site could be linked to particularly high anthropogenic pressures, limiting their settlement and development (Bunting *et al*., 2022). According to Alongi (2021), species of the genus *Avicennia* play a fundamental role in soil stabilization and mangrove resilience to climate change.

CONCLUSION

The present study has made it possible to characterize the floristic composition and the level of conservation of the mangroves of the Sassandra–Dabégo complex through the analysis of the species richness, floristic similarity, cover rate and spatial distribution of species. The study showed that the mangroves of Groudou, Island, Batélébré 2 and Dabégo still contain mangrove species such as *R. racemosa*, *A. africana* and *A. aureum*, indicating a relatively satisfactory conservation status of these three sites. These species have a good presence in Groudou and on the island, thus reflecting the stability of the banks and primary productivity. The Gaoulou mangrove is at an advanced stage of degradation with a total absence of characteristic mangrove species and a strong colonization of *C. odorata*, an invasive species indicative of disturbed environments. The mangroves of the Sassandra–Dabégo complex present a real conservation gradient, ranging from relatively stable sites (Groudou, Island) to highly degraded areas (Gaoulou), including intermediate situations (Batélébré 2, Dabégo).

These results underline the urgent need to strengthen sustainable mangrove management measures in this complex, particularly in Gaoulou, through ecological restoration actions based on the reforestation of indigenous mangrove species and the regulation of withdrawals. Strengthening monitoring systems and increasing awareness among local populations appear essential to preserve the ecological resilience of mangroves in southwestern Côte d'Ivoire and to guarantee the sustainability of the ecosystem services they provide.

Declarations

Author Contribution

K.D rédigeait le texte principale et les coauteurs K.D, K.R, K.B, L.T.T et B.C portaient leur critiques et suggestions

