

L'étude régionale de suivi du trait de côte et élaboration d'un schéma directeur du littoral de l'Afrique de l'Ouest a été initiée par l'UEMOA dans le cadre du programme régional de lutte contre l'érosion côtière (PRLEC – UEMOA), objet du Règlement 02/2007/CM/UEMOA, adopté le 6 avril 2007. Cette décision faisait également suite aux recommandations de la Conférence des Ministres chargés de l'Environnement en date du 11 avril 1997, à Cotonou. Dans ses conclusions, la réunion des Ministres chargés de l'Environnement, tenue le 25 janvier 2007, à Cotonou (Bénin), a approuvé ce Programme régional de lutte contre l'érosion côtière.

L'étude est exécutée par l'Union Internationale pour la Conservation de la Nature (UICN) dans le cadre de son Programme Marin et Côtier (MACO) pour l'Afrique centrale et occidentale, dont la coordination est basée à Nouakchott et qui est développé en tant que composante thématique du PACO (Programme pour l'Afrique centrale et occidentale) de l'UICN pour l'Afrique de l'Ouest et Centrale, dont la coordination est établie à Ouagadougou.

La maîtrise d'ouvrage de l'étude est assurée par l'UEMOA, en l'occurrence par la coordination du PRLEC – UEMOA de la Commission de l'UEMOA. Ces travaux ont été placés sous la supervision :

- ⇒ Du Comité Régional d'Orientation du PRLEC¹-UEMOA, mis en place pour une meilleure orientation des différents projets et leur exécution diligente et efficace. Celui-ci est présidé par l'Etat, qui assure la présidence du Conseil des Ministres de l'UEMOA.
- ⇒ **Du Comité Scientifique Régional du PRLEC- UEMOA**, établi en vue d'assister la Commission de l'UEMOA pour la validation du contenu technique et scientifique des projets initiés dans le cadre de la mise en œuvre du PRLEC. Ce comité formule également un avis technique et scientifique sur tous les rapports élaborés dans le cadre de l'exécution de ce programme.

Supervision :Malick Diallo, UEMOA, Directeur de l'Environnement et de l'Eau. Papa Goumba Lo, Président du Comité Scientifique Régional du Programme régional de Lutte contre l'Erosion Côtière de l'UEMOA.

Coordination générale : Mathieu Ducrocq, UICN, Coordinateur régional du Programme marin et côtier pour l'Afrique Centrale et Occidentale ;

Coordination technique et édition : Jean-Jacques Goussard – EOS.D2C / EAM-GEOME

¹ Programme de Lutte contre l'Erosion Côtière de l'UEMOA (Union Economique et Monétaire Ouest Africaine).

COASTAL MANAGEMENT SCHEME REQUIREMENTS BY SECTOR

1. **PRESENTATION**

The management scheme comprises a breakdown of the entire coast into 44 littoral zones containing a total 176 sectors.

This breakdown was produced by crossing the observed coastal sensitivity characteristics with the local human issues at stake.

Each zone comprises one or more sectors. These sectors define relatively uniform portions of the shoreline depending on the cross-referencing mentioned above.

These sectors constitute the main spatial reference framework for the shoreline monitoring programme.

The **zones** were defined in a more flexible way that is perhaps open to discussion. The main idea was to geographically structure the reference framework of the sectors, while respecting certain discontinuities, in particular the borders between countries.

1.1. DOCUMENTATION OF SECTORS

For each sector, the following items are presented:

- \Rightarrow **Main set of problem issues:** indicated in the box to the top right of each sector. The Environment issue includes aspects related to biodiversity, the Tourism issue includes residential accommodation.
- \Rightarrow **Diagnostics:** descriptive items.
- \Rightarrow **Dynamics:** information about the observed and/or known coastal dynamics.
- \Rightarrow **Stakes:** description of the principal human stakes involved and foreseeable trends for the future.
- \Rightarrow Actions: recommendations regarding the action to be undertaken.
- ⇒ **Priority:** the priority for action for each sector is ordered on a gradient of 4 levels of increasing priority:

Low	No action to be undertaken in the current situation
Average	Integration of the recommendations into the projects and development schemes that may concern the sector under consideration. No action recommended in the near future.
High	The sectors with a high priority level must be given special attention, consisting, in particular, of including the management scheme requirements in all development operations undertaken locally, and in assessing the effects and impacts of operations and changes that may occur in the adjacent sectors.
Very high	The actions concerning these sectors must be undertaken quickly, as the situations observed are already critical or are tending towards critical in the near future.

In most cases these priorities concern the reduction of the risks threatening people and goods, generally related to coastal erosion or exceptional weather/ocean events. In cases where the main problem issue of the sector is the environment, the priority applies to the conservation recommendations and requirements regarding protection.

⇒ Monitoring and observation: here, again, 4 levels have been considered:

No	No action to be undertaken in the current situation
Watchkeeping for the purpose of vigilance	It is important to regularly collect general information relative to changes in dynamics that have already been identified and mentioned in the diagnostics and stakes parts for an early detection of changes which, if they occur, would tend to accelerate rapidly. The aim of this watchkeeping is the early identification of the emergence of rapid changes, which may be significant, and to supervise them where necessary through studies and local planning documents and conservation measures to prevent risk situations.
Regular	monitoring programme and should be placed under the responsibility of observers.
Intensive and regular	Monitoring and observation in these sectors may include regular topometric measurements of shoreline monitoring, as conducted by academic teams within the framework of the case studies. For the sectors already covered by the case studies, the findings should be compared at regular intervals with the reference situations characterised by the case studies.

1.2. RECOMMENDATIONS BY SECTOR

It is difficult to establish a typology of recommendations by sector, as these are always specific. However, many recommendations refer to the requirements in the general part of the management scheme.

In the cases where developments to protect the shoreline are considered feasible, they should systematically be included in a global scheme materialised in a sector scheme. The sectors in which the building of defence systems can be envisaged, given the stakes involved, are mentioned in the global summary table provided in the following pages, which summarise the basic recommendations made by sector.

1.3. CARTOGRAPHIC REPRESENTATION

The locations and boundaries of the different sectors are mapped in the cartography document which accompanies the management scheme. The keys to the representation are described in the legends accompanying each map and in the cartography information document appended to the management scheme.

2. SUMMARY TABLE OF SECTORS

MAURITANIA

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study	
	1						1				
	ZONE	MR1	NOUADHIBOU PENINSULA	AND BAIE DU I	LEVRIER						
1	Sector	MR1-a	Cap Blanc	Low	No particular provisions			ENVIRONMENT			
2	Sector	MR1-b	Pointe and Bay de Cansado	Low	Watchkeeping for the purpose of anticipation			PERIURBAN	Yes		
3	Sector	MR1-c	Urban littoral zone and Nouadhibou harbour	Average	Regular			URBAN & HARBOUR			
4	Sector	MR1-d	North Nouadhibou - Bay de l'Etoile	Average	Intensive and regular		Yes	ENVIRONMENT	Yes		
5	Sector	MR1-e	Bay du Lévrier	Average	Regular			ENVIRONMENT			
	ZONE	MR2	BANC D'ARGUIN – NORTH N	NOUAKCHOTT							
6	Sector	MR2-a	Banc d'Arguin (PNBA)	Low	Regular			ENVIRONMENT			
7	Sector	MR2-b	Mamghar – Majhrat	Low	No particular provisions			ENVIRONMENT			
8	Sector	MR2-c	Tanit – Sebkhra N'Dramcha	Low	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes		
9	Sector	MR2-d	Djeidrat	Low	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes		
		•	•	•							
	ZONE	MR3	NOUAKCHOTT								
10	Sector	MR3-a	North Nouakchott	High	Regular	Yes	Yes	URBAN & TOURISM	Yes	Yes	
11	Sector	MR3-b	South Nouakchott	Very high	Intensive and regular	Yes	Yes	URBAN & HARBOUR	Yes	Yes	
	ZONE	MR4	MAURITANIA SOUTH AND S	ENEGAL RIVE	R DELTA						
12	Sector	MR4-a	PK 28 - South Tiguent	Average	Regular			ENVIRONMENT & ANTICIPATION	Yes		
13	Sector	MR4-b	South Tiguent - Chott Boul	Low	Watchkeeping for the purpose of anticipation			ENVIRONMENT & ANTICIPATION	Yes		

14	Sector	MR4-c	Chott Boul - Ghara (RBTDS)	Low	Regular		ENVIRONMENT	
15	Sector	MR4-d	Ndiago	Low	Regular		ENVIRONMENT	

SENEGAL

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
	ZONE	SN1	SAINT-LOUIS – GANDIOLAIS	S – GRANDE C	ОТЕ					
16	Sector	SN1-a	Urban, periurban and heritage sector of Saint- Louis	Very high	Intensive and regular	Yes	Yes	URBAN & PERIURBAN		Yes
17	Sector	SN1-b	South Saint Louis and insularised Barbarie Split.	High	Intensive and regular	Yes		ENVIRONMENT & TOURISM		
18	Sector	SN1-c	Grande Côte - Nyayes	Low	Watchkeeping and anticipation		Yes	ANTICIPATION	Yes	
19	Sector	SN1-d	Kayar - Guedjewaie	High	Watchkeeping and anticipation			ENVIRONMENT	Yes	
	ZONE	SN2	DAKAR							
20	Sector	SN2-a	Dakar dune coast North Camberene - Yoff	High	Intensive and regular	Yes	Yes	PERIURBAN & URBAN		
21	Sector	SN2-b	Dakar rocky coast West Yoff - Cap Manuel	High	Intensive and regular	Yes	Yes	URBAN		Yes
22	Sector	SN2-c	Bay de Hann - Rufisque	Very high	Intensive and regular	Yes	Yes	ENVIRONMENT & URBAN		Yes
	·	•	•	-	-		-	•		
	ZONE	SN3	PETITE COTE							
23	Sector	SN3-a	Bargny - Kene - Ndiogom	High	Regular	Yes	Yes	PERIURBAN & ANTICIPATION	Yes	
24	Sector	SN3-b	Popenguine	High	Regular	Yes	Yes	PERIURBAN & TOURISM	Yes	Yes
25	Sector	SN3-c	Saly - Portudal - Somone	Very high	Intensive and regular	Yes	Yes	TOURISM	Yes	Yes
26	Sector	SN3-d	Urban sector of Mbour	Very high	Intensive and regular	Yes	Yes	URBAN & TOURISM	Yes	Yes
27	Sector	SN3-e	Mbour - Pointe Sarène	High	Intensive and regular	Yes	Yes	TOURISM	Yes	Yes
28	Sector	SN3-f	North Joal - Mbodiene Plage	Average	Watchkeeping for the purpose of anticipation		Yes	TOURISM	Yes	
29	Sector	SN3-g	Joal	High	Regular			ANTICIPATION	Yes	

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
				•	•		•	•		
	ZONE	SN4	SINE SALOUM							
30	Sector	SN4-a	Fadiouth peninsula and island	High	Intensive and regular	Yes	Yes	PERIURBAN & URBAN	Yes	
31	Sector	SN4-b	South Fadiouth	Average	Intensive and regular			ENVIRONMENT	Yes	
32	Sector	SN4-c	Palmarin peninsula - Falcao - Ngalou	Average	Intensive and regular		Yes	ENVIRONMENT	Yes	Yes
33	Sector	SN4-d	Djiffer – Palmarin peninsula	Very high	Intensive and regular		Yes	RURAL		
34	Sector	SN4-e	Siné Saloum South	High	Regular			ENVIRONMENT & RURAL		
	ZONE	SN5	MARITIME CASAMANCE							
41	Sector	SN5-a	Niafarang	Average	Watchkeeping for the purpose of anticipation		Yes	ENVIRONMENT	Yes	
42	Sector	SN5-b	Kafountine	Average	Watchkeeping for the purpose of anticipation		Yes	TOURISM & ANTICIPATION	Yes	
43	Sector	SN5-c	Insular or almost insular littoral zones on the right bank of the Casamance	High	Watchkeeping for the purpose of anticipation			ENVIRONMENT & ANTICIPATION	Yes	
44	Sector	SN5-d	Djembering - Pointe Nikine	Average	Watchkeeping for the purpose of anticipation		Yes	ENVIRONMENT & ANTICIPATION	Yes	
45	Sector	SN5-e	Cap Skiring	Average	Regular			TOURISM		

THE GAMBIA

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
	ZONE	GM1	Gambia							
			Essau - Barra and right bank		Watchkeeping for the					
35	Sector	GM1-a	of the Gambia estuary	Low	purpose of anticipation			ANTICIPATION	Yes	
36	Sector	GM1-b	Banjul Centre	Very high	Intensive and regular	Yes		URBAN		
37	Sector	GM1-c	Banjul - Kololi Point	High	Regular	Yes		URBAN		Yes
38	Sector	GM1-d	Kololi Point - Bald Cape	High	Intensive and regular	Yes	Yes	TOURISM		Yes

No	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
					Watchkeeping for the					
39	Sector	GM1-e	Bald Cape - Sanyang	Low	purpose of anticipation		Yes	ANTICIPATION	Yes	
					Watchkeeping for the					
40	Sector	GM1-f	Gunjur	Low	purpose of anticipation		Yes	ANTICIPATION	Yes	

GUINEA BISSAU

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study			
	ZONE GW1 GUINEA BISSAU												
46	Sector	GW1-a	Sector maritime North - Cap Varela	High	Regular	Yes	Yes	TOURISM					
47	Sector	GW1-b	Sector maritime Central	Low	No recommendations			MANGROVE & RICE GROWING	Yes				
48	Sector	GW1-c	Bissau – Urban zone	High	Regular		Yes	URBAN & ENVIRONMENT					
49	Sector	GW1-d	Guinea Bissau South - Tite – Tombali	Low	No recommendations			MANGROVE & RICE GROWING	Yes				
50	Sector	GW1-e	Bijagos islands	High	Regular			ENVIRONMENT					
51	Sector	GW1-f	South Cacine	Very high	Intensive and regular			MANGROVE & RICE GROWING	Yes				

GUINEA

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study	
	ZONE	GN1	NORTH CAP VERGA – TRIST	DRTH CAP VERGA – TRISTAO							
50	Sector	CN1 a	Extreme North West	Low	No recommendations						
52	Secior	Givi-a	mangrove islands and Tristao	LOW				ENVIRONIVIENT			
53	Sector	GN1-b	Rio Nunez - Kamsar	Average	Regular			URBAN			

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
54	Sector	GN1-c	Coastal plain of Kapatchez	Average	Regular			MANGROVE & RICE GROWING		
55	Sector	GN1-d	Cap Verga	Average	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes	
				·			-			
	ZONE	GN2	MANGROVES IN THE CENTR	RAL ZONE						
56	Sector	GN2-a	Boffa mangrove islands	Low	No recommendations			MANGROVES		
57	Sector	GN2-b	Koba peninsula	High	Intensive and regular			MANGROVE & RICE GROWING		Yes
58	Sector	GN2-c	Konkouré deltaic estuary	Low	No recommendations			MANGROVES		
				•			•	•	·	
	ZONE	GN3	CONAKRY URBAN AND PER	RIURBAN ARE	4					
59	Sector	GN3-b	Mangroves and rice-growing Conakry - Dubreka	Average	Regular		Yes	ANTICIPATION	Yes	
60	Sector	GN3-c	Mangroves and Conakry – Coyah periurban border	High	Intensive and regular		Yes	PERIURBAN		
61	Sector	GN3-a	Loos islands	Low	Watchkeeping for the purpose of anticipation			URBAN	Yes	
				·						
	ZONE	GN4	RICE GROWING ISLANDS O	F SOUTHERN	GUINEA					
62	Sector	GN4-a	Kakossa	Average	Regular			MANGROVE & RICE GROWING		
63	Sector	GN4-b	Kabak Plain	Very high	Intensive and regular			MANGROVE & RICE GROWING		Yes
64	Sector	GN4-c	Benty	Average	Regular			MANGROVE & RICE GROWING		

