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Characterization of the Flora in the Bamboung and Sangomar Marine Protected Areas (MPAs)

Jules DIOUF[1,2*], Marie Emilie Philomène NDONG[1], Djibril DIOP[1,2], Alassane DIOUF[1], Ndongo DIOUF[1,2], Birane DIENG[1,2], Abdoul Aziz CAMARA et Mame Samba MBAYE[1,2]

[1]Botany and Biodiversity Laboratory, Department of Plant Biology, Faculty of Science and Technology, Cheikh Anta Diop University, P.O. Box 5005 Dakar-Fann, Senegal
[2]Dakar Herbarium, Department of Plant Biology, Faculty of Science and Technology, Cheikh Anta Diop University, P.O. Box 5005 Dakar-Fann, Senegal

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***Corresponding author:** Jules DIOUF
Botany and Biodiversity Laboratory, Department of Plant Biology, Faculty of Science and Technology, Cheikh Anta Diop University, P.O. Box 5005 Dakar-Fann, Senegal

Abstract | **Original Research Article**

With a coastline of approximately 700 km, Senegal has a rich marine and coastal biodiversity. However, despite the fundamental role that marine and coastal biodiversity plays in local livelihoods, marine and coastal ecosystems are undergoing increasing degradation. In response to this situation, the international community recommended, at the Fifth World Congress on National Parks held in Durban in 2003, that efforts to protect the marine environment be strengthened. In response to these recommendations, the Government of Senegal has therefore initiated a resolute policy for the preservation of marine and coastal biodiversity. However, despite efforts to document the biodiversity of these sites, there remains a significant lack of information on the flora, particularly that of the islands. It is in this context that this study was conducted in the Bamboung and Sangomar MPAs to contribute to our understanding of their flora. Data was collected using the transect survey method. A total of 195 species belonging to 151 genera and 51 families, including 66 common species were recorded. The Fabaceae family is dominant at both sites. The low E/G ratio and the high representation of monospecific families and genera indicate that the flora is diverse. These results showed that the islands within these MPAs deserve greater attention, as they still harbor some of the few remaining areas of natural vegetation in the region.

Keywords: Marine Protected Areas, Islands, Plant Diversity.

INTRODUCTION

With appproxymately 700 km of coastline, Senegal boasts an exceptional wealth of marine and coastal biodiversity. Yet, despite the vital importance of these ecosystems to people's livelihoods, their condition is rapidly deteriorating. According to the IUCN and UNEP, cited by Goeury (2014), over the past few decades, nearly 30% of coral reefs and 35% of mangroves have been lost. Habitat destruction remains the primary threat to terrestrial and aquatic species, making the creation and effective management of protected areas essential (MEDD, 2015). In light of this, the international community, at the 5th World Congress on National Parks held in Durban in 2003, recommended strengthening the protection of the marine environment by increasing the coverage of protected areas from 1% to 5% (CBD, 2003). In line with this initiative, the Government of Senegal, in close partnership with local communities, implemented a proactive policy to preserve marine and coastal biodiversity. The establishment of Marine Protected Areas (MPAs) serves several objectives: protecting threatened species, conserving critical ecological habitats, preserving biodiversity, and sustaining socio-economic activities (Leloup, 2011). This approach is based on the concept of ecosystem services, according to which the benefits provided by ecosystems, by far, exceed the costs of their conservation (Goeury, 2014). However, despite advances in our understanding of the biodiversity of these sites, information regarding terrestrial flora remains limited, particularly on the islands within the Bamboung and Sangomar MPAs. It is against this backdrop that this study was conducted, with the aim of contributing to a better understanding of the flora of the Bamboung and Sangomar MPAs.

MATERIALS AND METHODS

Presentation of the Study Sites

The Bamboung Marine Protected Area is located in the Saloum River Delta Biosphere Reserve in Senegal, within the Bamboung Bolon (Guire & Tranchot-Diallo, 2023). This MPA and its buffer zone comprise thirteen (13) villages and is located in the Fatick region, Foundiougne department, Toubacouta municipality (BAMBOUNG MPA PAG, 2023). The Sangomar Marine Protected Area includes the communes of Palmarin and Dionewar and is bounded to the north by the Joal-Fadiouth MPA, to the south by the Saloum Delta National Park, and to the east by the Palmarin Community Nature Reserve (RNC) and the communes of Bassoul and Djirnda. A large part of it lies within the Saloum Delta Biosphere Reserve (Faye & Dieng, 2020).

Collecting Data

A literature review was conducted to assess the current state of knowledge and determine how previous research has contributed to our understanding of the topic.

Collecting Floristic Data

There are several types of inventories, which can be distinguished according to their characteristics, including the methods used to conduct them, spatial extent of their application, and their objectives (Lecomte and Rondeux, 2002). In this study, a stratified sampling method based on vegetation types was adopted. Using ARC GIS software, a 500×500-meter grids was established. For each land-use unit, a randomly selected without-replacement sample of characteristic grids was drawn. A grid is considered characteristic if it is entirely contained within the land-use unit— thereby ensuring its homogeneity.