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Figures

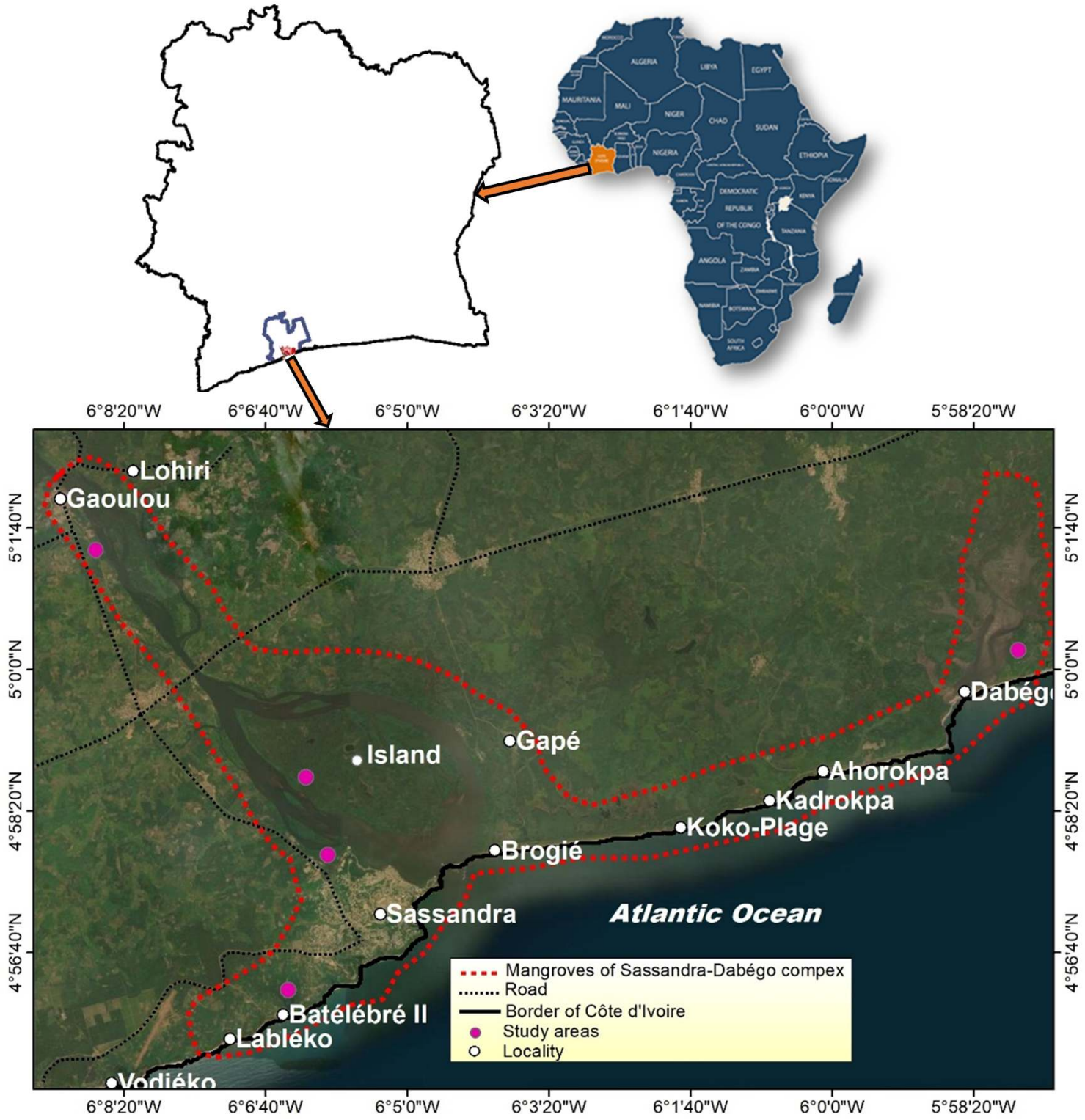

Figure 1

Location of the Sassandra-Dabégo complex

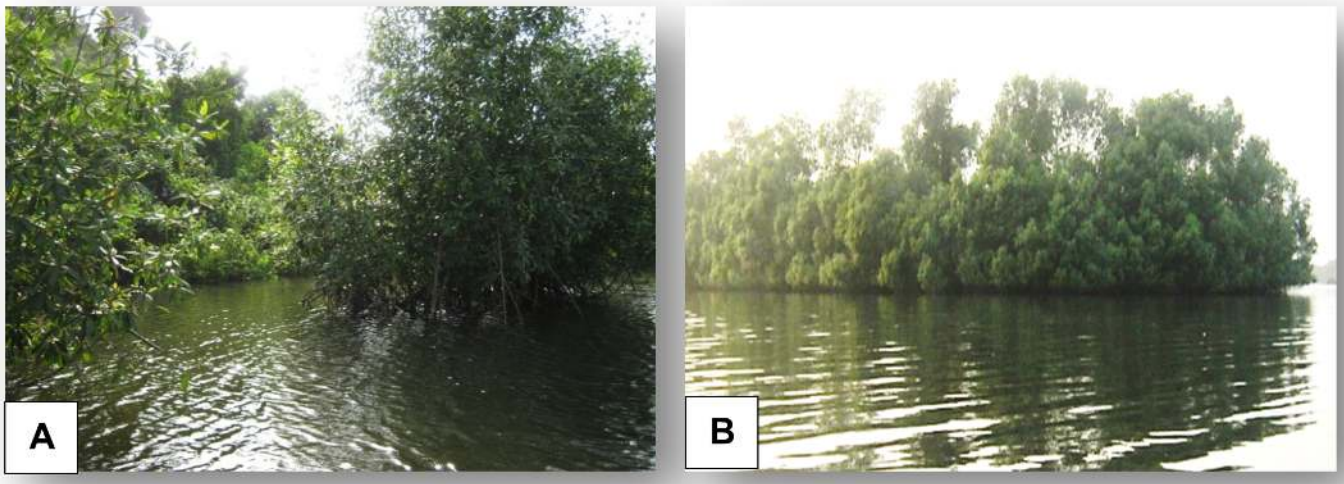

Figure 2

Vegetation of *Rhizophora racemosa* in the mangroves of Groudou (**A**) and block **B**)

Figure 3

Anthropogenic disturbance of the Gaoulou mangrove (A & B)