SIERRA LEONE

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
	ZONE	SL1	NORTH SIERRA LEONE	1					1	
65	Sector	SL1-a	Right bank of Kolente	Average	No recommendations			MANGROVE & RICE GROWING		
66	Sector	SL1-b	Kolente Estuary	High	Regular			MANGROVE & RICE GROWING		
67	Sector	SL1-c	Lungi	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
68	Sector	SL1-d	Rokel Estuary	Average	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes	
	ZONE	SL2	URBAN AND PERIURBAN F	REETOWN						
69	Sector	SL2-a	Urban sector on North/North East front	Average	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes	
70	Sector	SL2-b	Goderich urban sector on West front	High	Regular		Yes	URBAN		
71	Sector	SL2-c	Hamilton - Lakka	High	Regular		Yes	URBAN		
72	Sector	SL2-d	West Front - Tokeh	High	Intensive and regular		Yes	URBAN	Yes	
73	Sector	SL2-e	Tombou - Cape Shilling	High	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
74	Sector	SL2-f	Banana Island	Average	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes	
	ZONE	SL3	SOUTH CENTRAL SIERRA L	EONE						
75	Sector	SL3-a	Bay du mole South of Freetown	Average	No recommendations			MANGROVE & RICE GROWING		
76	Sector	SL3-b	Shenge	High	Intensive and regular	Yes?		MANGROVES		Yes
							<u> </u>			
	ZONE	SL4	SHERBRO - LIBERIA	-						
77	Sector	SL4-a	Sherbro Estuary	Low	Watchkeeping for the purpose of anticipation			ENVIRONMENT	Yes	
78	Sector	SL4-b	Turtle Island banks	High	Regular			ENVIRONMENT		
79	Sector	SL4-c	Sherbro – main island	Average	Regular			ENVIRONMENT		
80	Sector	SL4-d	Sherbro – mouth of Moa	Low	No recommendations			ENVIRONMENT		

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
81	Sector	SL4-e	Sulima - mouth of Moa	Low	Watchkeeping for the purpose of anticipation			ENVIRONMENT		

LIBERIA

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
	ZONE	LR1	SIERRA LEONE - ROBERTS	PORT - MONRO	AIVO					
82	Sector	LR1-a	Sierra Leone - Robertsport	Low	No recommendations			ENVIRONMENT		
83	Sector	LR1-b	Robertsport	Low	Watchkeeping for the purpose of anticipation			ENVIRONMENT		
84	Sector	LR1-c	Lake Piso	Low	No recommendations			ENVIRONMENT		
85	Sector	LR1-d	East Robertsport - Monrovia	Low	No recommendations			ENVIRONMENT		
	·	•	•		-		•	•	·	
	ZONE	LR2	ZONE UNDER THE INFLUEN	ICE OF MONRO	DVIA					
86	Sector	LR2-a	North Saint-Paul river – Right bank	High	Intensive and Regular	Yes	Yes	URBAN	Yes	
87	Sector	LR2-b	Interior lagoon	Very high	Intensive and regular		Yes	PERIURBAN & URBAN		
88	Sector	LR2-c	West Point - Mesurado mouth and harbour area	Very high	Intensive and regular	Yes	Yes	URBAN		
89	Sector	LR2-d	Mamba Point - Sinkor	High	Intensive and regular		Yes	URBAN		
90	Sector	LR2-e	Sinkor - Paynesville	High	Regular		Yes	URBAN		
91	Sector	LR2-f	Paynesville - Mamgbali	Average	Regular		Yes	URBAN		
92	Sector	LR2-g	Mamgbali - Sopwe Town	High	Regular		Yes	ENVIRONMENT & TOURISM		
93	Sector	LR2-h	Sopwe Town - Dolota	Average	Regular			TOURISM		
							•	•		
	ZONE	LR3	DOLOTA - BUCHANAN							
94	Sector	LR3-a	Dolota	Average	Watchkeeping for the purpose of anticipation			ENVIRONMENT	Yes	
95	Sector	LR3-b	Buchanan	High	Intensive and regular		Yes	URBAN		
	ZONE	LR4	BUCHANAN - RIVERCESS -	GREENVILLE -	GRANCESS					

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
96	Sector	LR4-a	Buchanan - Rivercess	Low	No recommendations			ENVIRONMENT		
97	Sector	LR4-b	Rivercess	Low	No recommendations			ENVIRONMENT		
98	Sector	LR4-c	Rivercess - Greenville	Low	No recommendations			ENVIRONMENT		
99	Sector	LR4-d	Greenville	Low	No recommendations			ENVIRONMENT		
100	Sector	LR4-e	Greenville - Grancess	Low	No recommendations			ENVIRONMENT		
	ZONE	LR5	GRANCESS - CAP PALMAS							
101	Sector	LR5-a	Grancess	Low	No recommendations			ENVIRONMENT		
102	Sector	LR5-b	Grancess - Harper	Low	No recommendations			ENVIRONMENT		
103	Sector	LR5-c	Harper	Low	No recommendations			ANTICIPATION	Yes	
104	Sector	LR5-d	Cap Palmas	Low	No recommendations			ANTICIPATION	Yes	

IVORY COAST

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
				·			-			
	ZONE	CI1	LIBERIA BORDER - SAN PE	DRO						
105	Sector	CI1-a	Cavally Estuary – Liberia border	Low	Watchkeeping for the purpose of anticipation			ENVIRONMENT	Yes	
106	Sector	CI1-b	Tabou West	Low	No recommendations			RURAL		
107	Sector	CI1-c	Tabou	Low	No recommendations		Yes	RURAL		
108	Sector	Cl1-d	Tabou East	Low	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes	
109	Sector	CI1-e	Grand Bereby	Low	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
110	Sector	CI1-f	San Pedro West	Low	No recommendations			ENVIRONMENT		Yes
111	Sector	Cl1-g	San Pedro urban area and Western periphery	High	Intensive and regular		Yes	URBAN & HARBOUR		Yes
				·			-			
	ZONE	CI2	EAST SAN PEDRO - SASSA	NDRA - FRESC	0					
112	Sector	Cl2-a	East San Pedro	Low	No recommendations		Yes	ENVIRONMENT		Yes
113	Sector	Cl2-b	Sassandra right bank	Average	Watchkeeping for the		Yes	ENVIRONMENT & TOURISM	Yes	

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
					purpose of anticipation					
114	Sector	Cl2-c	Sassandra left bank - Dagbebo	Low	Watchkeeping for the purpose of anticipation			ENVIRONMENT	Yes	
115	Sector	CI2-d	Dagbebo - Fresco	Low	Watchkeeping for the purpose of anticipation			ENVIRONMENT	Yes	
	ZONE	CI3	FRESCO - ASSAGNY							
116	Sector	CI3-a	Fresco	Low	Watchkeeping for the purpose of anticipation			ENVIRONMENT	Yes	
117	Sector	CI3-b	West Grand Lahou	Low	Watchkeeping for the purpose of anticipation			ENVIRONMENT	Yes	
118	Sector	CI3-c	Grand Lahou, right bank and Bandama estuary	Very high	Intensive and regular	Yes	Yes	URBAN & TOURISM		
119	Sector	CI3-d	Left bank of Bandama	Average	No recommendations			ENVIRONMENT		
				,			•	•		
	ZONE	CI4	RURAL SECTOR ASSAGNY	- JACQUEVILL	E - ABIDJAN WEST					
120	Sector	Cl4-a	Assagny - Jacqueville	Average	No recommendations			RURAL		
121	Sector	CI4-b	Jacqueville	Low	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
122	Sector	CI4-c	Jacqueville - West Abidjan	Average	Watchkeeping for the purpose of anticipation	Yes	Yes	ANTICIPATION	Yes	
			•	·						
	ZONE	CI5	ABIDJAN - PORT BOUET							
123	Sector	CI5-a	Port Bouet	Very high	Intensive and regular	Yes	Yes	URBAN & HARBOUR		
124	Sector	CI5-b	Port Bouet East	Very high	Intensive and regular	Yes	Yes	URBAN		
	1									
	ZONE	CI6	PERIURBAN AREA EAST A	BIDJAN - GRAN	ID BASSAM					
125	Sector	Cl6-a	Abidjan East periurban area	High	Intensive and Regular	Yes	Yes	URBAN		
126	Sector	CI6-b	Grand Bassam West coast	Very high	Intensive and Regular	Yes	Yes	URBAN & TOURISM		
127	Sector	Cl6-c	Grand Bassam	High	Intensive and Regular	Yes	Yes	URBAN		
128	Sector	CI6-d	Bassam Estuary right bank	High	Intensive and regular	Yes	Yes	TOURISM		
	ZONE	CI7	SANDY TERRACE AND COC	ONUT GROVE	S IN EASTERN COTE D'IV	OIRE				
129	Sector	CI7-a	Grand Bassam - Assinie	Low	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
130	Sector	CI7-b	Assinie and mouth of the Abi lagoon	Very high	Intensive and regular		Yes	ENVIRONMENT & TOURISM		
131	Sector	CI7-c	East Abi lagoon	Low	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes	

GHANA

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
		-		·						
	ZONE	GH1	SANDY TERRACE AND COC	ONUT GROVE	S IN WESTERN GHANA - 0	COTE D'IVOIRE O	COAST			
132	Sector	GH1-a	Côte d'Ivoire border - Bonyere	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
133	Sector	GH1-b	Bonyere - Ekwe	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
134	Sector	GH1-c	Ekwe - Kikam	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
			•	-			-	•		
	ZONE	GH2	CAPE THREE POINTS							
135	Sector	GH2-a	Three Points West	High	Watchkeeping for the purpose of anticipation		Yes	TOURISM	Yes	
136	Sector	GH2-b	Three Points Centre	High	Watchkeeping for the purpose of anticipation		Yes	ENVIRONMENT & TOURISM	Yes	
137	Sector	GH2-c	Three Points East	High	Watchkeeping for the purpose of anticipation		Yes	TOURISM	Yes	
			•							
	ZONE	GH3	URBAN SECTOR AND PERI	JRBAN EXTEN	ISION OF SEKONDI - TAKO	ORADI				
138	Sector	GH3-a	Apowa - Takoradi	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
139	Sector	GH3-b	Takoradi	Average	Regular	Yes	Yes	URBAN & HARBOUR	Yes	
140	Sector	GH3-c	Sekondi	Average	Regular	Yes	Yes	URBAN & HARBOUR		
141	Sector	GH3-d	Sekondi - Shama	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
	ZONE	GH4	SHAMA – ELMINA HINTERLA	AND						
142	Sector	GH4-a	Shama - Ankwanda	Average	Watchkeeping for the purpose of anticipation			ENVIRONMENT	Yes	
			-				-			
	ZONE	GH5	URBAN AREAS AND EXTEN	SIONS ELMINA	A - CAPE COAST - SALTPO	OND				
143	Sector	GH5-a	Elmina	Average	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes	
144	Sector	GH5-b	West Cape Coast	Average	Watchkeeping for the purpose of anticipation			ANTICIPATION	Yes	
145	Sector	GH5-c	Cape Coast	Average	Regular			PERIURBAN		
146	Sector	GH5-d	East Cape Coast	Average	Watchkeeping for the purpose of anticipation			ENVIRONMENT	Yes	
147	Sector	GH5-e	Periurban sector Cape Coast - Saltpond	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
							-			
	ZONE	GH6	RURAL HINTERLAND OF UR	RBAN AREAS C	OF CAPE COAST AND ACC	CRA				
148	Sector	GH6-a	Saltpond - Mfantsiman	High	Regular		Yes	RURAL		
149	Sector	GH6-b	Winneba	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
150	Sector	GH7-a	Senya - Nyanyano	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
	ZONE	GH7	ACCRA WEST URBAN AREA	4						
151	Sector	GH7-b	Nyanyano - Accra West urban area	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
				·					-	
	ZONE	GH8	ACCRA URBAN AREA AND							
152	Sector	GH8-a	Accra wetland Densu delta	High	Regular	X	Yes	PERIURBAN & TOURISM		
153	Sector	GH8-D	Accra centre west	Very nign	Intensive and regular	Yes	Yes			
154	Sector	СН8-С	Accra centre	very nign	intensive and regular	res	res			
155	Sector	GH8-d	- Sakumo	High	Regular		Yes	ENVIRONMENT		
156	Sector	GH8-e	Tema	Very high	Intensive and regular	Yes	Yes	URBAN & HARBOUR		
157	Sector	GH8-f	Prampram	High	Regular		Yes	PERIURBAN		
	7015	0110								
		GH9		ADA FUAH - I	NINGU					

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
158	Sector	GH9-a	New Ningo - Lekpoguno	Very high	Intensive and regular		Yes	RURAL AT RISK		
159	Sector	GH9-b	Lekpoguno - Akplanbya	High	Intensive and regular		Yes	RURAL AT RISK		
160	Sector	GH9-c	Akplabnya - Totopé	Low	Intensive and regular		Yes	ENVIRONMENT		
161	Sector	GH9-d	Ada Foah	High	Intensive and regular		Yes	RURAL AT RISK		
	ZONE	GH10	VOLTA DELTA LEFT BANK							
162	Sector	GH10-a	Dzeita – left bank of the Volta	Very high	Intensive and regular			RURAL		
163	Sector	GH10-b	Keta	Very high	Intensive and regular	Yes		RURAL		
164	Sector	GH10-c	Keta - dyke	Very high	Intensive and regular	Yes	Yes	RURAL		
165	Sector	GH10-d	Adina	High	Intensive and regular	Yes	Yes	RURAL		
166	Sector	GH10-e	East Ghana – Border with Togo	High	Regular		Yes	PERIURBAN		

TOGO

No.	Туре	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
	·	·								
	ZONE	TG1	Тодо							
167	Sector	TG1-a	Border of Ghana - Lomé West	Average	Regular		Yes	URBAN		Yes
168	Sector	TG1-b	Lomé centre	Average	Regular		Yes	URBAN		Yes
169	Sector	TG1-c	Lomé urban - East port	Very high	Intensive and regular	Yes	Yes	URBAN & HARBOUR		Yes
170	Sector	TG1-c	Lomé East	High	Intensive and regular	Yes	Yes	PERIURBAN	Yes	Yes
171	Sector	TG1-d	Togoville - Agbodrafo - Aného	Very high	Intensive and regular	Yes	Yes	RURAL		Yes

BENIN

No	. Type	Ref	Description	Priority	Monitoring-observation	Improvement	Sector scheme	Main set of problem issues Core set of problem issues	Potential developments to be anticipated	Case study
	ZONE	BJ1	GRAND POPO - WEST COT	ONOU						
17	2 Sector	BJ1-a	Border of Togo - Grand Popo	Very high	Intensive and regular	Yes	Yes	TOURISM		
17	3 Sector	BJ1-b	Mono and Kouffo estuary lagoons	Very high	Intensive and regular			RURAL & ENVIRONMENT		Yes
17	4 Sector	BJ1-c	West Ouidah - Cotonou	High	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
	ZONE	BJ2	COTONOU							
17	5 Sector	BJ2-a	Cotonou West airport	Average	Watchkeeping for the purpose of anticipation		Yes	ANTICIPATION	Yes	
17	6 Sector	BJ2-b	Cotonou airport to Port	High	Regular	Yes	Yes	URBAN	Yes	
17	7 Sector	BJ2-c	Harbour sector and Cotonou channel	High	Regular	Yes	Yes	URBAN & HARBOUR		Yes
17	8 Sector	BJ2-d	Ambassadeurs sector	Very high	Intensive and regular	Yes	Yes	URBAN		Yes
17	9 Sector	BJ2-e	East Cotonou	High	Watchkeeping for the purpose of anticipation		Yes	PERIURBAN	Yes	



MR - MAURITANIA

Mauritania has had a Coastal development plan (PDALM) in force since 2006.