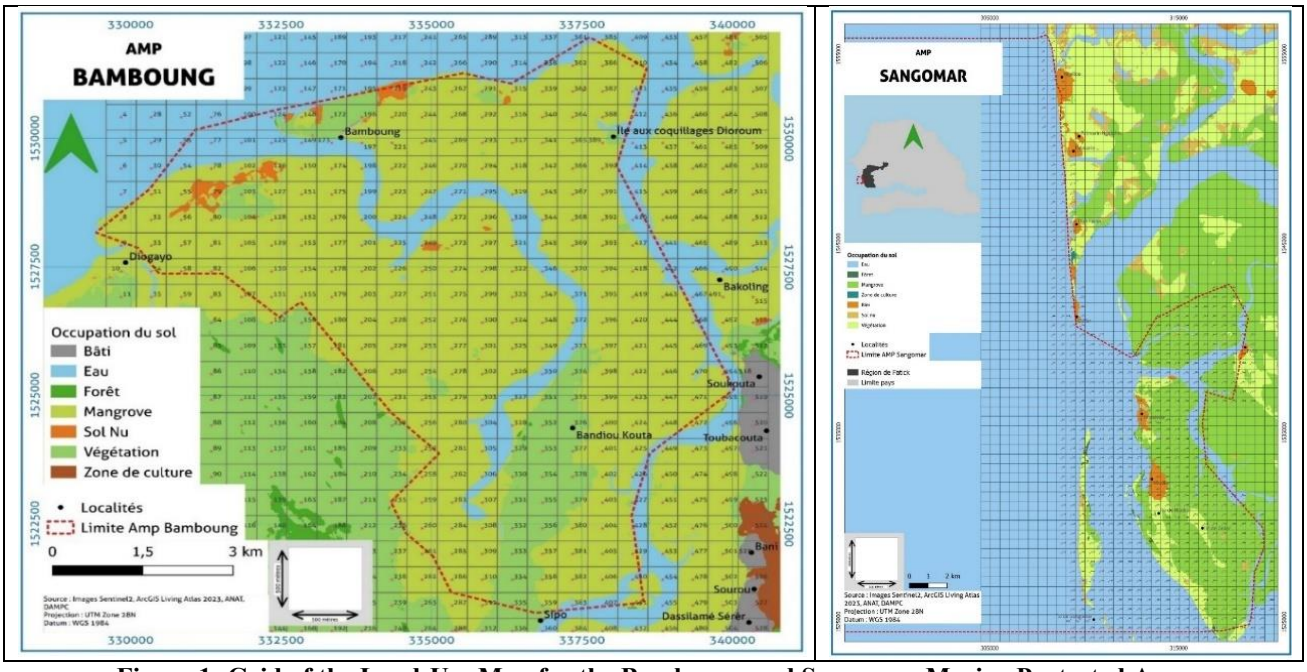

Figure 1: Grid of the Land-Use Map for the Bamboung and Sangomar Marine Protected Area

In each targeted grid cell, the mobile survey method was applied by systematically traversing the cell in different directions and recording all species encountered on a standardized data sheet (Sarr *et al*., 2021).

Data Processing

The inventory data were entered into an Excel file. The floristic structure was analyzed and its biological, chorological, and taxonomic spectra were determined. Species were classified based on their presence in the study areas. Species nomenclature followed Lebrun and Stork (1991, 2015). Scientific names and their updates were checked against the database of the Conservatory and Botanical Garden of the City of Geneva (CJGB), which uses the APG IV classification (www.ville-ge.ch/musinfo/bd/cjb/africa). To determine the biological spectrum, species were classified according to their biological type. The classification used is that of Raunkiaer (1934), which has been adapted for the study of tropical plant communities by various authors (Serge *et al*., 2015). To establish the chorological spectrum, species were classified according to their geographic distribution. To this end, data on species distribution were obtained primarily from Thiombano *et al*., (2012) as well as from the works of Dieng *et al*., (2019); Diouf *et al*., (2019); Diouf (2020); Ndour *et al*., (2021); and Ka (2023).

RESULTS

Flora Composition

The table below lists the species encountered during this study in the Bamboung and Sangomar marine protected areas. Each species is identified with

information on their geographic distribution and biological category. In total, 195 species belonging to 51 families and 151 genera were recorded in the two MPAs. The flora of the Bamboung MPA comprises 126 species distributed across 43 families and 108 genera, while the flora of Sangomar consists of 140 species distributed across 40 families and 110 genera. An analysis of Table 1 also shows that the Fabaceae, Poaceae, and Malvaceae were the most represented families with the Fabaceae family, accounting for 20.5% in Bamboung and 22.7% in Sangomar; the Poaceae family, accounting for 10.2% in Bamboung and 12.1% in Sangomar; and the Malvaceae family, accounting for 7.1% in both MPAs. Analysis of this data also shows that 36 of the 43 families in the AMP of Bamboung and 32 of the 40 families present in the AMP of Sangomar are represented by three or fewer species.