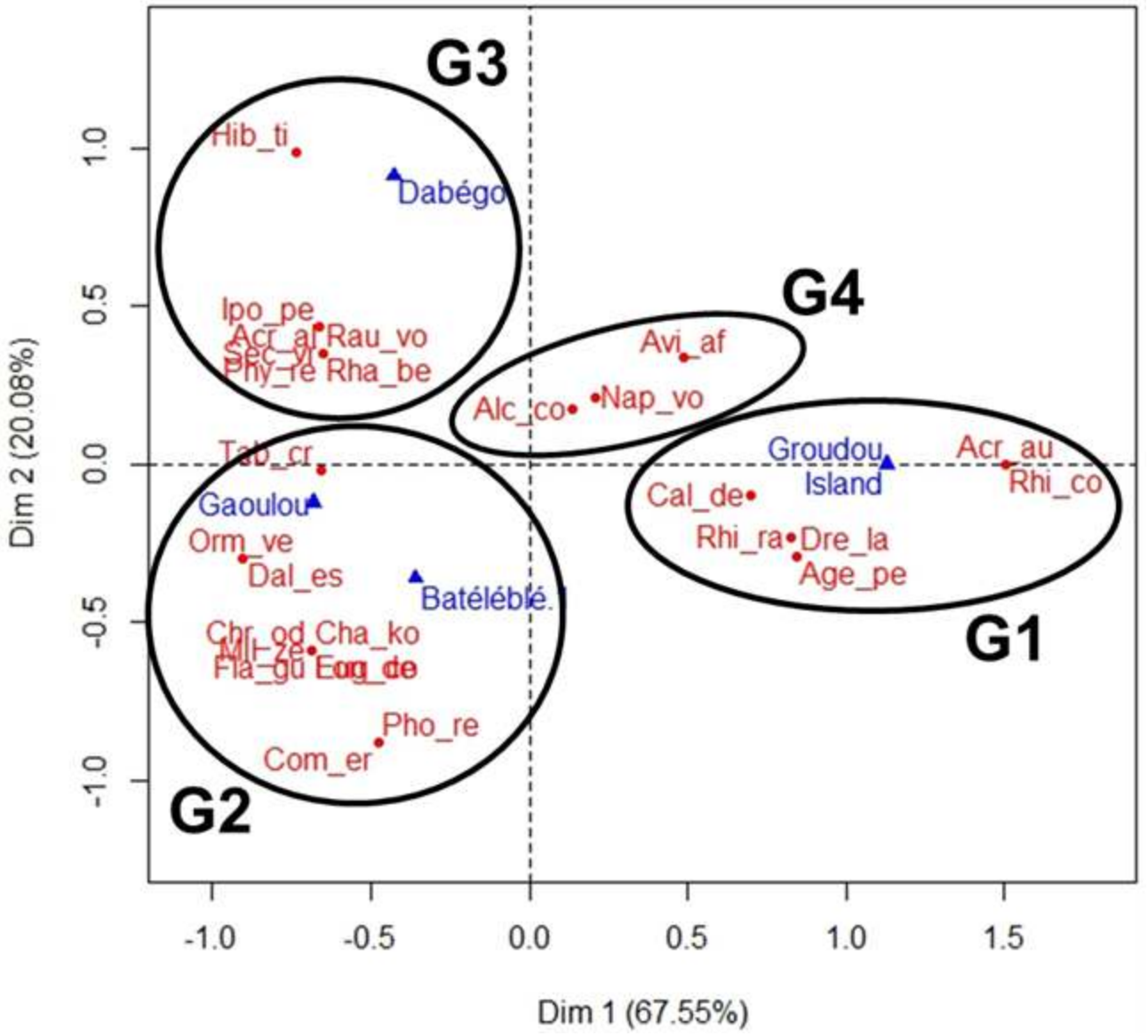

Figure 4

Figure 5. Distribution of species according to the locations of the complex

***Acr_al* :** *Acridocarpus alternifilus* ; ***Acr_au* :** *Acrostichum aureum* ; ***Age_pe* :** *Agelaea pentagyna* ; ***Alc_co* :** *Alchornea cordifolia* ; ***Avi_af* :** *Avicennia africana* ; ***Cal_de* :** *Calamus deerratus* ; ***Cha_ko* :** *Chassalia kolly* ; ***Chr_od* :** *Chromoleana odorata* ; ***Com_er* :** *Commelina erecta* ; ***Dal_es* :** *Dalbergia escatapyilum* ; ***Dre_la* :** *Drepanocarpus lanatus* ; ***Eug_co* :** *Eugenia coronata* ; ***Fla_gu* :** *Flagellaria guineensis* ; ***Hib_ti* :** *Hibiscus tiliaceus* ; ***Ipo_pe* :** *Ipomoea pes-caprae* ; ***Lon_de* :** *Lonchocarpus sericeus* ; ***Mil_ze* :** *Millettia zechiana* ; ***Nap_vo* :** *Napoleonacaea vogelii* ; ***Orm_ve* :** *Ormocarpum verrucosum* ; ***Pho_re* :** *Phoenix reclinata* ; ***Phy_re* :** *Phyllanthus reticulatus* ; ***Rau_vo* :** *Rauvolfia vomitoria* ; ***Rha_be* :** *Rhapiostylis beninensis* ; ***Rhi_co* :** *Rhinchospora corymbosa* ; ***Rhi_ra* :** *Rhizophora racemosa* ; ***Sec_vr* :** *Securinega vrosa* ; ***Tab_cr* :** *Tabernaemontana crassa*