MR1 NOUADHIBOU PENINSULA AND BAIE DU LEVRIER

			ENVIRONMENT
MR1-a	1 - C	AP BLANC	
Diagnostics	Rocky coast, Cap Blanc satellite reserve clo	se to a small population	of monk seals (Monachus
Diagnostics	monachus). Practically no human land use.		
Dynamics	No remarks, migration of the sandbank that cause	sed a ship to run aground. To	oday the ship is a wreck and
Dynamics	is responsible for the migration observed. Reduct	tion in the elevation of the sa	ndbank.
Stakes	Risks of pollution related to harbour traffic at Nou	adhibou and the nearby ore	port.
Actions	Strict protection of the site. Vigilance regarding p	ollution risks.	
Priority	Low	Monitoring-observation	No provisions
Comments	Recommended involvement of the teams from IL	JCN and Banc d'Arguin Nation	onal Park in the monitoring -
	observation.		



The grounded wreck at Cap Blanc has considerably altered the sediment distribution at the level of the Cap (source: Jean-Jacques Goussard)

			PERIURBAN	
MR1-b	2 – CANSADO POINT AND BAY			
Diagnostics	Rocky plateau (sandstone). Town and mining port of Cansado. Oil terminal. Bay site with landscape quality, urban beach at Nouadhibou.			
Dynamics	No remarks.			
Stakes	Risks of pollution related to industrial activities. Grounding and dismantling of wrecks in Cansado Bay.			
Actions	Vigilance regarding pollution risks. Impact studies should be planned with a view to setting up an agreed development zone if new industrial facilities are envisaged.			
Priority	Low	lonitoring- Washingbook Washin	atchkeeping for the prose of anticipation	

			URBAN AND HARBOUR
MR1-c	3- URBAN LITTORAL ZON	E AND NOUADHIB	OU HARBOUR
Diagnostics	Important harbour installations and associated	industrial facilities. Lim	nited residential accommodation.
	Fish processing site related to the Bay du Repos	s fishing port.	
Dynamics	No remarks.		
Stakes	Treatment of effluent from all of the harbour and industrial activities.		
Actions	Seek global sanitation solution taking charge of all the effluent. Development and signposting of access		
	channels to harbour zones.		
Priority	Average	Monitoring- observation	Regular

				ENVIRONMENT
MR1-d	4 - North Nouad	lhibou - Bay de	l'Etoile	
Diagnostics	Bay de l'Etoile: system of wetlands for which	conservation statu	s is requested. F	Remarkable natural
	ecosystem, tourism and residential facilities on the	he south bank.		
	To the South of Bay de l'Etoile/sandy spit sepa	rated from the agglo	meration of Noua	adhibou by a saline
	wetland depression (crop of cordgrass), scattere	d residential accomm	nodation.	
Dynamics	No remarks.			
Stakes	Privatisation of sea front on the approach to Bay de l'Etoile (risks in the event of ocean surge). Pollution			
	and risks of alteration of the wetland zones in the Bay de l'Etoile.			
Actions	Strict protection of all the sites, whether biological heritage or landscape. Control of urban development in			
	the approach to Nouadhibou. Drawing up of a littoral zone development directive or sector scheme.			
	Classification of Bay de l'Etoile to be concretized.			
Priority	Average	Monitoring- observation	Intensive and r	egular
Comments	Recommended involvement of teams from IUCN and local NGO in observation			

			ENVIRONMENT
MR1-e	5 - BAY DU LEVRIER		
Diagnostics	Diversified shore, sandy, rocky bordering a shallow marine environment of high ecological and fishing		
	value. East bank not occupied, beginnings	of land appropriation	on on the West bank approaching
	Nouadhibou. Important archaeological sites.		
Dynamics	No remarks.		
Stakes	Risks of accumulation of pollutants originating from the harbour and urban activity in the Bay du Lévrier.		
Actions	Strict protection of all the sites, whether biological heritage or landscape. Control of urban development in the approach to Nouadhibou.		
Priority	Average	Monitoring- observation	Regular
Comments	Recommended involvement of the teams from monitoring (the PACOBA project - Banc d'Arguir	m Banc d'Arguin I Observatory include	National Park in the observation – es the Bay du Lévrier)



Littoral zone of Bay de l'Etoile (source: Jean-Jacques Goussard)

BANC D'ARGUIN – NORTH NOUAKCHOTT

			ENVIRONMENT		
MR2-a	6 - BANC D'ARGUIN (PNBA)				
Diagnostics	An area encompassing land and sea of high ecological and fishing value that justifies the classification as				
	a World Heritage National Park, currently being	g developed for tourism in a	way that is compatible with		
	conservation goals. Imraguen populations in PN	NBA, numerous spontaneous	settlements on the edge of		
	the Park, on the road between Nouakchott and N	louadhibou.			
Dynamics	Complex, large fossil delta, largely documented l	by the PACOBA project.			
Stakes	Conservation of the ecological complex of Banc d'Arguin in a context of economic pressure and				
	increasing commercial incentives, in particular with respect to the products of fishing within the Park.				
	Control of access conditions, in particular in relation to the prohibition on trawling in shallow waters.				
	Tourism to be developed. Nesting sites of endemic sub-species (spoonbills), risks of submersion for				
	certain villages (lwik and R'gueiba)				
Actions	Application of the PNBA development and management plan.				
Priority	Low	Monitoring-observation	Regular		
Comments	Recommended involvement of the teams fro	m Banc d'Arguin National	Park in the observation -		
	monitoring. Banc d'Arguin Observatory set up	as part of the PACOBA pro	ject. Installation of a sentry		
	mechanism to observe the sea level.				

			ENVIRONMENT
MR2-b	7 - MAMGHAR – MAJHRAT		
Diagnostics	Sandy shore that can be crossed at low tide, adjacent to imporpoints.	rtant dune fo	ormations. A few settlement
Dynamics	Variable, littoral zone subject to coastal drift, some points vulr significant wind sediment supply put into circulation through the re	erable in the	e event of surge. Probably al drift.
Stakes	Lack of drinking water restricts development perspectives. Protect of nomadic breeding.	ction of the s	tabilising plants in a context
Priority	Low Monitoring- observation	No pr	ovisions

			ANTICIPATION	
MR2-c	8 - TANIT – SEBKHRA N'DRAMCHA			
Diagnostics	Sandy shore that can be crossed at low tide, adjacent to unstable dune formations of low elevation.			
	Hinterland characterised by the N'Dramcha sa	abkhra. Tanit fishing p	port project. Very low numbers of	
	resident population grouped in a few settlement	points.		
Dynamics	Variable, littoral zone subject to coastal drift, some points vulnerable in the event of surge. Very restricted			
	wind sediment supply at the level of the grand sabkhra.			
Stakes	Lack of drinking water restricts development perspectives, viable alternatives sought to develop the			
	N'Dramcha sabkhra. Protection of the stabilising plants in a context of nomadic breeding.			
Actions	On the assumption that the Tanit port project starts up, anticipation of developments on the periphery.			
Priority	Low	Monitoring- observation	Watchkeeping for the purpose of anticipation	

			ANTICIPATION
MR2-d	9 - DJEIDRAT		
Diagnostics	Sandy shore that can be crossed at low tide, adjacent to unstable dune formations of variable elevation.		
	In the southern part, in contact with Nouakchott, ma	arine terraces that are s	uitable for development. In this
	sector, a new airport is planned at Djreida.		
Dynamics	Variable, littoral zone subject to coastal drift, some points vulnerable in the event of surge.		
Stakes	Protection of the stabilising plants in a context of nomadic breeding.		
Actions	Anticipate a possible residential development (setting aside of land) to the North of Nouakchott induced		
	by the Nouakchott-Nouadhibou road corridor and the Djreida airport project.		
Priority	Low/	onitoring- Wa	atchkeeping for the purpose
1 noncy	ob	oservation of	anticipation

MR3

NOUAKCHOTT

Note the long South-North depression of Aftout es-Saheli, parallel to and close to the shore, which runs along the coast of Mauritania from the Senegal delta to Nouakchott. This long "gutter" considerably increases the risks of extensive flooding in the event of a major marine intrusion.

	URBAN & TOURISM			
MR3-a	10 - NORTH NOUAKCHOTT			
Diagnostics	Coastal portion of the Nouakchott urban area. Very important fishing centre in the North part, Wharf.			
	Despite the high rate of accretion observed to the North of Nouakchott harbour, the coastal rim is			
	generally quite low and even very low in places. Conquest of the public maritime domain North of the			
	fishing port, walls as boundaries of the "concessions" on the beach.			
Dynamics	To the North of the sector (area called "cabanons(huts)"), significant shoreline recession observed.			
	Despite the existence of the port and its pier further South, presence of a beach crest berm, exposure of			
	hardened materials on the front of the dunes. Between the fishing port and the wharf, narrow coastal rim			
	with hollows in places that facilitate marine intrusions in the event of surges.			
Stakes	Sand extraction at several places. Implantation of buildings (hotels in particular) on the dune. High traffic			
	leading to subsidence of the dune rim. Development of the urban littoral zone and protection of the dune			
	rim. Prohibition on sand extraction. Periurban housing project along 5 km of coast that may affect the rim			
	and the rare natural vegetation.			
Actions	Develop the urban littoral zone and protect the dune rim. Transport/servicing plan for sensitive areas.			
	Prohibit sand extraction. Prohibit building. Protect stabilising plants.			
Priority	High Monitoring-observation Regular			

	Evolutic
Case study	

Evolution of the littoral zone of Nouakchott: Characterisations and associated risks. See annex 1.

			URBAN AND HARBOUR
MR3-b	11 - SOUTH N	OUAKC	CHOTT – PK28
Diagnostics	Coastal portion of the Nouakchott urban area highly subject to erosion. Some protection schemes. Very		
	thin littoral rim, has disappeared in several pla	ces, wide	e wetland depression a short distance from the
	shore that could be connected with the sea in the	e event o	of marine intrusion through the lowest points.
Dynamics	High erosion, zone deprived of sediment su observed. Undercutting and unearthing of the pr	pply by otective g	the pier. Important marine intrusions already goyne.
Stakes	Very high risk of marine intrusion with submersion of temporary housing in sabkhra and possible flooding		
	of the depression close to Aftout es Sahéli. Deterioration of installations in the South part of the port. Risk		
	of water table rising and becoming permanently exposed.		
Actions	Consolidate and improve existing defences against erosion. Relocate populations from the most		
	threatened sectors. Implement an early warning system and flood risk prevention plan. Total protection of		
	the dune formation rim and stabilising plants. Total building prohibition. By pass solutions to be envisaged		
	at the level of the Port.		1
Priority	Very high	oring	Intensive and regular
	Evolution of the littoral zone of Nouakchott: Char	racterisati	ions and associated risks. See annex 1.
Case study			
1			



Vulnerable districts flooded in the sabkha, June 2005(a) and at SOCOGIM Beach. September 2009(b) - Source: case study.



Cartography of submersion contingency for the town of Nouakchott (source: GRESARC-IUCN, 2006).



Disappearance of the dune rim to the South of Nouakchott Harbour (source: case study).

MR4

SOUTH MAURITANIA AND SENEGAL RIVER DELTA

		ENV	RONMENT & ANTICIPATION
MR4-a	12 - PK28 –	SOUTH TIGUENT	
Diagnostics	Sandy coast adjacent to narrow rim (sometimes	under 100 m) bordered or	n the East by the occasionally
	flood-prone Aftout es Saheli depression. Low hi	uman land use concentrate	ed on the four points serviced
	(fishing centres).		
Dynamics	Very high natural instability.		
Stakes	Preservation of stabilising plants in the dunes in	n a context where the pop	ulation is becoming sedentary
	around a few villages, with livestock breeding les	s subject to water availabili	ty constraints. Risks of marine
	intrusions in the Aftout marine depression still pre	esent in places.	
Actions	Consolidate facilities around a few villages, in	tegral protection of veget	ation on the bordering dune.
	Restrict building and urban sprawl in the areas b	etween the villages. Contro	l extraction of materials.
Priority	Average	Monitoring-observation	Regular

	ENVIRONMENT & ANTICIPATION
MR4-b	13 - SOUTH TIGUENT - CHOTT BOUL
Diagnostics	Straight, slightly curved littoral zone. Wider sandy formations (1 to 2km) between the shore and the Aftout depression. Sector further away from the hard surfaced road link with Nouakchott, therefore relatively landlocked apart from beach route. Chott Boul protected area, former outlet of a branch of the Senegal river. This small marine protected area is of ornithological interest, as are Tumbos I and II (or North and South) marshes, located some way back from the bordering dune, which shelter a nesting population of dwarf flamingos. The West bank of these marshes is bordered by Acacia stands at the foot of the bordering dune, which have a significant regeneration capacity in a landlocked context where pastoral pressure is still moderate.
Dynamics	This sector is more stable than the previous one, but is nonetheless subject to coastal drift and active wind sediment transport.
Stakes	Oil prospecting? Develop discovery tourism related to the proximity of the Senegal river biosphere reserve? A densification of human land use is unlikely.
Actions	No remarks, preservation of natural milieus within the framework of the Senegal delta Transborder Biosphere Reserve.

Priority	Low	Monitoring- observation	Watchkeeping purpose of anticip	for Dation	the
Comments	Recommended involvement of the teams from D	awling National Park in t	he observation – mo	nitorinc	ı.

	ENVIRONMENT
MR4-c	14 - CHOTT BOUL - GHARA (RBTDS)
Diagnostics	This sector lies within the Senegal Delta Transborder Biosphere Reserve (RBTDS) classified by UNESCO on 27 June 2005. The Diawling National Park constitutes the principal conservation centre. The seasonal filling of the reservoirs in Diawling National Park by means of OMVS structures has enabled a spectacular restoration of the ecology of this area since 1996. This is a vast floodplain, with scattered clay basins, the monotony of which is broken by a few terraces, ridges and dunes. A system of dykes and floodgates structures the area of the basins on both sides of the river. The altitude is typically very low, and culminates at around twenty metres. Certain zones are situated below sea level (down to 0.5m). Important resting grounds for migrating bird life.
Dynamics	Large foredune on the sea front, certainly unstable, however, and subject to considerable windblown transport. Closely dependent on the way the fresh water supply is managed. The zone affected by the tides (including salt water wedge) seems to have extended following the opening of the breach in the Barbarie Strip in Senegal, which disrupts different activities, in particular fishing related to brackish milieus.
Stakes	Conservation of a unique set of wetlands, of international importance for migrating bird life, Extension of tourist development compatible with the constraints of the conservation of the sites and taking advantage of the proximity of Saint-Louis and the favourable context of the RBTDS. Difficulty with drinking water supply.
Actions	Apply plans for the management and development of the RBTDS. POLMAR Plan and measures to combat the dumping of hydrocarbons.
Priority	Low Monit oring Regular
Comments	Recommended involvement of the teams from Diawling National Park in the observation – monitoring.