Table 1: List of Species in the Bamboung and Sangomar Marine Protected Areas

Families	NG	NE	Species	Port	T.B	R.G	AMPB	AMPS
Acanthaceae (D)	6	6	*Asystasia gangetica* (L.) T. Anderson	*Herbaceous*	T	Pal	+	-
			Avicennia germinans(L.) L.	*Shrub*	P	AfT	+	+
			Hygrophila senegalensis (Nees) T. Anderson	*Herbaceous*	T	Af	+	-
			Nelsonia canescens (Lam.) Spreng.	*Herbaceous*	T	Pt	-	+
			Phaulopsis imbricata (Forssk.)	*Herbaceous*	T	Af	+	-
			Dicliptera paniculata (Forssk.) I.Darbysh.	*Herbaceous*	T	Mas	+	+
Aizoaceae (D)	1	1	*Sesuvium portulacastrum* (L.) L.	*Herbaceous*	T	Pt	+	+
Amanranthaceae (D)	3	3	*Achyranthes aspera* L.	*Herbaceous*	C	Cosm	+	+
			Blutaparon vermiculare (L.) Mears	*Herbaceous*	C	Am	+	+
			Suaeda vermiculata Forssk. ex J. F. Gmel	*Herbaceous*	C	AaAus	-	+
Anacardiaceae (D)	5	6	*Anacardium occidentale* L.	*Tree/Shrub*	P	Pt	+	+
			Ozoroa insignis Delile	*Shrub*	P	Af	+	-
			Lannea acida A.Rich.	*Tree*	P	Af	+	-
			Lannea microcarpa Engl. & K. Krause	*Tree*	P	Af	+	-
			Mangifera indica L.	*Tree*	P	Pt	+	+
			Sclerocarya birrea (A. Rich.) Hochst.	*Tree*	P	Af	+	+
Annonaceae (D)	1	1	*Annona senegalensis Pers.*	*Shrub*	P	Af	+	-
Apocynaceae (D)	6	6	*Calotropis procera* (Aiton) W.T. Aiton	*Shrub*	P	Pt	-	+
			Pentatropis nivalis (J.F.Gmel.) D.V.Field & J.R.I.Wood	*Liana*	P	Mas	+	+
			Leptadenia lanceolata (Poir.) Goyder	*Liana*	P	Af	+	+
			Pergularia daemia (Forssk.) Chiov.	*Liana*	C	Aa	-	+
			Strophantus sarmentosus DC.	*Liana*	P	Af	+	+
			Cascabela thevetia (L.) Lippold	*Shrub*	P	Am	-	+
Arecaceae (M)	3	3	*Borassus aethiopum* Mart.	*Palm tree*	P	AfT	+	+
			Cocos nucifera L.	*Palm tree*	P	Pt	+	+
			Elaeis guineensis Jacq.	*Palm tree*	P	Masm	+	+
Asteraceae (D)	4	4	*Blainvillea gayana* Cass.	*Herbaceous*	T	AfT	+	+
			Pseudoconyza viscosa (Mill.) D'Arcy	*Herbaceous*	T	Pt	+	+
			Cyanthillium cinereum (L.) H.Rob.	*Herbaceous*	T	Pt	-	+
			Vernonia colorata (Willd.) Drake	*Shrub*	P	Ma	+	-
Boraginaceae (D)	1	1	*Cordia sebestena* L.	*Shrub*	P	Pt	-	+
Cannabaceae (D)	2	2	*Trema orientale* (L.) Blume	*Shrub*	P	Ma	+	-
			Celtis toka (Forssk.) Hepper & J.R.I.Wood	*Tree*	P	Af	+	+
Capparaceae (D)	3	3	*Boscia angustifolia* A. Rich.	*Shrub*	P	Aa	+	+
			Capparis tomentosa Lam.	*Shrub*	P	Af	-	+
			Crateva adansonii DC.	*Shrub*	P	As	+	+
Caricaceae (D)	1	1	*Carica papaya* L.	*Shrub*	P	Pt	+	+
Cariophyllaceae (D)	1	1	*Polycarpaea linearifolia* (DC.) DC.	*Herbaceous*	T	Af	+	-
Casuarinaceae	1	1	*Casuarina equisetifolia* L.	*Tree*	P	Pt	-	+
Celestraceae (D)	2	2	*Loeseneriella ectypetala N.Hallé*	*Liana*	P	AfT	+	-
			Gymnosporia senegalensis (Lam.) Loes	*Shrub*	P	Mase	+	+
Chrysobalanaceae (D)	2	2	*Chrysobalanus icaco* L.	*Shrub*	P	AfT	-	+
			Neocarya macrophylla (Sabine) Prance	*Tree*	T	Af	+	+
Cleomaceae (D)	1	1	*Cleome viscosa* L.	*Herbaceous*	T	Pt	+	-
Combretaceae (D)	5	9	*Combretum glutinosum* Perr. ex DC.	*Shrub*	P	Af	+	-
			Combretum aculeatum Vent.	*Shrub*	P	Af	+	-
			Conocarpus erectus L.	*Shrub*	P	T	-	+