		ENVIRONMENT
MR4-d	15 - NDIAGO	
Diagnostics	Sector hemmed in on a very narrow coastal rim. A few, essentially fishir Natural mangrove areas on the Mboyo islands of regional importance, in parti migratory mullet populations.	ng villages (Moyo, Ndiago). icular for the reproduction of
Dynamics	Very narrow coastal rim (approximately 200 m) bordered inland by flood-prone even though the foredune is of considerable volume in places.	e areas. Very unstable area,
Stakes	Preservation of the mangroves on Mboyo islands. Supply the populations livir water (salination of freshwater lenses since the opening of the breach in populations in sites that are at risk from surges.	ng in the sector with drinking the Barbarie Strip). Some
Actions	Limit the extension of human settlement. Measures to preserve mangrove sta	nds.
Priority	Low Monitoring-observation F	Regular
Comments	Recommended involvement of the teams from Diawling National Park and the monitoring.	ne RBT in the observation –

REGIONAL SHORELINE MONITORING STUDY AND DRAWING UP OF A MANAGEMENT SCHEME FOR THE WEST AFRICAN LITTORAL ZONE DETAILED MANAGEMENT SCHEME – MAURITANIA - AUGUST 2010



RBT zoning scheme (source: CSE)



SN - SENEGAL (North)

Senegal has recently adopted a strategy to combat coastal erosion, and has various plans and framework documents for country planning.

SN1 SAINT-LOUIS – GANDIOLAIS – GRANDE COTE

A progression of the salt water wedge has been observed throughout the Gandiolais. The rise in sea level is certainly not the only cause of what seems to be a general observation. The effects of intensive pumping from the fresh water lenses should also be taken into account.

			URBAN AND PERIURBAN
SN1-a	16 - URBAN, PERIURBAN AND	HERITAGE SECTO	R OF SAINT-LOUIS
Diagnostics	Complex sector including the urban centre of Barbarie Split, a long, thin sandy spit and the sandy islands. Strong fishing and tourist activity following the threat of submersion of the town complex hydrological and sedimentary balances and very low elevation. These modifications today affect a good part growing and salt production). The concentration the peripheral villages and districts (Guet Ndar, the municipality of Saint-Louis) determines a hig related to the objective of making the Senegal rin	Saint Louis and the his low-lying milieu on the I y. The opening of a breat of Saint Louis, profound s, characterising a (pseud t of the economic activity of population in the town Ndar-Toute, and Goxxu gh risk situation. Still unce ver navigable (OMVS).	storic island of Saint-Louis, the eft bank of the river. Numerous ach in the Barbarie Split in 2003 dly modified a set of particularly lo) delta system of vast expanse ties (fishing, tourism, vegetable in itself, but also and especially in mbac,- 57% of the population of ertain location of a future ore port
Dynamics	Rapid erosion observed in several sites, but also mouth following the opening of the breach is st exposed sea front, but also the "inland littoral zo intertidal zone. Wind erosion is also intense, leading to sand in completely unstable. Disappearance of the villa reduction of surface area the <i>îlot aux oiseaux</i> houses at Goxxu mbacc and Guet Ndar in 2010. The breach created initially is today more or les 1). This new mouth is approximately 2 km wide.	o sectors in accretion in p till underway, with chang one" of the river banks, wi wading infrastructure. The age of Doun Babab Die (from 2 ha to 0.5 ha in 1 ss in equilibrium, with sea	laces. The reconfiguration of the es directly affecting not only the th a considerable increase in the e sector is globally low-lying and ye located opposite the breach, ess than ten years), collapse of isonal oscillations observed (see
Stakes	Reduction of risks for the populations exposed, of entire unusual life system of the delta that configuration of the delta. Requalification and re- the fish is processed once landed. Different protection solutions are being examin consisting in consolidating the existing breach, floods, an advantage for fishermen), but at the attempt to restore the initial situation. ²	conservation of the herita is largely dependent or eorganisation of catch lan ned with a main alterna , also securing its depth cost of a deterioration of	ge of Saint-Louis, but also of the in the salinity gradient and the iding areas and the areas where tive, excluding non-intervention, (protecting Saint Louis against the natural delta habitats, or the
Actions	Secure the safety of exposed populations, ir submersion. Study possible solutions for the pro- historical town of Saint Louis), taking into accor relocation of the economic activities affected. R the evolution of the Barbarie Split to be integrate	ncluding by relocation. In tection and development unt the strong dynamics Redesign a tourism devel and into a sector scheme.	Prevention plan for the risk of of the coast (in particular for the of the delta areas. Accompany opment plan taking into account
Priority	Very high	Monitoring- observation	Intensive and regular
Comments	High involvement of the municipal team of S observation and monitoring if supported by comp	Saint-Louis which could petent technical and scier	play the role of engine driving ntific resources.
Case study	Case study: Saint Louis and Barbarie Split. See	annex 1.	

² US Army Corps of Engineers. Barry . K.M. & N.C. Kraus. 2009. - **Stability of Blocked River Mouth on West Coast of Africa: Inlet of Senegal River Estuary**. Coastal and Hydraulics Laboratory. ERDC CHL TR-09-20. 56p.



Dynamics around the island of Baba DIEYE from 2003 to 2009 (source: case study)



Collapse of houses at Guet Ndar after pounding by waves (original photo Leîdi - March 2010, source: case study).



Collapse of protective wall at Guet Ndar (built in 1910 and already largely disintegrated). Image March 2010, Leïdi (source; case study.



South-West of the St Louis breach, aerial view (source: national diagnostic study)

			ENVIRONMENT & TOURISM
SN1-b	17 - SOUTH SAINT LOUIS	- INSULARISED BA	RBARIE SPLIT
Diagnostics	Long, thin sandy rim, practically insular since	the breach was opened	in 2003. Today it is once more
	connected to the continent with the gradual filling	g in of the former river me	outh.
Dynamics	High rate of wind erosion, siltation of vegetable accretion. Filling in of the former outlet of the Se	e plots and tourist facilitie enegal river at the South I	es. Alternate sites of erosion and imit of the sector.
Stakes	Viability of two tourist establishments situated South of the breach. Organic pollution and salinisation of the branch of the river situated between the sandy spit and the continent since the former river outlet has been filled in. Conservation of the Barbarie Split National Park and particularly the <i>île aux Oiseaux</i> (surface area reduced from 2 ha to 0.5 ha). Viability of vegetable production in a context of gradual salinisation of coastal fresh water lenses.		
Actions	Secure the safety of exposed populations, including by relocation. Prevention plan for the risk of submersion. Study possible solutions for the protection and development of the coast (in particular for the historical town of Saint Louis), taking into account the strong dynamics of the delta areas. Accompany the relocation of the economic activities affected. Redesign a tourism development plan taking into account the evolution of the Barbarie Split to be integrated into a sector scheme.		
Priority	High	Monitoring- observation	Intensive and regular
Comments	High involvement of the Barbarie Split National observation and monitoring if supported by com	al Park team which could petent technical and scie	d play the role of engine driving ntific resources.
Case study	Case study: Saint Louis and Barbarie Split. See	annex 1.	

			ANTICIPATION
SN1-c	18 - GRAND	E COTE – NYAYES	
Diagnostics	Very monotonous littoral zone. Scattered veget Mboro beach, with residential settlements relate the improvement and economic development of around the new town located between Lompoul Dakar-Saint-Louis. The Grande Côte manageme Urban development and land structuring. Agriculture. Ecology. Technology and the industrial network. Tourism.	able growing in the Nya d to the phosphate extract the Nyayes (Grande Côt and Diogo, which would ent scheme comprises 5 f	yes. A few tourist sites such as ction areas. Ambitious project for e management scheme) centred d balance out the twin centres of focal points:
Dynamics	High wind erosion? nonetheless offset by cor observed advance of the salt water wedge.	isiderable casuarina rep	lanting, siltation of the Nyayes,
Stakes	Important from the point of view of the application of the Grande Côte management scheme, with development of mining (zircon), the creation of a panoramic route, development of tourism, agriculture, industry, etc., with concurrent usages to be reconciled in the same space.		
Actions	Maintain and preserve the stabilising plants on the	ne dunes (bands of casua	arina).
Priority	Low	Monitoring- observation	Watchkeeping and anticipation



Stabilising of the dune system using a band of vegetation (source: national diagnostic study)

				ENVIRONMENT
SN1-d	19 - KAYAR	R - GUE	DJEWAIE	
Diagnostics	Important vegetable-growing sector. Kayar fishin Dakar periphery towards Guedjewaie. Large la extraction site for building.	ng centre andfill si	e. Straight coastline. Areas te at Mbeubeuss (Malika	s of extension of the and intense sand
Dynamics	Wind erosion always present despite the rows wedge.	of casu	arina. Observed progressi	on of the salt water
Stakes	Urban encroachment approaching the agglomera open landfill.	ation of	Dakar. Sanitation at Malik	a – resorption of the
Actions	Control land ownership and urban sprawl, in parti of the band of casuarina. Where necessary, sec extraction.	icular reg tor sche	parding the stakes with res me to be anticipated. Ana	pect to the protection lyse impacts of sand
Priority	High	Monit oring	Watchkeeping and anticip	ation
Comments	High priority related to the environmental issues a	t Malika.		

Projets d'Infrastructures de transp Agrandissement de la route Réhabilitation de la route - Relance de la ligne de chemin de fer Océan Atlantique Moortement de GLIEDIAWAYE jeti - Achèvement de la route Achèvement de la voie Aménagement du tronço Région de - Construction de la route SAINT-LOUIS - Bitumage de la route Station touristique de Potou sur Mer laison maritime lle ville (1⁴⁴⁴ phase de elle ville (2⁶⁰⁰ phase de de Han Région de DAKAR and our M Marché d'intérêt régi des fruits et légumes Fass Box Région de LOUGA Région de, THIÈS Mont Rolland Arrondisseme Ge Méculine de Sagatt Arrondissen de Sindi Arrondissement de Médina Dakha Légende. Les grandes affectations du territoire × Ministère de l'Urbanisme et de l'Aménagement du Territoire Limite d'État Région de LOUGA Limite de régio de transpor Carte 3 limite de dé 1/200 000 Juin 2007 Limite d Villages Akroport • ibercadine oute restorale Limite de la nouvelle ville TECSULT DAA Route tertaine Chemin de fer 1ère phase de développement (5 000 ha) Cardina nations 28mm phase de développement (20 000 hs) Projet d'Assistance Technique à l'Aménagement et au Développement Économique des Niayes (ATADEN) au Sénégal Zone d'esploite de gaz et de pé Tecsult International Limitée Wetropole regional raphie Relais régional Centre industriel Centre tertaine Relais runsi Pôle universiteire et de Recherche-Développer Cours d'eau permanent ٢ culturel ou patimoire de l'UNESC Zone humide Dure fregle Cours d'eau temporain Zone de diversificatio OSCARE ique touristique (La Côtien Technopóle de pêche

> Summary map of the Grande Côte management scheme (Source: Ministry of Urban Development, Senegal. 2007.- Summary map of the Grande Côte management scheme (SDAGC) 164p.)

SN2

DAKAR

				PERIURBAN AND
				URBAN
SN2-a	20 - DAKAR DUNE COA	AST NORT	H CAMBERENI	E - YOFF
Diagnostics	Considerable stretch of beach at Dakar, land	ing of catche	es, urbanisation en	croaching to the top of the
	beach, discharge of sewage and solid wa	aste. Extract	ion of materials.	Exposed to ocean swell.
	Uncoordinated individual initiatives to protect s	horeline.		
Dynamics	Sector undergoing rapid erosion around Yoff, o	could possibly	/ be related to sand	extraction at Malika.
Stakes	Viability of Lebous, an old, traditional landing	site for fisher	rmen, faced with er	osion and the shrinkage of
	space for parking canoes. Habitat and populati	ions at risk in	the event of surge.	
Actions	Protection systems could be envisaged but sh	ould be asso	ciated in a global se	ector scheme for the littoral
	zone North of Dakar.			
Priority	High	Monitoring	Intensive and reg	jular

	URBAN
SN2-b	21 - DAKAR ROCKY COAST WEST YOFF - CAP MANUEL
Diagnostics	Rugged, ablated coast with cliffs, headlands and coves, very heterogeneous topography with alternate
	gentle slopes and vigorous landform. This heterogeneousness is in relation to a highly diversified
	substrate, essentially rocky, fractured and weathered. Dolerite, basalt, infrabasaltic sandstone, clay-marl
	and loamy cliffs constitute a complex geological system.
	Quite dense, predominantly tourism and residential urbanisation in the North and central part (Ngor,
	Almadies and Mamelles); denser and older in the central parts (Mermoz and Fann). Residential districts in
	the South part of Cap Manuel. Urbanisation to the water's edge to the North and South, limited by the
	recently improved coast road in the central part. The privatisation of this rugged coast is underway and
	almost complete. This sector is highly exposed to ocean swell with predominantly North-Westerly waves.
Demonstra	Numerous filling and individual protective schemes, with no overall consistency.
Dynamics	Various differential forms of erosion observed, should be seen in relation to the lithological discontinuities
	of the formations that are fractured and weakened by the advent and inflitration of water from the
Stakaa	Continent. Typically, various forms of rock fail, landslides and disconformities.
Slakes	Viability of recent development to the coastal road and of high value-added tourism investments.
	Security of population in at risk situation (nabitation the cliff edge). Development and conservation
	in a public domain accessible to urban populations of the panoramic, landscaped corridor of the coast
Actions	Production and comparison of the respected of all of risk sites.
Actions	Building prohibition to be respected at all at risk sites. Improve the collection of rainwater and wastewater,
	and dramage in the most sensitive sites. Inne and viability perspectives to be taken into account in the
	regulification accompanied by withdrawal of contain eveneed district should be environmented by a stranger of the second state
	developments justified by the density of the stakes, but should be part of a coherent, overall scheme
Priority	High
Gase study	I influencing tectors in the changes in the charoline along the ceastal clittle in a highly urbanized miliour



Buildings on an at risk site at Pointe Diop (source: case study)



The expected results of the improvement of the beach at Koussoum (source: national diagnostic study)

	URBAN AND PERIJIRBAN
SN2-c	22 - BAY DE HANN - RUFISQUE
Diagnostics	This sector includes Dakar harbour, the urban beach, Bay de Hann and the littoral zone from Rufisque to Bargny; 87% of the industry in Dakar is located in this sector. The sector is densely populated, and the land used right to the shore. Numerous protection systems, rock fills, groynes, protective walls, often weathered or destabilised. Project underway for building dykes. Populations largely exposed in the event of surge, despite the geographic situation which offers some protection from ocean waves. The topographic situation of Rufisque also determines risks of flooding from the continent.
.Dynamics	Generalised erosion? except perhaps at the level of Diokoul power station (the cooling water supply channel acts as a goyne). Depending on the site, recession estimated at between 1 and 2 metres per year.
Stakes	Despite the improvements that are still possible, withdrawal would be the long-term solution, at a cost that would obviously be high given the density of the stakes. Major problems of pollution of urban, industrial and organic origin in the Bay de Hann, generating a real sanitation risk for the local population. On the scale of the sub-region, Dakar harbour has considerable development potential as a hub port which could receive rapidly expanding container traffic; various extensions should be planned.
Actions	Developments to be planned but, except for radical solutions (that are difficult to make sustainable) of fixing the shoreline, the withdrawal and requalification of sea front settlements are difficult to avoid. Action has already been undertaken to reduce the levels of pollution in the Bay de Hann.
Priority	Very high Monitoring-observation Intensive and regular
Case study	Changes in the shoreline at Rufisque between 1954 and 2006. See annex 1.



The Diokoul littoral zone protection plan (source: national diagnostic study)



Protective wall being built at Mbao (source: national diagnostic study)



Changes in the coastline of Rufisque 1954-2006 (source: case study).


Dakar Harbour: The extension of the container terminal (TAC - rock fill between the TAC and breakwater 8) whose wharf, with a base of 13m, will be able to receive third generation container ships (source: national diagnostic study)

SN3

PETITE COTE

The observed level of impacts related to coastal erosion, and the extent to which these impacts are due to individual, uncoordinated protection decisions in a context of (i) low sediment supply, (ii) low sediment reserves; (iii) extraction of probably high volumes of sand; (iv) seasonal variation in the direction of ocean waves, advocate for a complete review of the development methods used on the Petite Côte, within the framework of a consistent sector scheme that arbitrates among conflicting uses.

Regaining control of land ownership and the regulation of spontaneous improvements to combat erosion (carried out in the public domain) are critical prerequisites before contemplating new protection investments. These "spontaneous" improvements should also be associated with the *de facto* "privatisation" of the public maritime domain, which is increasingly evident on the Petite Côte.

The same applies to the projected extension of tourist areas, which, given past experience, can ill afford to forego better integration of shoreline dynamics. These developments are also an opportunity to draw up a new policy for the development of coastal tourism. The building of an airport and a future ore port at Bargny, with the south extension of Dakar, will not simplify the management of erosion on the Petite Côte, characterised by the low sediment supply.

PERIURBAN & ANTICIPATION

Diagnostics	Practically urban sector, linear. Characterised by an often very narrow but continuous strip (even when		
	the coast is adjacent to wetland) of seafro	ont residential settlements,	with a few traditional villages
	included. Rocky coast to the South of the sect	or.	
.Dynamics	Generalised erosion as witnessed by the num	ber of protection systems.	
Stakes	General stakes of the Petite Côte, numerous	s improvements, dykes, wa	alls, rock fill to protect individual
	homes. Materials available in proximity. High	hly probable growth and e	extension of coastal settlements
	inland beyond the coastal road.	,	
	Uncertain future of low-lying land in the vicinit	v of the South of Bargny. d	ependina on the arowth of future
	land-intensive activities of Dakar (land accessible in particular with backfill). In particular, future facilities of		
	ore port of Dakar.	···· [·····	.,
Actions	Protections could be made consistent on the	scale of the sector, but mo	re probably the shoreline will be
	completely backfilled and artificialised, with a	view to delaving withdrawa	al which is probably inevitable in
	the long term.	, ,	
Priority	High	Monitoring-observation	Regular

			PERIURBAN & TOURISM
SN3-b	24	- POPENGUINE	
Diagnostics	Very particular type of coast, segments of c crumble. Alternating small cliffs and more or of plants (hardpan exposed). Rock fill materia at low cost: dyke protecting a hamlet (fishing of rockslide. In the North, still relatively un scattered residences on the sea front, etc.	liffs in hardpan, substrate a less narrow beaches. Surro als available locally facilitat point), a few residences o urbanised, numerous plots	soft in depth, natural tendency to bunding landscape practically bare ing individual protection initiatives n the edge of small cliffs with risk closed off awaiting construction,
Dynamics	Very dynamic littoral zone and narrow, unstal	ble beaches.	
Stakes	Anticipation of human land use on an unsta viability over time of walls-dykes and protection	ble coast where encroachn ve armouring.	nent is underway. Efficiency and
Actions	Measures to prevent installations on at risk sites. Sector scheme recommended, taking into account the		
	kind of substrates and the risks of rock fall		
Priority	High	Monitoring-observation	Regular



The cliff at Popenguine under development (source: national diagnostic study)

		TOURISM
SN3-c	25 - SALY – PORTUDAL –SOMONE	
Diagnostics	Littoral strip almost totally developed and artificialised: hotel complexes, holiday homes	and village
	enclaves. Littoral zone undergoing rapid change, beach North of Somone, with six groyne	es in rock fill,

	small marina with piers, various protections erosion. Evident conflicting uses between to width of the beach.	s, walls and beach armou ourism and fishing in a cor	ring. Several coves with visible ntext of gradual decrease in the
Dynamics	Generalised erosion throughout the sector. A works.	few sites undergoing accr	retion upstream of the protection
Stakes	A coordinated sea front scheme is required t coastal current system. Bringing together the targeted at all the players concerned with risk	to avoid disrupting a fragile different stakeholders and prevention.	balance of the dynamics of the broader awareness raising work
Actions	Measures to prevent installations on at risk harmonisation of spontaneous protections. In overall, coordinated approach. Regaining of prerequisite.	sites. Sector scheme reconsprovements should be pla control of the land owner	ommended, with evaluation and nned within the framework of an ship system is in any case a
Priority	Very high	Monitoring-observation	Intensive and regular
Case study	Changes in the shoreline from Saly to Mbour -	- 19654-2007. See annex 1	•



Loss of sediment at the foot of the protection system (source: case study).



Impact of protective systems (source: case study).



Combat coastal erosion or adapt to it? Terrace on stilts at Saly (source: case study).

	URBAN & TOURISM
SN3-d	26 - URBAN SECTOR OF MBOUR
Diagnostics	Town currently growing (around the periphery), with numerous plots surrounded by low walls awaiting construction. Large agglomeration, almost a satellite 60 kilometres from Dakar, local tourism centre, rural area close to groundnut cultivation areas. Important fishing port (fresh fish with market and lorries). Undulating coast with beautiful beaches in marked coves, changing continuously in sections of erosion/accretion. Balance of current system highly sensitive to any changes in the shoreline. Conquest of the beach as far forward as possible, sometimes in two phases with extensions built on the maritime domain adjacent to the initial concession. The hotel area closes off the majority of public access to the beach.
Dynamics	Very dynamic littoral zone, phases of erosion/accretion largely induced by the works and improvements on the sea shore.
Stakes	Consequences of the individual protection decisions with no consistency among them. Maintain the sector's tourism appeal with a beach heritage that is continuously shrinking. Evident privatisation of a long stretch of beaches. Efficiency and viability over time of walls-dykes and protective armouring. For the future, the population's access to the beach could be limited to the urban beach used for landing fish with all its various nuisances.
Actions	Sector scheme recommended with a view to harmonisation and respect for the functionality of improvements. Reclamation in certain extreme cases when the stakes justify it and as part of an overall scheme.
Priority	Very high Monitoring-observation Intensive and regular
Case study	Changes in the shoreline from Saly to Mbour - 1954-2007. See annex 1.



Surprising spontaneous solution...: waste from fishing products used as flood protection for the artisanal transformation site south of the IKAGEL factory at Mbour. Photograph taken facing North, on 03-08-2007 (source: case study).

	TOURISM
SN3-e	27 - MBOUR – POINTE SARENE
Diagnostics	The most striking phenomenon is the growth of concessions of all sizes, closed, hedged, with protected
	natural vegetation tending to close off access to the coast leaving only the openings of original village
	enclaves (with fishing and fish drying – Warang).
	Well served by the coastal road which is hard surfaced to Joal.
	Littoral zone with an undulating longitudinal profile with alternate sectors of erosion and accretion.
Dynamics	Average erosion of 1 m per year (source: case study). Considerable at Warang, and also downstream of the goyne protecting the Adiana club beach.
Stakes	No significant hotel complexes, holiday homes, some of which are very close to the beach, with walls, section of rock fill of individual protection. Complete lack of coordination of individual protective actions. In the land planning of the South zone, planned breaks in residential urbanisation to preserve beach accesses for the inland population, to prevent the complete privatisation of the littoral zone outside the village enclaves.
Actions	Sector scheme recommended with a view to harmonisation and respect for the functionality of improvements. Reclamation in certain extreme cases when the stakes justify it and as part of an overall scheme. In the land planning of the South zone, planned breaks in residential urbanisation to preserve beach accesses for the inland population, to prevent the complete privatisation of the littoral zone outside the village enclaves.
Priority	High Monitoring-observation Intensive and regular
Case study	Monitoring of erosion and accumulation phenomena on the littoral zone from Mbour to Pointe Sarene since 1954. See annex 1.

			TOURISM
SN3-f	28 - NORTH J(OAL - MBODIENE PL/	AGE
Diagnostics	This sector marks the end of the tourism a residential concessions and the latest luxury stretch of several hundred hectares. Apart fro South of the village of Pointe Sarene, most of back, reducing the risks of settlements clos Mbodiene. The functioning of the estuary zo East of the village of Pointe Sarene.	and residential settlements hotel complexes. One of th om the hotel complex built of the hotels and holiday ho ser to the shore. Urban sp ne is largely perturbed by	s on the Petite Côte, with vast nese closes off the coast along a in a potentially flood-prone area omes have been situated further orawl in progress inland around the blocking of sediment supply
Dynamics	The littoral zone South of Pointe Sarene takes the form of a narrow lido that ends in a sandy spit in the vicinity of Joal. Unstable littoral zone. This spit is part of the former estuary of the coastal river, the functioning of which has been profoundly altered by the building of a dam at the level of the North Mbodiène tourist complex.		
Stakes	Control of the development of residential and hotel building in this complex sector bordered with wetlands, also forming sediment reserves.		
Actions	Preserve wetlands complex. Locate possible future tourist and residential development areas back from the beach. Control land ownership to prevent urban sprawl in this wide break in urbanisation before Joal and Sine Saloum.		
Priority	Average	Monitoring-observation	Watchkeeping for the purpose of anticipation
Case study	Monitoring of erosion and accumulation pheno since 1954. See annex 1.	omena on the littoral zone fr	om Mbour to Pointe Sarene

				ANTICIPATION
SN3-g		29 - JOAL		
Diagnostics	Growing town forming a conurbation with Fadiout. Very important centre for collecting catches and the processing of fish, salting, cold storage, smoking, with air pollution, etc. No quay or wharf infrastructure,			
	catch landing on the urban beach, with conside	erable concentration of boa	ts.	
	The cape acts as a relative shelter. A certain	number of scattered build	ings on the b	each, more or less
	protected by walls and armouring exposed to storms.			
Dynamics	Straight littoral, tendency to undulation with local accretion/erosion. Relatively unstable sector.			
Stakes	Control of building on the beach (to avoid the situation observed at Fadiout see following sector).			
Actions	Inform local residents and authorities of the risks related to densification of built-up area.			
Priority	High	Monitoring-observation	Regular	

SN4

SINE SALOUM

			PERIURBAN & URBAN	
SN4-a	30 – FADIOUTH	PENINSULA AND ISLAN	ID	
Diagnostics	Rim and urbanised terraces in continuity wit fragile and exposed. Narrow beach built-up to landed, which extends to the port of Joal, has up part and the sea. On the residential poin protective systems (walls, armouring). The e protected) and is in danger of disappearing. V A densely urbanised island (shell island), but connected by walkways to (i) the peninsula; (ii Peninsula connected to the North-East by a d	In durbanised terraces in continuity with Joal in a more continental situation. Interesting site, but and exposed. Narrow beach built-up to the limit of the tide. Only the vast cove where canoes are which extends to the port of Joal, has conserved a segment of beach between the densely built- t and the sea. On the residential point, three hotels and residences, built on the tide limit, with ive systems (walls, armouring). The extreme point, with no buildings, is partially planted (to be ed) and is in danger of disappearing. Vast zone of salt production. sely urbanised island (shell island), but more sheltered from the ocean waves and storm surges, cted by walkways to (i) the peninsula; (ii) the nearby cemetery island. ula connected to the North-East by a dyke track that crosses the salt wetlands.		
Dynamics	Unstable sector undergoing erosion.			
Stakes	Possible development of built-up area in a h already subdivided into plots. Maintain the c where shoreline recession is more than likely. The most at risk sector seems to be situated The extreme point should be more vigorous vegetation seems to be vigorously used as mangroves). As the buildable urban site is sa well attack the zone more or less dyked by t drying). Possible future reclamation on the tan	igh risk situation on the extrem urrent footprint of constructions d in the residential part with wa sly planted with casuarina type s wood for fuel, as is the cas turated, future growth (in addition he dyke road (but the majority) unes (brackish swamp) islands?	hity of the peninsula, visibly is in the future in a situation Ils/armouring on the beach. e plants (the low, ligneous e for what remains of the on to that on Fadiouth) could of which is taken up by fish	
Actions	Preserve natural vegetation, in particular on the extremity of the Fadiouth peninsula. Ban the extraction of materials on the whole of the sector and adjacent sectors. Vigilance in order to prevent the development of uncoordinated individual protective initiatives. Possible study of a protection system for the whole sector			
Priority	High	Monitoring-observation	Intensive and regular	

			ENVIRONMENT
SN4-b	31 - S0	OUTH FADIOUTH	
Diagnostics	Littoral zone physiographically diversified (n	arrow, discontinuous sand	dy rims, mudflats, tannes, etc.).
	Sector hemmed in (track along the edge and	I then crossing the zone in	a difficult situation, wetland and
	flood-prone areas) and practically uninhabited	. Limited tourist developme	ents not excluded in the future.
Dynamics	Very unstable sector.		
Stakes	Conservation of an unconstructible wetland ar	ea of biological interest.	
Actions	Maintain the break in urbanisation.		
Priority	Average	Monitoring-observation	Intensive and regular

	//////////////////////////////////////			
SN4-c	32 - PALMARIN PEN	IINSULA – FALCAO -	- NGALOU	
Diagnostics	Liaison with the continent by track, very fra extraction activity (sites sensitive to rise in sea Despite a very exposed situation, presence of and residential cabins (Palmarin – Ngalou), lo of even topography.	gile in sections crossing s a level but locally more easi of beach edge settlements, ocated in the places where	altwater marshes. Important salt ily relocated). tourist facilities being developed the terrace is slightly higher and	
Dynamics	Terrace very low, littoral rim interrupted in pla	ces, very complex, changin	g littoral zone. Unstable sector.	
Stakes	Human settlements at risk (erosion and e	especially storm surges).		
Actions	Encourage plant coverage of the littoral settlements should be considered in the long tourism, on the whole of the sector.	zone (defensive measure term. Moderate the develop	es, etc.). Relocation of certain oment of building, in particular for	
Priority	Average	Monitoring-observation	Intensive and regular	
Case study	Changes in the shoreline of the littoral zone o	f Palmarin. See annex 1.		



Changes in built-up areas at Fadiouth between 1988 and 2002 according to Ackermann. G. & al. 2006.- Landscape dynamics and sustainable development perspectives on the Petite Côte and in the Sine-Saloum delta. VertigO. 7(2) : 9p).

			RURAL AT RISK
SN4-d	33 - DJIFFER I	PENINSULA – PALMA	ARIN
Diagnostics	Extremely unstable zone. In particular for Dji risk of being cut off from road network by the Fadiout. The breach of the Sangomar spit recession with rates of 137m per year recor Palmarin and of Djiffer camp.	ffer, fishing centre in the e e disappearance of part of (Lagoba breach) in 1987 rded. This beach led to th	estuary. Particularly exposed and the track linking Djiffer and Joal corresponds to an episode of e displacement of the village of
Dynamics	Extremely unstable sector.		
Stakes	Withdrawal of population outside the at risk se	ctor of Djifer.	
Actions	Protective stabilising plants to slow down for a permanent installations.	a time the uncontrollable dy	namics. Relocate population and
Priority	Very high	Monitoring-observation	Intensive and regular
Case study	Changes in the shoreline of the littoral zone of	Palmarin. See annex 1.	



Changes in the sector between Diakhanor and Djiffere (source: case study).

43

		EN	VIRONMENT & RURAL AT RISK
SN4-e	34 - SINE – SALOUM SOUTH		
Diagnostics	Littoral zone of predominantly sandy spits adjacent to mangroves actively and continuously changing (Sangomar point). Small insular terraces, sheltering small fishing villages as in all the islands inside the Saloum delta, with the usual constraints in this type of situation: isolation, drinking water, precarious settlements in the event of storms. Niodon, the largest village, with a small fishing point and a few (eco) tourism facilities.		
Dynamics	Continuously changing, extremely unstable sector. Rapid siltation observed on the occupied sites.		
Stakes	Littoral zone part of the Saloum delta marine national park with another, mangrove zone nearby (community marine protected area of Bamboung). Settlements at Niodor and Diolewar in at risk sites.		
Actions	Respect the National Park management provisions. Limit the development of agglomerations in at risk situations. Stabilising plants to slow down the rate of siltation.		
Priority	High Monitorin	g-observation	Regular
Case study	Changes in the shoreline of the littoral zone of Palmarin. See annex 1.		