			Guiera senegalensis J.F. Gmel.	*Shrub*	P	Af	+	-
			Languncularia racemosa (L.) C.F.Gaertn	*Shrub*	P	T	+	+
			Terminalia avicennioides Guill. & Perr.	*Shrub*	P	Af	+	-
			Terminalia catappa L.	*Tree*	P	Pt	-	+
			Terminalia macroptera Guill. & Perr.	*Tree*	P	Af	+	-
			Terminalia mantaly H. Perrier	*Tree*	P	Mal	-	+
Commelinaceae (M)	1	1	*Commelina benghalensis* L.	*Herbaceous*	T	As	+	-
Convolvulaceae (D)	4	6	*Cressa cretica* L.	*Herbaceous*	C	Mas	+	+
			Ipomoea aquatica Forssk.	*Liana/Herbaceous*	T	Pt	-	+
			Ipomoea cairica (L.) Sweet	*Liana/Herbaceous*	G	Pt	-	+
			Ipomoea eriocarpa auct.	*Liana/Herbaceous*	T	Pal	-	+
			Jacquemontia tamnifolia (L.) Griseb.	*Liana/Herbaceous*	T	Af	+	-
			Distimake aegyptius (L.) A.R.Simões & Staples	*Liana/Herbaceous*	T	Pt	+	+
Cucurbitaceae (D)	3	3	*Cucumis maderaspatanus* L.	*Liana/Herbaceous*	Hé	Pal	+	-
			Momordica charantia L.	*Liana/Herbaceous*	T	Cosm	-	+
			Zehneria thwaitesii (Schweinf.) C.Jeffrey	*Liana/Herbaceous*	T	Mas	+	-
Cyperaceae (M)	4	9	*Bolboschoenus maritimus* (L.) Palla	*Herbaceous*	G	Cosm	+	+
			Cyperus amabilis Vah	*Herbaceous*	G	Cosm	+	-
			Cyperus articulatus L.	*Herbaceous*	G	Pt	-	+
			Cyperus esculentus L.	*Herbaceous*	G	Cosm	+	+
			Cyperus difformis L.	*Herbaceous*	T	Pt	-	+
			Cyperus schimperianus Steud.	*Herbaceous*	G	Aa	-	+
			Cyperus crassipes Vahl	*Herbaceous*	G	Pt	-	+
			Fimbristylis ferruginea (L.) Vahl	*Herbaceous*	Hé	Pt	-	+
			Kyllinga odorata Vahl	*Herbaceous*	Hé	Pt	-	+
Ebenaceae (D)	1	1	*Diospyros mespiliformis* Hochst. ex A. DC.	*Tree*	P	Af	+	-
Euphorbiaceae (D)	6	7	*Alchornea cordifolia* (Schumach. & Thonn.) Müll.Arg.	*Shrub*	P	Af	+	-
			Anthostema senegalense A. Juss	*Tree/Shrub*	P	Af	+	-
			Euphorbia balsamifera Aiton	*Shrub*	P	Af	-	+
			Euphorbia tirucalli L.	*Shrub*	P	As	-	+
			*Jatropha curcas*L.	*Shrub*	P	AfT	+	+
			Pedilanthus tithymaloides (L.) A.Poit.	*Herbaceous*	P	Am	-	+
			Ricinus communis L.	*Shrub*	P	Pt	-	+
Fabaceae (D)	26	40	*Abrus precatorius* L.	*Liana/ligneuse*	P	Pt	+	+
			Acacia ataxacantha DC.	*Shrub*	P	Af	-	+
			Acacia macrostachya Rchb. ex DC.	*Shrub*	P	Af	+	+
			Acacia nilotica (L.) Willd. ex Delile	*Shrub*	P	Af	+	+
			Acacia seyal Delile	*Shrub*	P	As	+	+
			Aeschynomene indica L.	*Herbaceous*	T	Pt	+	-
			Albizia lebbeck (L.) Benth.	*Tree*	P	Pt	+	+
			Alysicarpus ovalifolius (Schumach.) J. Léonard	*Herbaceous*	T	Ma	-	+
			Canavalia rosea (Sw.) DC.	*Liana/Herbaceous*	Hé	T	-	+
			Cassia nigricans Vahl	*Herbaceous*	T	Aa	+	+
			Cassia occidentalis L.	*Herbaceous*	T	Pt	+	+
			Cassia siamea Lam.	*Herbaceous*	P	As	+	-
			Chamaecrista mimosoides (L.) Greene	*Herbaceous*	T	Pal	+	-
			Crotalaria arenaria Benth.	*Herbaceous*	T	Af	-	+
			Crotalaria goreensis Guill. & Perr.	*Herbaceous*	T	Af	+	+
			Dactyloctenium aegyptium (L.) Willd.	*Herbaceous*	T	Pal	-	+
			Daniellia oliveri (Rolfe) Hutch. & Dalziel	*Tree*	P	Af	+	-
			Grona hirta (Guill. & Perr.) H.Ohashi & K.Ohashi	*Herbaceous*	T	Aft	+	-
			Detarium senegalense J.F. Gmel.	*Tree*	P	Af	+	+
			Dialium guineense Willd.	*Tree*	P	Af	+	-
			Dichrostachys cinerea (L.) Wight & Arn.	*Shrub*	P	Ma	+	+
			Faidherbia albida (Delile) A. Chev.	*Tree*	P	Af	-	+
			Indigofera astragalina DC.	*Herbaceous*	T	As	+	+
			Indigofera dendroides Jacq.	*Herbaceous*	T	AmAs	-	+
			Indigofera pilosa Poir.	*Herbaceous*	T	Af	-	+
			Indigofera hirsuta L.	*Herbaceous*	Hé	AmAs	-	+
			Indigofera tinctoria L.	*Herbaceous*	C	Af	-	+
			Leucaena leucocephala (Lam.) de Wit	*Tree*	P	Pt	-	+