Localisation des secteurs mesurés

Sector changes in the littoral zone of Sangomar island (source: case study)

GM – The GAMBIA

For more than 50 years The Gambia has experienced considerable problems related to coastal erosion. These are a result of its situation, the lithology of the shoreline, and the installation of tourism infrastructure and other sources of anthropic pressure, such as the extraction of beach sand, today banned.

The tourism development plan for the 1970s and 1980s instigated ostensibly quite vigorous control of the distribution of hotel facilities, for which almost the entire area close to the coast was reserved. Holiday homes are still very rare today on the whole littoral zone, even in situations highly suitable for building. This text book case of planning is not to be found in any other country in the sub-region. On the other hand, the questions related to the risks associated with coastal erosion, to the risks of storms, have been underestimated and approached on a case-by-case basis. The tourism development plan for the Gambia was updated in 2007.

The littoral zone of Banjul has been subject to important improvements since 2000, including the refilling of certain beaches (2,400,000 m3). The results seem to be encouraging, but should be confirmed over the next decade.

GM1	The Gambia
-----	------------



Zoning of tourism development in the Gambia (source: national diagnostic study)

			ANTICIPATION
GM1-a	35 - ESSAU - BARRA AND R	GHT BANK OF THE	GAMBIA ESTUARY
Diagnostics	Small historical town with a fort dominating the entrance to the sheltered estuary. Small harbour infrastructure for the ferry and fish landing point. Urban growth inland along the road in particular towards Senegal and at a distance from the littoral zone. Barra point extends north in a sandy terrace in a peninsular situation, bordered on the inside by channels and mangrove lagoons as far as the border with Senegal. Fragile littoral zone, crescent-shaped beaches. There is little human land use in the area close to the shore, on the first terrace rim. Further in, vegetable growing ("nyaye type") using the freshwater lens exploited by individual wells.		
Dynamics	Unstable littoral zone.		
Stakes	Relatively isolated (in spite of the ferry) by the estuary, with a much less attractive littoral zone, this sector has been totally excluded from the tourism development plan for the Gambia. On condition that there are facilities inland of the littoral zone, it represents a possible long term potential, if the littoral zone becomes saturated one day like nearby Senegal. Conservation of the trees growing on the uncultivated terrace, current extraction of wood for fuel. Protected forestry area?		
Actions	Vigilance regarding the dynamics of land use and the extension of built-up areas.		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation

	URBAN		
GM1-b	36 - BANJUL CENTRE		
Diagnostics	In a practically insular situation, served by a road network on unstable terrain and surrounded in the South by a dyke road that acts as a dyke for the low lying urban extension built on the mangrove embankment, lagoons and wetlands that are not yet urbanised. The urban beach is bordered by large hotels. Beaches of very fine sand or more or less silt estuary sand but relatively sheltered from ocean swell. The cemetery has been under threat for a long time and has been affected on several occasions by surges.		
Dynamics	The littoral zone of sandy banks of estuary deposits is very fragile, changing, with sections undergoing erosion and accretion, momentarily balanced. The risks of submersion concerning the low-lying part of the town that is protected by a dyke have been on the agenda for a long time ³ .		
Stakes	Dense urban site with highly unstable surroundings and littoral zones, and a significant part of the town in a dyke situation and built on terrain that is not consolidated in depth. A part of the current urban extension is not protected by the dyke with small platforms scattered along the edge of the main roads.		
Actions	Continue and complete developments/improvements in progress. Study flood-submersion contingency at the level of the town of Banjul, risk prevention plan. Close monitoring of the developments carried out.		
Priority	Very high Monitoring-Observation Intensive and regular		
Comments	The monitoring system implemented within the framework of recent developments on the Banjul coast		
	can make a useful contribution to the monitoring-observation of the sector.		

URBAN

	URBAN		
GM1-c	37 - BANJUL - KOLOLI POINT		
Diagnostics	The coast facing the sea is predominantly rocky, especially in the North part. A few beaches in creeks where erosion is in progress (crescent-shapes facies), but most often a thin layer of sand on rock. The hotel area with a few homes and a fishing point at Bakau, with quay-pontoon jutting out well into the sea. For more than half the hotels, there are limited or no beach resources. Several hotels advance towards the sea protected by walls-armouring. However, of note are wide areas with no buildings immediately bordering the coastal escarpments. In addition to the rock belt of the cape, there are several protective developments on the North-East part.		
Dynamics	Active erosion on a mainly rocky littoral zone with headlands and creeks with low sediment reserves.		
Stakes	Active erosion also related to the reflection on the rocky micro-cliffs and protective walls, leading to the deterioration of the potential for beach resort and tourism. Impacts of the development of the beach at Cape Point.		
Actions	Preserve unbuilt areas with location of future development of built-up area back from the shore.		
Priority	High Monitoring-Observation Regular		
Comments	The monitoring system implemented within the framework of recent developments on the Banjul coast		
	can make a decidi contribution to the monitoring-observation of the sector.		

³ Jallow. B. P. 1996.- Vulnerability of the coastal zone of The Gambia to sea level rise and development of response strategies and adaptation options. **Climate Research**. 6:165-177p.





Original development of the beach at Cape Point (source: national diagnostic study)



Armouring at Cape Point (source: case study).

	TOURISM
GM1-d	38 - KOLOLI POINT - BALD CAPE
Diagnostics	A discontinuous strip of large capacity hotels saturates the littoral zone with golf course. The whole is
	clearly delimited by the coastal road, which separates this strip from the urban habitat. Certain
	establishments are visibly very deteriorated. Globally, the buildings are as close as possible to the
	foreshore, but certain hotels have their buildings and swimming pool someway back. In other cases,
	these leisure facilities are directly on the sea front. Overall, there is a certain amount of diversity and the
	zone would have deserved a case study, as its development probably dates (70s-80s). Protected forest
	area (Bilijo forest) constituting a first break in urbanisation, followed by area still with little building in the
	South. Materials extraction site.
Dynamics	Sector globally undergoing active erosion, improvements, in particular at the level of the Hotel
	Senegambia.
Stakes	Viability of improvements. Planning of new installations that will not fail to appear in the residual space
	South of the sector. Maintain and protect breaks in urbanisation.
Actions	Protect natural vegetation in breaks in urbanisation that are still to be secured. Plan the implementation of
	any new hotel complexes with impact study. Closely monitor the developments carried out by Haskoning.
Priority	High Monitoring-Observation Intensive and regular
Comments	The monitoring system implemented within the framework of recent developments on the Banjul coast
	can make a useful contribution to the monitoring-observation of the sector.

			ANTICIPATION
GM1-e	39 - BALI	D CAPE - SANYANG	
Diagnostics	Nearshore littoral with very little human land use (two tourist establishments in Sanjang bay). Beach		
	serves as a road at low tide. The existing ha	rd-sunaced road constitute	s a pamer to urbanisation as far
	as the cape (Baldcap), leaving a strip devoid	of numan use. A small prot	ected forest surrounds the cape.
	Large protected wetland and Tanji fishing port		
Dynamics	No remarks.		
Stakes	Maintain the current situation, trend towards residential appropriation in the future to be anticipated.		
Actions	Anticipate tourist and residential facilities and development. Protection and preservation of the vegetation		
	on the dune rim required, in particular by maintaining the natural vegetation and possible replanting.		
	Preservation of the urban sprawl and urbanisation of all surroundings of the complex of wetlands at Tanji.		
Priority	Low	Monitoring Observation	Watchkeeping for the purpose
FIDING		womonitoring-Observation	of anticipation



Kaita and Senegambia Hotels before the developments, top, After the re-sanding of the beaches, bottom (source: case study).

			ANTICIPATION
GM1-f	40 - GUNJUR		
Diagnostics	Littoral zone with a generally longitudinal profile, undulating from headlands – shallows. Beach-top rim subject to wind erosion in places. Important fishing port at Gunjur to the South of the town. Access to the littoral zone by branches of the hard-surfaced road which approaches the coast, a few dwellings. Globally, little human land use on the sandy terraces close to the littoral zone, locally in ridges and channels. Average density tourist zone in the northern part of the sector.		
Dynamics	Berms and beach top cliffs observed in places. Wind erosion of the rim sands.		
Stakes	The southern part of the Gunjur sector has potential for tourism and dwellings and will probably eventually be used in the same way as in Casamance.		
Actions	Anticipate tourist facilities and development. Protection and preservation required for the dune rim vegetation.		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation



SN - SENEGAL (South)

MARITIME CASAMANCE

			ENVIRONMENT	
SN5-a	41 - NIAFARANG			
Diagnostics	Littoral zone changing greatly, under the influence of a headland probably reinforced at the level of the sea by a layer of sandstone – hardpan with shallows. Immediate hinterland very complex: terraces in ridges and channels forming, long narrow estuary bordered by unstable sand rims, with partial vegetation cover, traces of crescent-shaped deposits from storms and/or swells, mangroves. Conservation of the whole probably interesting in terms of biodiversity, given the wide diversity of a mosaic of evolving natural environments. Different communities and ecosystems are effectively represented on a small surface area.			
Dynamics	Dynamic littoral zone including highly unstable sand spit formations, southern part of the sector undergoing erosion.			
Stakes	As a prolongation of a future residential development starting at Kafountine, but no-build zone covering a wide coastal fringe. Further inland, small sites to be examined with a view to possibly installing light infrastructure for ecotourism.			
Actions	Restrict installations other than light and temporary ones on the shore. Preserve the natural vegetation of the rim, maintain seafront vegetation on beach edge and lack of hard structures in this green strip. Densification of residential and tourist facilities to be restricted and reserved where necessary to the zones landward of the shore in the extreme south of the sector, with an overall logic (sector scheme) to be connected to the sector of Kafountine.			
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation	

SN5-D	42 - KAFOUNTINE			
Diagnostics	30 years ago, small village of farmers/fishermen with a tourist camp. Kafountine has expanded considerably, in particular with an important, equipped fishing centre, in a very exposed situation. A basic track serves several small tourist establishments, with traces of concessions further south. The southern extension zone is a rim adjacent to a wetland/lagoon area that becomes lagoon channel and mangrove towards the south. Wide, unstable beach subject to wind, light wind erosion, accelerating towards the south of the bird peninsula (<i>presqu'île aux oiseaux</i>). The northern part is undergoing residential tourist development and land appropriation. Rims separated by a narrow lagoon channel, the concessions and traces of plots are situated on both sides of the channel.			
Dynamics	Littoral zone by nature very unstable, numerous segments of beach undergoing erosion, in particular where buildings have been developed in proximity to the beach.			
Stakes	The south extension is typically a very fragile and exposed zone with a shoreline sensitive to storm surges. In this context, urbanisation is not desirable. Nonetheless, the pictures show marks of division into plots. The central zone is a high terrace approaching the beach, with large concessions of residential cabins in palm groves, up to the edge of the beach. Precious land visibly appropriated. In the north part, the stakes are the same as for the central part, a scheme is indispensable to anticipate future building in this zone.			
Actions	Limit installations other than light and temporary ones on the shore. Preserve the natural vegetation of the rim, maintaining of seafront vegetation beach edge and lack of hard structures in this green strip. Densification of residential and tourist facilities to be restricted and reserved where necessary to the zones landward of the shore in the centre and north of the sector, with an overall logic (sector scheme) to prevent urban sprawl behind the coastal zone.			
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation	

SN5

		EN	/IRONMENT & ANTICIPATION
SNE o	43 - INSULAR OR PENINSULAR LITTORAL ZONES		
3N9-C	ON THE RIGHT E	BANK OF THE CASA	MANCE
Diagnostics	Facing the sea and the banks of the Casamance, narrow sandy rims and low, narrow terraces constitute very unstable sandy littoral zones. These small, insular, emerged areas are occupied in places by small fishing villages on the larger islands: Diogo, Karabane (small tourist site with wharf for cruise ships).		
Dynamics	Littoral zone by nature very unstable, whether banks of mangroves or partially planted sand rims that are subject to wind erosion in places (bird peninsula south of Kafountine). This bird peninsula seems to be threatened with breaching (approximately 200 m at the narrowest point), with insularisation of the southern point, as in the south of Diiffer in the Saloum.		
Stakes	Particularly fragile sector. Littoral zone with a vocation for ecotourism, light facilities inland of the coast. The stabilising of the sand by the planting of trees on the areas of sharp sand could be envisaged (as on the Grande Côte) in more favourable soil and rain conditions.		
Actions	Limit installations other than light and temporary ones. The whole of the natural milieu should be preserved under a conservation unit like the neighbouring Saloum delta.		
Priority	High	Monitoring-Observation	Watchkeeping for the purpose of anticipation

ENVIRONMENT & ANTICIPATION				
SN5-d	44 - DJEMBERING - POINTE NIKINE			
Diagnostics	A sandy terrace with ridges and channels relays the formation of the continental terminal with rice- growing in the channels. Sandy littoral zone with undulating longitudinal profile, a thin rocky headland jutting out into the sea. The scarcity and precariousness of drinking water resources have limited the possibility of the extension of tourist zone from Cap Skiring towards the north. In addition, the sandy rim on the edge of the beach is unstable, a complex topography of channels. To the north of Djembering, with a North West orientation, a wide strip of unconsolidated sand is subject to generalised south - south easterly wind transport. Sites that are buildable, even for ecotourism with light infrastructure, are rare in proximity to a littoral zone and immediate binterland of isolated terrace (only one track inside the area)			
Dynamics	Littoral zone very unstable with alternate levels undergoing accretion and erosion from the sea. To this instability is added the landward loss of sand due to wind-blown erosion.			
Stakes	Particularly fragile sector. Littoral zone with a vocation for ecotourism, light facilities inland of the coast. The stabilising of the sand by the planting of trees on the areas of sharp sand could be envisaged (as on the Grande Côte) in more favourable soil and rain conditions.			
Actions	Preserve vegetation coverage at the top of the beach and rim. Restrict new infrastructure on beach. Vigilance and possible monitoring of individual protective initiatives to be placed, where necessary, in an overall improvement scheme.			
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation	

	TOURISM
SN5-e	45 - CAP SKIRING
Diagnostics	Peninsula stretching from Cap Roxo on the border with Bissau to Nikine point, the sea outlet of the Casamance estuary. Landform of flattened hills of continental terminal formation with sandstone base and inclusions of hardpan appearing at the level of small headlands separating beautiful beaches into sandy coves (segments of type 4b then 4a). For approximately twelve kilometres, the area close to the littoral zone is practically saturated with hotels and residences, and a golf course. With an airport nearby, this tourist zone hosts an international clientele, linked to Ziguinchor then Dakar by a hard-surfaced road, and business got off to a good start, and was then hampered by social unrest in Casamance.
Dynamics	The small scarcely consolidated headlands are very fragile and sensitive to erosion. The slightest modification could disrupt the precarious balance of the beaches, which are highly exposed to storm surges in the rainy season. The southern extremity is sandy terrace, discontinuous vegetation and is sensitive to active wind erosion. This sector also probably suffered the impacts of the reduction of sediment flows from Casamance (generalised improvements of low-lying ground and period of drought in the 1970s-1980s).
Stakes	Maintain the headlands and the balance of the beaches, knowing that reinforcing structures may be dangerous. The necessity of maintaining plant coverage in strips along the headlands and beaches, playing an attenuating role during storm episodes. There should be no permanent developments on the edge of the beach. There are limited drinking water resources, with a high risk of the salt water wedge rising in the event of more intense exploitation of the water tables.
Actions	Preserve vegetation coverage at the top of the beach and rim. Restrict new infrastructure on beach. Vigilance and monitoring of individual protective initiatives to be placed, where necessary, in an overall improvement scheme. Review and update of existing management schemes.
Priority	Average Monitoring-Observation Regular

*	GW - GUINEA BISSAU

GW1

GUINEA BISSAU

The physical geography of the country is typified by the following elements:

- \Rightarrow A considerable length of straight littoral zone more than 90% of which is constituted by a belt of mangrove trees.
- ⇒ Homogeneousness of the living systems of the "Balante" population facing the sea (fishing and ricegrowing in land under sea influence).
- ⇒ Location of habitat on high terraces and hills out of reach of storm surges, even in the event of a rise in sea level (except very locally as in the urban zone of Bissau). Large huts surrounded by orchards and staple crops.
- ⇒ Fishing practiced in the mangroves (except in the Bijagos) generalised? but as a complementary activity. Few populations live on the beach.
- ⇒ Importance of rice growing on dyked mangrove areas, low-lying ground with brackish waters and fresh water. This rice-growing is demanding in terms of rainfall and Guinea Bissau has seen large areas in the north abandoned during episodes of drought. Ancient rice civilisation witnessed by the Portuguese as early as the 16th century. The lowest-lying, most threatened land areas are often also the most fertile. In terms of dyking work, 20 centimetres is already a significant height...⁴

Tourist potential: apart from the small site of Varela, all the potential is mainly located in the Bijagos, a part of which is listed as a National Park.

The improvement of the road network replaced a situation of land isolation of a large part of Maritime Guinea when the country attained independence, communications in colonial times were by coastal shipping linking the principal small coastal agglomerations and Bissau.

Due to the difficulties related to the poor quality of the high resolution pictures, only one zone has been considered for Guinea Bissau with a breakdown into 6 sectors.

	TOURISM
GW1-a	46 - SECTOR MARITIME NORTH - CAP VARELA
Diagnostics	Important rice-growing area, but which seems to have greatly decreased after 1980, the date of the initial maps. All the mobilisation systems of the milieu, land and water are represented: mangroves, hydromorphic sand, channels of terraces, wetlands, low-lying ground with fresh and/or brackish waters. The whole enjoys less favourable rainfall conditions compared to the rest of Guinea (volume and predictability).
	A seaside tourism site still relatively unexploited but which, except for Bijagos, remains the only site with potential for international tourism in Guinea Bissau. Extension, albeit restricted to around 3 km of beach adjacent to buildable land quite close to the littoral zone.
	itself as a continuity of Maritime Casamance in Senegal.
Dynamics	Shoreline changing greatly subject to both the influence of the coastal current system of the headlands (Varela and Roxo) and coastal drift currents and sediment transport in opposite directions depending on the season, and highly exposed to storm surges during the rainy season. Cap Varela, relatively unconsolidated geologically, is very sensitive to erosion. This sector also probably suffered the impacts of the reduction of sediment flows from Casamance (generalised improvements of low-lying ground and period of drought in the 1970s-1980s).
Stakes	The littoral zone south of Cap Varela has 15 kilometres of attractive sandy beaches but adjacent to a very narrow sandy rim unsuitable for tourist facilities. In addition to the stakes relative to the different rice-growing areas, we mention the great fragility with respect to marine erosion with, facing the swell,

⁴ Given the scale, not all the rice-growing concerned has been fully mapped.

	discontinuous rock outcrops of hardpan at Ca	p Verga.		
Actions	The answers concern the precaution to be taken with the future implementation of hotel infrastructure to optimally preserve the function of the headland (imperative enforcement of ban on extraction of the rare blocks of rock in the region).			
	Maintain coastal vegetation. Coastal defence scheme organising a global tourist facility effo	structures justified within th rt.	ne framework of an overall sector	
Priority	High	Monitoring-Observation	Regular	

			GROWING
GW1-b	47 – CENTRAL MARITIME SECTOR		
Diagnostics	Same as sector GW1-d, but small surface area for rice-growing under the direct influence of the sea.		
Dynamics	Very dynamic mangrove systems.		
Stakes	Same as sector GW1-d, but small surface area for rice-growing under the direct influence of the sea.		
Actions	Global reflection to be undertaken on the sustainability of mangrove rice-growing systems and relevant improvements to address the context of a rise in sea level.		
Priority	Low	Monitoring-Observation	No recommendations

		ENVIRONMENT & URBAN		
GW1-c	48 - B	ISSAU – URBAN ZONE		
Diagnostics	The town has expanded considerably since independence.			
	the waters from the vast catchment area of	of the Corrubal, which seasonally clears silt from the estuary, to		
	which is added the removal effect of the	e tides. There is nonetheless a tendency to siltation, with an		
	harbour infrastructure and the development	ent of quays and wharfs in two principal centres. Despite the		
	impact of the submersed goyne favouring	the deepening or simply maintaining of the principal channel of		
	the estuary, questions remain regarding	the tendency to siltation between these two principal centres		
	Urban growth: the topography of flattene	d hills (fan network) separated by shallows and mangroves has		
	to 10 km from the town centre. An area	equivalent to the present day urban area remains technically		
	suitable for building. However, the attraction of the saturated centre and its proximity encourage building			
	in former rice-growing wetlands, through the use of rock fill/embankments, block by block, or in small plots. In addition to relatively unfavourable conditions (sanitation, risk of flooding when the intra urban			
	wetlands for rice-growing or natural vegetation disappear), this situation is prejudicial to the urban			
	environment (ecological services: hydrological role, collection of rainwater runoff, and uncontrolled			
	commercial centre, the majority of wetland	s are disappearing rapidly.		
Dynamics	Risks of submersion related to the drying of	out of low-lying, floodable wetlands.		
Stakes	Sustainability of the operation of harbour	installations, dependency on other hub ports such as Dakar,		
	given the dimensions of modern cargo sh	hips. Control of urban growth, and respect of the wetland gaps		
	accumulation of urban and domestic efflue	ed ecological services. Risk of contamination of waters and		
Actions	Improve the transport system towards the	centre and support access to land ownership of buildable plots		
	on the periphery on suitable soils. Global scheme absolutely essential at this stage.			
Priority	High	Monitoring-Observation Regular		

MANGROVE & RICE



Bissau urban encroachment on the mangroves or paddy fields more or less filled in (source: Google Earth)

			MANGROVE & RICE
			GROWING
GW1-d	49 - GUINEA BISSA	AU SOUTH - TITE – T	OMBALI
Diagnostics	Importance of the extension of the rias and	few mangrove areas that	can be improved with a small
	extension of low-lying ground that can be planted with rice.		
Dynamics	Very dynamic mangrove systems.		
Stakes	Same as sector GW1-f, but rice-growing areas under threat much more limited.		
Actions	Global reflection to be undertaken on the sustainability of mangrove rice-growing systems and relevant		
	improvements to address the context of a rise in sea level.		
Priority	Low	Monitoring-Observation	No recommendations

				ENVIRONMENT
GW1-e	50 – BIJAGOS ISLANDS			
Diagnostics	Several islands have been subject to protective measures and particular status justified by the extraordinary diversity of the natural milieus in the sea, on the coast and on the land. These islands remain moderately occupied or artificialised by a population that is quite sparse, isolated and self-sufficient. The paddy fields occupy a limited surface area but are essential for the self-sufficiency of the population.			
Dynamics	Multiple situations to be assessed in each case on a level of detail (kind of shoreline, exposure to swell, tidal currents, etc.). Tidal ranges often high and essential morphogenic role of tidal removal currents.			
Stakes	In the short term, risks of pillaging of fishing resources induced from the exterior, but providing revenue, even modest, for the populations. In the future, ecotourism development of the Park, certain islands (Caravela in particular) which have beaches and particularly attractive landscape environments as a reception point for exploring the natural and cultural diversity of the archipelago. In the current situation, Bubaque island, with its landing strip and a small hotel infrastructure, could act as a platform for possible ecotourism biking activities.			
Actions	Rigorous and concerted application of the provisions in the management plans of the conservation units. Vigilance regarding possible tourist installations on the other islands. Supervision of access to fishing resources, especially demersal.			
Priority	High	Monitoring-Observation	Regular	

			MANGROVE & RICE	
			GROWING	
GW1-f	51	- SOUTH CACINE		
Diagnostics	Considered a very important rice-growing	area due to the pluviom	etry exceeding 2,000 mm, enabling	
	secure yields in pluvial rice-growing on ma	ngrove land. The continen	tal part has been extensively cleared	
	of trees and the few maritime Guinean for	rest massifs that were pres	sent thirty years ago have almost all	
	disappeared. In the post-forestry system	, the very fragile soils a	re rapidly leached and turned into	
	savannah (sandy soils under a heavy rain	regime)		
Dynamics	Very dynamic mangrove system to be asse	essed in each situation.		
Stakes	Importance of risks related to the rise in se	ea level on the rice-growin	g sector (performance of the system	
	and limits of the potential of dry staple crops as an alternative to rice). If the rise in sea level hypothesis is			
	confirmed, it will probably be necessary to reconfigure rice-growing on the lowest-lying ground:			
	reinforcement of dyke system which would be costly in terms of labour, abandoning of certain areas of			
	land too difficult to manage, etc.			
Actions	Global reflection to be undertaken on the	sustainability of mangrove	e rice-growing systems and relevant	
	improvements to address the context of a r	rise in sea level.		
Priority	Very high	Monitoring-Observation	Intensive and regular	

GN - GUINEA

```
GN1
```

NORTH CAP VERGA - TRISTAO

			ENVIRONMENT	
GN1-a	52 - EXTREME NORTH WEST MANGROVE ISLANDS AND TRISTAO			
Diagnostics	System of islands and peninsulas with a very complex mangrove topography, littoral zone constantly			
	evolving. Low aptitude of sites for rice-growing	ng or fish farming, and sparse and sc	attered population of	
	fishermen with some rice-growing for their own	n needs.		
	The island of Tristao is distinguished by the e	extension of sandy terraces in ridges a	nd channels, and the	
	presence of a few small villages. The hinterla	and of the littoral zone is not well-conn	ected (hard-surfaced	
	road stops at Boké), but has a network of t	racks, small villages and seems to be	e undergoing relative	
	agricultural densification.			
	Intensive exploitation of wood from the mangr	ove trees.		
Dynamics	Very dynamic mangrove system;			
Stakes	The zone is part of the transborder Guinea-Guinea Bissau protected area. The island of Tristao has			
	important resting grounds for sea birds. The future will depend on the development of road connections			
	(towards Guinea Bissau? NEPAD transcoastal?). Given the tourist potential of the Guinean coast, the			
	sandy littoral soil on a stretch of over 20 kilometres is attractive, but too far from the road routes to			
	envisage the mobilisation of this tourist potential in the near future.			
Actions	Enforce the respect of protective measures on the site of Tristao and restrict the extraction of wood from			
	the mangroves for various uses (also taking into account the proximity of Kamsar).			
Priority	Low	Monitoring-Observation	No	
			recommendations	



Tristao island: typical section of ridge and channel terraces.

///////////////////////////////////////	//////////////////////////////////////		
GN1-b	53 - RIO NUNEZ – KAMSAR		
Diagnostics	Bauxite transport terminal with ore wharf, Kamsar has experienced considerable urban expansion becoming one of the principal agglomerations on the Guinean coastal fringe (probably ahead of Boké, as the central town in the South West of Guinea Apart from the potential of Kapatchez plain, the hinterland is essentially extensive agro pastoral and has little potential for sustainable agricultural (soils, landform, etc.) and population density (and will probably remain so in the future). Important fishing port north of the ore terminal. Filling in has been carried out on mangrove soils.		
Dynamics	Shoreline greatly artificialised.		
Stakes	How far Kamsar will expand is not known, but the high terrace is saturated at the level of the ore port, so a second small zone of growth by filling in the mangroves and rice-fields is forming around the fishing port which has a quay. Similarly, on the fan terraced urban site, the deeply saturated areas are seeing new huts being built on the edge of the mangroves or paddy fields with some filling in (these installations are also related to the attraction of the centre), more or less following the same model as Bissau.		
Actions	Include the development of Kamsar in an urban development scheme taking into account the preservation of natural sites and the restriction of pollution of all types.		
Priority	Average Monitoring-Observation Regular		

			MANGROVES & RICE	
			GROWING	
GN1-c	54 - COASTAL PLAIN OF KAPATCHEZ			
Diagnostics	Sandy-silt littoral zone with discontinuous deposits of sharp sand isolating the mangroves well-endowed with trees or vast, bare mudflats and tannes. Undulating longitudinal profile tending towards a straight line. Impact of hydraulic works to alter the course of the Kapatchez to facilitate drainage of a rice-growing area upstream that has greatly perturbed the environments.			
	Strong potential of surface areas suitable	for shrimp farming, already	y identified.	
Dynamics	Highly unstable littoral zone bordering a vast system of low-lying ground under the direct or indirect influence of the tide. Considerable change observed between 1954 and 1989 (accretion and erosion).			
Stakes	A known "textbook case" of the complexity of design of hydraulic developments with positive or negative global impacts in terms of economic valorisation and the balance of milieus, the basis for sustainability. An important potential on the scale of Guinea, but very complex hydrological, pedological and geological context.			
Actions	Re-think design in view of the results of v rise in sea level.	what has been undertaker	n, taking into account a scenario of a	
Priority	Average	Monitoring-Observation	Regular	



Rice-growing in mangroves in Guinea (Source: see PowerPoint)

GN1-d	55 - CAP VERGA				
Diagnostics	System of hard rock on stretch of approximately 10 kilometres, jutting out into the sea for approximately 7 kilometres compared to the overall shoreline. Complex littoral zone of type 4b in creeks and coves, sandy rims and wetlands (not mapped on a the scale of 1:500,000). Apart from the Loos islands, the only tourist resort on the Guinean littoral zone. Nearby hinterland with hilly landform, diversity of sites and sandy beaches. Today connected to Conakry by a hard-surfaced road (approximately 150 kilometres from the capital). Some infrastructure: small hotels, residential huts, but few in number. Many tracks in places.				
Dynamics	This headland plays an important role in the	near coastal current sys	stem.		
Stakes	About thirty kilometres of littoral zone still spared from tourist development, with the (theoretical) possibility of a future development scheme anticipating the probable long term development of tourism and resort residence, and overseeing the development of infrastructure and equipment. Restoration of the Guinea forest (deteriorated by burning and clearance) around the sites with a future tourist vocation.				
Actions	Anticipate tourist development. Protect the attractiveness of the landscape of the site.				
Priority	Average	Monitoring- Observation	Watchkeeping for the purpose of anticipation		

		2	
•	N.		