			Parkia biglobosa (Jacq.) R. Br. ex G. Don	*Tree*	P	Af	+	-
			Piliostigma thonningii (Schumach.) Milne-Redh.	*Shrub*	P	AfT	+	-
			Prosopis africana (Guill. & Perr.) Taub.	*Tree*	P	Af	+	+
			Prosopis juliflora (Sw.) DC.	*Tree*	P	Cosm	-	+
			Sesbania pachycarpa DC.	*Herbaceous*	T	Asu	+	+
			Sesbania rostrata Bremek. & Oberm.	*Herbaceous*	T	Af	+	+
			Stylosanthes erecta P.Beauv.	*Herbaceous*	C	Ma	+	-
			Stylosanthes fruticosa (Retz.) Alston	*Herbaceous*	P	Af	-	+
			Tamarindus indica L.	*Tree*	P	Pt	+	+
			Tephrosia linearis (Willd.) Pers.	*Herbaceous*	T	Af	-	+
			Tephrosia bracteolata Guill. et Perr.	*Herbaceous*	T	Af	-	+
			Zornia glochidiata Rchb. ex DC.	*Herbaceous*	T	Ma	+	+
Goodeniaceae (D)	1	1	*Scaevola plumieri* (L) Vahl	*Shrub*	P	Af	-	+
Icacinaceae (D)	1	1	*Icacina senegalensis* Juss.	*Shrub*	T	Af	+	-
Lamiaceae (D)	2	3	*Hyptis suaveolens* (L.) Poit.	*Herbaceous*	T	AmAs	+	+
			Hyptis spicigera Lam.	*Herbaceous*	T	Pt	+	+
			Leonotis nepetifolia (L.) R.Br.	*Herbaceous*	T	Mae	-	+
Lauraceae (D)	1	1	*Cassytha filiformis* L.	*Herbaceous*	P	T	-	+
Loranthaceae (D)	1	1	*Tapinanthus bangwensis* (Engl. & K. Krause) Danser	*Epiphyte*	Epiphyte	Af	-	+
Malvaceae (D)	10	14	*Adansonia digitata* L.	*Tree*	P	Ma	+	+
			Bombax costatum Pellegr. & Vuill.	*Tree*	P	Af	+	-
			Corchorus aestuans L.	*Herbaceous*	T	Pt	+	+
			Corchorus olitorius L.	*Herbaceous*	T	Pt	+	-
			Corchorus tridens L.	*Herbaceous*	T	Asu	+	+
			Hibiscus cannabinus L.	*Herbaceous*	G	Af	+	+
			Hibiscus physaloides Guill. & Perr.	*Herbaceous*	P	Af	+	-
			Hibiscus sabdariffa L.	*Herbaceous*	T	Am	-	+
			Melochia melissifolia Benth.	*Herbaceous*	P	AfT	+	-
			Sida acuta Burm.f.	*Herbaceous*	T	Pt	-	+
			Sterculia setigera Delile	*Tree*	P	AfT	-	+
			Thespesia populneoides (Roxb.) Kostel.	*Shrub*	P	T	-	+
			Waltheria indica L.	*Herbaceous*	C	Pt	+	+
			Wissadula amplissima (L.) R.E.Fr.	*Herbaceous*	P	AfAm	-	+
Meliaceae (D)	1	1	*Azadirachta indica* A. Juss.	*Tree*	P	Pt	+	+
Menispermaceae (D)	1	1	*Tinospora bakis* (A. Rich.) Miers	*Liana*	G	Af	+	-
Moraceae (D)	1	4	*Ficus lutea* Vahl	*Tree*	P	Af	-	+
			Ficus thonningii Blume	*Tree*	P	AfT	-	+
			Ficus sycomorus L.	*Tree*	P	Mas	+	-
			Ficus platyphylla Delile	*Tree*	P	Af	+	+
Myrtaceae (D)	1	2	*Eucalyptus camaldulensis* Dehnh.	*Tree*	P	AaAus	+	-
			Eucalyptus alba Reinw. ex Blume	*Tree*	P	Pt	+	+
Ochnaceae (D)	1	1	*Lophira lanceolata* Tiegh. Ex Keay	*Tree*	P	Af	+	-
Passifloraceae (D)	1	1	*Passiflora foetida* L.	*Liana/Herbaceous*	P	Pt	+	+
Phyllantaceae (D)	1	1	*Hymenocardia acida* Tul.	*Tree*	P	Aft	+	-
Poaceae (M)	17	21	*Andropogon africanus* Franch.	*Herbaceous*	Hé	AfT	+	+
			Andropogon gayanus Kunth	*Herbaceous*	Hé	Af	+	-
			Aristida mutabilis Trin. & Rupr.	*Herbaceous*	T	Pt	+	-
			Cenchrus biflorus Roxb.	*Herbaceous*	T	As	-	+
			Ctenium elegans Kunth	*Herbaceous*	T	Af	+	-
			Cynodon dactylon (L.) Pers.	*Herbaceous*	T	Cosm	+	+
			Dactyloctenium aegyptium (L.) Willd.	*Herbaceous*	T	Pal	+	+
			Digitaria horizontalis Willd.	*Herbaceous*	T	Pt	+	+
			Echinochloa colona (L.) Link	*Herbaceous*	T	Pt	+	+
			Eleusine indica (L.) Gaertn.	*Herbaceous*	T	Pt	-	+
			Enteropogon prieurii (Kunth) Clayton	*Herbaceous*	T	Aa	+	-
			Eragrostis ciliaris (L.) R.Br.	*Herbaceous*	T	Pt	-	+
			Eragrostis tremula (Lam.) Hochst. ex Steud.	*Herbaceous*	T	Aa	+	+
			Eragrostis turgida (Schumach.) De Wild.	*Herbaceous*	T	Af	-	+
			Panicum pansum Rendle	*Herbaceous*	T	Af	+	+
			Cenchrus pedicellatus (Trin.) Morrone	*Herbaceous*	T	Pal	+	+

			Phragmites australis (Cav.) Trin. ex Steud.	*Herbaceous*	G	Cosm	-	+
			Schizachyrium exile (Hochst.) Pilg.	*Herbaceous*	T	Mas	-	+
			Schoenefeldia gracilis Kunth	*Herbaceous*	T	As	+	+
			Sporobolus microprotus Stapf	*Herbaceous*	Hé	Af	-	+
			Sporobolus pellucidus Hochst.	*Herbaceous*	Hé	Aa	-	+
Polygalaceae (D)	1	1	*Securidaca longipedunculata* Fresen.	*Shrub*	P	AfT	+	-
Rhamnaceae (D)	1	2	*Ziziphus mucronata* Willd.	*Shrub*	P	Af	+	+
			Ziziphus mauritiana Lam.	*Shrub*	P	As	-	+
Rhizophoraceae (D)	1	1	*Rhizophora mangle* L.	*Shrub*	P	T	+	+
Rubiaceae (D)	3	6	*Gardenia ternifolia* Schumach. & Thonn.	*Shrub*	P	Af	+	-
			Mitragyna inermis (Willd.) K. Schum.	*Tree*	P	Af	+	-
			Spermacoce chaetocephala DC.	*Herbaceous*	T	Ma	+	-
			Spermacoce ruelliae DC.	*Herbaceous*	T	Af	+	+
			Spermacoce stachydea (DC).Hut	*Herbaceous*	T	Af	+	-
			Spermacoce verticillata L.	*Herbaceous*	P	Af	-	+
Rutaceae (D)	1	1	*Zanthoxylum zanthoxyloides* (Lam.) Zepern. & Timler	*Shrub*	P	Af	-	+
Sapindaceae (D)	3	3	*Allophylus africanus* P.Beauv.	*Shrub*	P	AfT	+	+
			Lepisanthes senegalensis (Juss. ex Poir.) Leenh.	*Tree*	P	Af	+	-
			Cardiospermum halicacabum L.	*Liana/Herbaceous*	T	T	-	+
Scrophulariaceae	1	1	*Scoparia dulcis* L.	*Herbaceous*	T	Pt	+	+
Solanaceae (D)	1	1	*Solanum nigrum* L.	*Herbaceous*	T	Cosm	-	+
Tamarinaceae (D)	1	1	*Tamarix senegalensis* DC.	*Shrub*	P	Pt	+	+
Typhaceae (M)	1	1	*Typha domingensis* Pers.	*Herbaceous*	C	Pt	-	+
Verbenaceae (D)	3	3	*Gmelina arborea* Roxb.	*Tree*	P	As	-	+
			Lantana camara L.	*Shrub*	P	Pt	+	+
			Stachytarpheta indica (L.) Vahl	*Herbaceous*	P	Pt	-	+
Zygophyllaceae (D)	1	1	*Balanites aegyptiaca* (L.) Delile	*Shrub*	P	As	+	-
	151	195					126	140

NG = Nombre de genre ; NE = Nombre d'espèce ; M = Monocotylédones ; D = Dicotylédones ; TB= Type Biologique; RG= Répartition Géographique: T = Thérophytes ; Hé = Hémicryptophytes ; H= Hydrophytes ; G = Géophytes ;E= Epiphyte; P = Phanérophytes;C= Chaméphytes ; Pt=Pantropicales ; Af = Africaine ; As = Asiatiques; Am = Américaines ; Mal: malgache ; Mase = Afro malgache asiatiques et européennes ; Cosm = Cosmopolite; Masm = Afro malgache asiatique et américaine ; Asu = Espèces afro-asiatiques et australiennes ; Ma= Afro malgache ; Pal= Paléo tropicales ; Mas = Afro malgache asiatique; Aa: Afro-asiatique ; AfT: Afrique tropicale ; T=Tropicale; AaAus = Afro-asiatiques australiennes; AfAm = Africaines Américaines ; Mae= Afro-malgache européenne ; AmAs = Américaine et asiatique.

Taxonomic Spectrum

Table 2 below provides information on the floral composition of the Bamboung and Sangomar MPAs. The recorded flora consists entirely of angiosperms. In the Bamboung MPA, eudicots account for 84.3% of the species found, 90.7% of the families, and 83.5% of the genera, compared to 15.7% of the species, 9.3% of the families, and 16.5% of the genera for monocots. In Sangomar, within this group of angiosperms, dicots are dominant, accounting for 90% of the families, 79.4% of the species, and 80.2% of the genera, compared to 10% of the families, 20.6% of the species, and 19.8% of the genera for monocots.

Table 2: Flora Composition of the Bamboung and Sangomar Protected Areas

Classes	BAMBOUNG						SANGOMAR					
	Families		Genera		Species		Families		Genera		Species	
	N	%	N	%	N	%	N	%	N	%	N	%
Monocots	4	9.3	17	15.7	19	15.1	4	10.0	21	19.1	28	20.0
Eudicots	39	90.7	91	84.3	107	84.9	36	90.0	89	80.9	112	80.0
TOTAL	43	100.0	108	100.0	126	100.0	40	100.0	110	100.0	140	100.0

N= Number ; % = Percentage

Biological Spectrum

The proportions of biological types among the species recorded in the two MPAs are shown in the graph below:

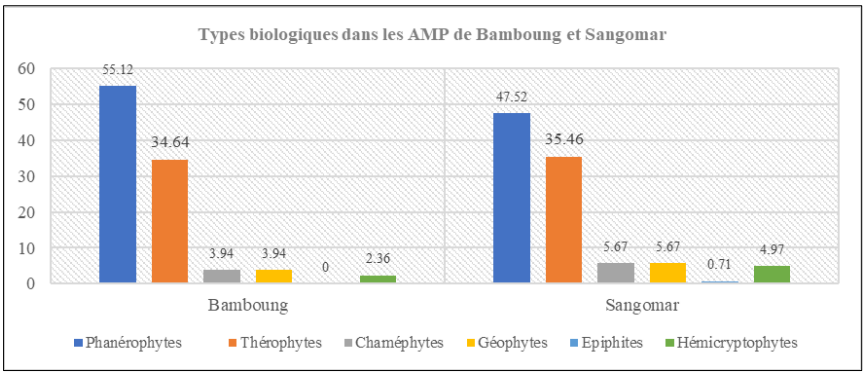

Figure 2: Biological categories of species found inside the Bamboung and Sangomar MPAs

Figure 2 shows that six biological types are represented in both MPAs: phanerophytes, therophytes, hemicryptophytes, chamaephytes, geophytes, and epiphytes. Phanerophytes and therophytes are the most dominant biological types in both MPAs, together accounting for approximately 85% of the inventoried species. Epiphytes are the least represented and account for less than 1% of the species recorded in both MPAs.

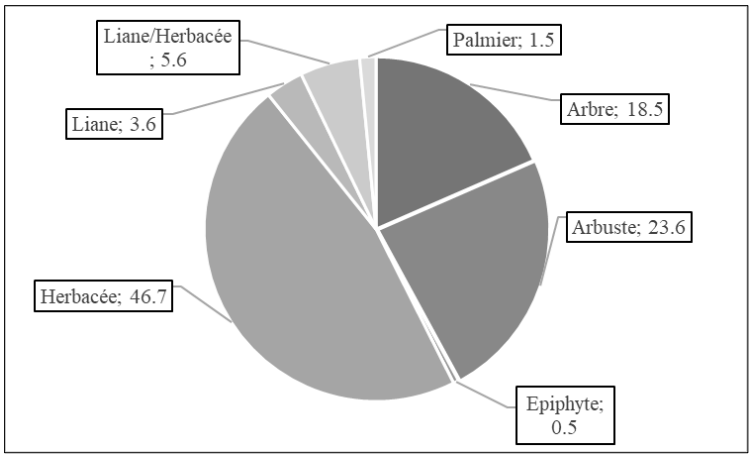

Figure 3: Distribution of the Species by Port

Figure 3 shows a flora dominated by herbaceous plants (46.7%). Shrubs (23.6%) and trees (18.5%) also represent a significant proportion. Lianas and lianas/herbaceous plants account for a combined total of 9.2%. Palm trees (1.5%), although relatively uncommon, serve as specific ecological indicators.

The Chorological Spectrum

Table 3 shows that the majority of species have African (37.8% for the AMPB and 24.11% for the AMPS), pantropical (20.47% for the AMPB and 30.50% for the AMPS), and tropical African (9.45% for the AMPB and 6.38% for the AMPS) chorological distribution.

Table 3: Geographic Distribution of Species Recorded in the Two MPAs

Geographic distribution	Bamboung		Sangomar	
	Number	Percentage	Number	Percentage
Pantropical Species (Pt)	26	20,47	43	30,5
African Species (Af)	48	37,8	34	24,11
Asian Species (As)	7	5,51	8	5,67
Malagasy Species (Mal)	0	0	1	0,71
American Species (Am)	1	0,79	4	2,84
African, Malagasy, Asian, and European Species (Mase	1	0,79	1	0,71
Cosmopolitan species (Cosm)	5	3,94	8	5,67
Afro-Malagasy, Asian, and European species (Mase)	1	0,79	1	0,71
Afro-Malagasy, Asian, and American species (Masm)	1	0,79	1	0,71
Tropical African species (AfT)	12	9,45	9	6,38
Afro-Malagasy species (Ma)	7	5,51	4	2,84
Paleotropical species (Pal)	5	3,94	4	2,84

Afro-Malagasy and Asian species (Mas)	5	3,94	4	2,84
Afro-Asian species (Aa)	2	1,57	4	2,84
Tropical (T)	2	1,57	7	4,96
Australian Afro-Asian species (AaAus)	1	0,79	1	0,71
African-American species (AfAm)	0	0	1	0,71
European Afro-Malagasy species (Mae)	0	0	1	0,71
Afro-Asian and Australian species (Asu)	2	1,57	2	1,42
American and Asian species (AmAs)	1	0,79	3	2,13

DISCUSSION

Taxonomic Spectrum

The floristic characterization of the Bamboung Protected Area revealed 126 species belonging to 43 families and 108 genera. However, this diversity appears to be lower than that of the Sangomar Protected Area, where 140 species belonging to 40 families and 110 genera were recorded. This difference could be explained by the location of the Bamboung MPA, which is more accessible to local communities (the village of Sippo and the settlement of Keur Bamboung), potentially resulting in greater anthropogenic pressure. In contrast, the Sangomar Marine Protected Area (AMPS) consists mainly of uninhabited areas (Guior and Sangomar), which are rarely visited by local communities, largely due to the insular nature of Sangomar Island. Compared to the vascular flora of Senegal, which is dominated by dicots (Ba and Noba, 2001), the flora of Bamboung and Sangomar MPAs exhibits a similar structure, but with an even higher proportion of dicots.

In Bamboung, Dicots account for 83.5% compared to 16.5% for monocots, while in Sangomar they account for 79.4% compared to 20.6%. In both MPAs, the floristic composition is largely dominated by two families: the Fabaceae and the Poaceae. These families are also the first- and second-most represented familiesin Senegal's flora (Noba *et al*., 2004; Bassène *et al*., 2012; Mbaye, 2013).

The Biological Spectrum

The analysis of the floristic composition by biological type reveals a clear predominance of phanerophytes, followed by therophytes. The predominance of phanerophytes may reflects edaphic conditions favorable to the establishment of forest vegetation or wooded savannas (Nguinambaye *et al*., 2015). Furthermore, the study highlights a high proportion of annual species: the abundance of therophytes is explained by their ability to adapt to environmental disturbances owing to their short life cycle (Ka, 2023).

The Chorological Spectrum

In both MPAs, African and pantropical species constitute the most represented chorological groups, accounting respectively for 58.27% of the species recorded in Bamboung and 54.61% in Sangomar. A similar trend was observed in the study by Ndour *et al*., (2021) on the aquatic flora and floodplains of the Djoudj National Bird Park. The marked prevalence of pantropical species appears to be linked to Senegal's geographic location at the westernmost part of the continent, bordering the Atlantic Ocean (Noba, 2002).

CONCLUSION

This study has deepened our understanding of the flora of the the Bamboung and Sangomar marine protected areas. It reveals a flora dominated by several plant families, particularly the Fabaceae, followed by the Poaceae and Malvaceae. Dicots and phanerophytes are the most abundant groups at both sites. To preserve this rich flora and anticipate threats, it is recommended that regular ecological monitoring be implemented to document changes in the flora and strengthen conservation efforts.

Conflict of Interest: The authors hereby declare that there is no conflict of interest.

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