GN2 MANGROVES IN THE CENTRAL ZONE

			MANGROVES
GN2-a	56 - BOFFA MANGROVE ISLANDS		
Diagnostics	The insular units stand out in a system of great complexity of the mangrove hydraulic network, few sites therefore suitable for rice-growing or fish farming. Low level of promotion therefore of human occupation density. Littoral zone highly subject to the removal effects of the vast estuaries and coastal sediment drift redistributing on parrow rims of type 2a (bordering the mangroves facing the sea)		
Dynamics	Very unstable.		
Stakes	Maintain mangrove stands with little perspective of rice-growing or fish farming given the topographic complexity.		
Actions	No action recommended		
Priority	Low	Monitoring-Observation	No recommendations

	MANGROVE & RICE		
GN2-b	57 – KOBA PENINSULA		
Diagnostics	It has been subject to three operations for hydraulic improvement:		
	\Rightarrow A hill containment for complementary irrigation of a perimeter of sugar cane on terraces.		
	\Rightarrow Dyking and hydraulic improvement of low-lying ground for rice-growing.		
	\Rightarrow The protective dyke against the high tides is located in a section of the central part in contact with		
	the swell and is therefore directly exposed.		
	The remainder of the dyking slightly landward has, for the moment, the protection of a sandy rim of varying		
	widths.		
	The littoral zone of the slightly undulating straight type seems to present a natural point undergoing erosion		
	in the central part, and undergoing accretion rather in the southern point on the outlet of the Konkoure		
	estuary. This point undergoing erosion corresponds to the outlet of the principal canal.		
	A pilot perimeter of rish ramming has been installed on the former paddy fields of the mangrove rands, with perspectives of pessible extension on the Keba peningula. While the first years of production turned out to		
	be promising the management problems encountered have caused the project to stagnate but the		
	potential is considered one of the most interesting for both Guinea and West Africa		
Dynamics	Rapid erosion of the sandy rim, essentially in relation with the drainage outlet developed on the plain.		
-			
	"The erosion of the Koba coastal rim is concentrated in the sectors where there are drainage sluices for the waters of the		
	polder system. The mechanism is structured in the following way: when the marsh is emptied, on the beach there is a		
	removal of sand accumulated in front of the sluice by the coastal drift. This removal effect carves out a channel towards		
	the lower beach, or even towards the forward coast, forming a delta. This sediment is dissipated by the coastal drift		
	current. This sand distribution provokes an acceleration of erosion in the sectors directly south of the works. When the		
	tide rises and the sea is high, the drift fills the channel with fresh sediment, which is new, expelled towards the sea when		
	the tide ebbs and the sea is low. This phenomenon is reinforced in the spring tides period and its repetition provokes the		
	gradual thinning of the beach by this "naemorrhaging" of sand out to sea.		
	There is therefore a topographic lowering of the heach in the sector of the sluices. This lowering therefore enables the		
	breaking front to advance towards the coast, accelerate the burying of the backshore and the retreat of the crest of the		
	rim.		

	Since 1986, the thinning is such that the jets from the shore when the sea is full at spring tides have already flooded the village of GAMBLAN (Koba) situated on the summit of the rim.			
	As the sluice at MANKOURA was closed for several year the foreshore, more than 60 metres wide by 3 metres particularly wet, and this sluice had to be covered for a days later, not only had the upper beach retreated 30 mud floor, unearthing the palm trees and shrubs on both	ars, a very beautiful convex be thick burying part of the slui at least 8 days. Afterwards, it metres on the rim, but the e h sides of the sluice as it pass	each was therefore reconstituted on ice. The rainy season in 1988 was had lost 1/3 of its thickness and 15 rosion also attacked the sub-jacent ed.	i ; t
	The natural protection of this rim is ensured when the tr not disturbed. However, the drainage of the polder has	ransport, a fundamental comp to be reconciled with protectin	onent of the dynamic equilibrium, is g the beach from erosion."	;
	Source: case study.			
Stakes	The retreat of the dyke road on the most expos planted as well as possible with vegetation. The Between dyke and coast, people have settled rig and drain near the sluice works of the central dra rim.	ed section may be necess problem of the impact of t ght to the edge and are hi ain, the output of water fro	sary with the clearing of a strip he central drain outlet remains. ighly exposed or between dyke m which destabilises the littoral	:
Actions	Global reflection to be undertaken on the s	ustainability of mangrow	e rice-growing systems and	
	relevant improvements to address the contex	xt of a rise in sea level.		_
Priority	High	Monitoring-Observation	Intensive and regular	
Case study	Case study of coastal erosion at Koba (Boffa) and Kaback (Forecariah prefecture). See annex 1.			



Outlet of the central drain on Koba plain (source: Google Earth)

			MANGROVES
GN2-c	58 – KONKOURE DELTAIC ESTUARY		
Diagnostics	The insular units stand out in a system of great complexity of the mangrove hydraulic network, few sites therefore suitable for rice-growing or fish farming. Low level of promotion therefore of human occupation density. Littoral zone highly subject to the removal effects of the vast estuaries and coastal sediment drift redistributing on narrow rims of type 2a (bordering the mangroves facing the sea).		
Dynamics	Very unstable.		
Stakes	Maintain mangrove stands with little perspective of rice-growing or fish farming given the topographic complexity.		
Actions	No action recommended		
Priority	Low	Monitoring-Observation	No recommendations

			URBAN	
GN3-a	59 - MANGROVES AND PADDY FIELDS CONAKRY - DUBREKA			
Diagnostics	Rocky shore of the urban peninsula highly exp	oosed to ocean swell.		
	Edge of urban encroachment like the previous	sector on low-lying land an	d mangroves.	
	Large surface areas arranged in paddy fields	in mangrove swamp, but t	heir cultivation at the moment is	
	not certain.			
Dynamics	No remarks.			
Stakes	Same stakes as for the following sector, with the problems related to managing pollution, urban waste			
	and effluent.			
Actions	Given the urban transport problems and the economic importance of Conakry town centre, the			
	urbanisation of low-lying ground close to the town will remain a general trend which can only be managed			
	through structural measures (transport plan, u	rban renovation).		
Priority	Average	Monitoring-Observation	Regular	

	PERIURBAN		
GN3-b	60 - MANGROVES AND PERIURBAN EDGE CONAKRY - COYAH		
Diagnostics	Urban encroachment from the airport to Coyah in the lowlands, including mangroves? with more or less rough filling in. Appearance of a new internal shore at the edge of the tide, urban growth in progress, particularly sensitive around Coyah, with occupation of low-lying terraces formerly rice-growing on hydromorphic sand. A few paddy fields remain, but many plots formerly developed on mangrove soil seem to have been abandoned. Dense, saturated urban zone of Conakry with corridor extension in progress along the road to Kindia towards the interior.		
Dynamics	No remarks.		
Stakes	Maintain the vegetation of mangrove trees still being exploited illegally. Control urbanisation on lowlands, although not exposed to storm surges, in the long term risk of rise in sea level. Rocky shore of the urban peninsula quite stable, except in places for certain houses on the edge of the shore and exposed to rock fall. Wastewater lagooning plant exposed to ocean waves.		
Actions	The treatment of the Conakry littoral zone raises more global questions related to the organisation of urban services, equipment and the road system. The restoration or development of a landscaped seafront to promote the building and historical heritage will in any case have to be envisaged in the future.		
Priority	High Monitoring-Observation Intensive and regular		

			ANTICIPATION
GN3-c	61 - LOOS ISLANDS		
Diagnostics	Rocky hardpan littoral zone with a few sandy creeks. Some historical and heritage sites. Tourist resort for residents of Conakry in the absence of other beaches less than 150 kilometres from the town.		
Dynamics	No remarks.		
Stakes	Maintain the site's landscape and leisure functions.		
Actions	Control the development of infrastructure destined for tourism. Limit urban sprawl on hillsides and protect natural vegetation.		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation

GN4 RICE GROWING ISLANDS OF SOUTHERN GUINEA

Serious problem of drinking water supply for the resident farmers in the hypothesis of a rise in sea level and a significant advance of the salt water wedge.

	MANGROVE & RICE
GN4-a	62 - KAKOSSA
Diagnostics	System similar to Kabak (following sector), without visible threatened developments. Higher percentage
	of surface area used for rice-growing in mangrove soils, with an increased risk in the event of a rise in sea
	level.
Dynamics	Dynamic, constantly evolving sector.
Stakes	Production zones put at risk (risk of submersion and deterioration of developments) during extreme storm
	events and/or rise in sea level.
Action	Global reflection to be undertaken on the sustainability of mangrove rice-growing systems and relevant

	improvements to address the context of a rise	e in sea level. Importance o	of the conservation of as wide as
	possible a littoral fringe of mangrove trees.		
Priority	Average	Monitoring-Observation	Regular



Location of linear villages on the fossil rims in mangroves (Guinea - source: JF Hellio & N Van Ingen)

	MANGROVE & RICE GROWING
GN4-b	63 - KABAK PLAIN
Diagnostics	Dense rice-growing island, subject to developments with drain and a dyke more or less fixed on a sandy rim type 2a. Narrow strip of mangrove trees in front of the dyke. Interior sandy rims with axial village. At the south point, island-peninsula connected by a highly unstable sand bank.
	"A Rural Engineering study in 1951 made it possible to develop 1,500 hectares, situated between the fossil rims and the back of the mangroves on the sea front. This development engendered the formation of sulphated and acid soil, causing mediocre harvests in the rice-growing areas and the sterilisation of a large part of the land suitable for rice growing. In addition, the maintenance of these hydraulic works unsuitable for the highly hydro- sediment mobility of the sector of Kaback, required a considerable investment in terms of labour and finance on the part of the local communities, the State and the development partners.
	The major costal development operation at Kabak was undertaken between 1975 and 1978. The work was entrusted to a Chinese company, which rehabilitated the existing 1,500 ha and then created an 800-hectare extension of the exploitable perimeter by building a 10 km dyke along the sea front.
	Unfortunately, two years after the rehabilitation work, an abrupt dredging caused the disappearance of the line rim, by causing it to retreat more than 300 metres towards the end of the fourth year of the rehabilitation. The conditions that presided over the destabilisation of these developments varied depending on the importance of anthropic activities carried out.

	At Kaback, the extension of polder is not followed by important runoff, usually directed inland. In Sep 1982, the conjunction of spring tides and renewed heavy seas specific to the end of the rainy season was a for the sea to breach the middle part of the dyke, followed some time later by a second breach towards the				
	In fact, the extension zone is located to the west of the island. It forms a strip approximately 1 km wide and i situated between the littoral zone and a sand dune. To protect this zone from flooding by the sea, a dyke 1 to metres high was built using the materials from the dune rim, located 1 km from the coast. This ancient dyke ha now been largely destroyed by the advancing sea.				
	The breach of the dyke at Kaback gave a clear indication of the natural risks engendered by marine erosion in Guinea. Kaback island is in fact a good illustration of the consequences of coastal erosion in Guinea. Despite a history of developments over the past fifty years, a succession of failures in 1996 led to the building of a new dyke, technically similar to the one that was washed away at the end of the 1970s. The implementation works for this dyke followed the same line, but slightly back from the place of the previous breach. The hydraulic system was reviewed and adapted to the drainage conditions and to the hydro-sedimentary situation observed when the structure was designed. We have therefore returned to the same situation as before. An impressive earth dyke, fixed hydraulic works not suited to the hydro-sedimentary mobility and costly in terms of labour and finance for the State and the local community. «				
	Source: Kabak plain case study.				
Dynamics	Strong tendency to regression under the effect of erosion. Fragile sector of largely artificialised mangrove.				
Stakes	Production zones put at risk (risk of submersion and deterioration of developments) during extreme storm events and/or rise in sea level. Very dynamic, changing sector, very fragile and directly sensitive to a rise in sea level.				
Action	Global reflection to be undertaken on the sustainability of mangrove rice-growing systems and relevant improvements to address the context of a rise in sea level. Importance of the conservation of				
	as wide as possible a littoral fringe of mangrove trees.				
Priority	Very high Monitoring-Observation Intensive and regular				
Case study	Case study of coastal erosion at Koba (Boffa) and Kaback (Forecariah prefecture). See annex 1.				



Sequence of developments on Kabak plain: From left to right: screen of mangrove trees, dyke and channels, production zones, linear habitat along the fossil sand rims (source: Google Earth)

	MANGROVE & RICE		
	GROWING		
GN4-c	64 - BENTY		
Diagnostics	Quite concentrated rice-growing area. Predominantly rice-growing on hydromorphic sand, but also in mangrove plots. Rice-growing strips in contact with high terrace – mangroves. Benty is more or less difficult to access in the rainy season. A few small developments on low-lying ground. Some oil palm plantations. Dry staple crops on flattened hills. Very fragile soils given the high rainfall.		
Dynamics	Fragile sector of largely artificialised mangrove.		
Stakes	More than two thirds of the extension in rice-growing is on hydromorphic sand, the remainder in mangrove swamp. Several sites identified with a potential for shrimp farming. Fragility of the "false cape" point on narrow rims of type 2a. The mangrove sector, which has been entirely cleared at the back and planted, is fragile. On the other hand, the interior littoral zone has conserved a strip of mangrove trees and its North Westerly exposure affords it some protection from storm surges. A project for an ore port mentioned, with considerable potential impacts to be analysed.		
Action	Global reflection to be undertaken on the sustainability of mangrove rice-growing systems and relevant improvements to address the context of a rise in sea level.		
Priority	Average Monitoring-Observation Regular		
Case study	Case study of coastal erosion at Koba (Boffa) and Kaback (Forecariah prefecture). See annex 1.		

SL – SIERRA LEONE

The littoral zone of Sierra Leone presents the following general characteristics:

- ⇒ Low density of human land use on the very sparsely populated littoral zone. Agricultural potential underdeveloped. Stakes often limited.
- ⇒ Littoral zone contrasted and diversified: straight/undulating littoral zones, the last large areas of mangroves before the Gulf of Guinea, rocky breakwater at Freetown.
- ⇒ Littoral zone more than 10 km wide, essentially constituted of sandy terraces in ridges and channels, the major part of the pedological milieu has turned to savannah and is very fragile, subject to local rainfall and evolving in places towards sterile, leached sandbanks.
- ⇒ Very limited stakes due to the low level of occupation, otherwise, possible creation of a conservation unit encompassing the interior wetlands and, subject to confirmation of the interest of the sites in terms of biodiversity (flora and fauna). The small Sherbro archipelago, with its shallows, probably constitutes an important ecosystem for marine biodiversity.
- \Rightarrow The rice-growing or even shrimp farming potential of the vast gutter of wetlands is difficult to asses, but could be significant.

The principal stakes can be summarised as follows:

North Zone: rice-growing under the direct or indirect influence of the sea.

Freetown:

- Control urbanisation of the tourist sector (to avoid urban sprawl)
- Probable extraction of sand on the beach to be controlled
- Exploitation of mangrove wood to be controlled
- Respect and preserve the natural hilly area.

South Zone: creation of a conservation unit encompassing the Sherbro islands.

Sierra Leone probably has a real potential for shrimp farming (physical conditions, terraces, hydrology and climate very similar to neighbouring Guinea), however, with non-negligible impacts, which should be taken into account, particularly the destruction of the mangroves or competition with rice-growing areas.

SL1	NORTH S	SIERRA LEONE	
			MANGROVE & RICE GROWING
SL1-a	65 - RIGHT B	BANK OF KOLENTE	
Diagnostics	The situation differs from that of the following s fields on hydromorphic sand. The dense habitat with a slightly higher elevation (as at Benty in ne has been improved	sector by the extension, is concentrated in linear eighbouring Guinea). On	approaching the sea, of paddy villages on the ridges of terraces the landward side the mangrove
Dynamics	Dynamic, constantly evolving sector.		
Stakes	Same remarks as for the following sector. A very unusual perimeter in the mouth, which shows how fertile the recent alluvial deposits are. Availability of drinking water and the advancing of the salt water wedge may constitute major problems for the dense populations on low terraces.		
Action	Global reflection to be undertaken on the sustainability of mangrove rice-growing systems and relevant improvements to address the context of a rise in sea level.		
Priority	Average	Ionitoring-Observation	No recommendations

			MANGROVE & RICE
			GROWING
SL1-b	66 - KC	DLENTE ESTUARY	
Diagnostics	The two large catchment areas with high ra basket for Freetown, vast developed area hydromorphic sand, but also in fresh wat agropedological and hydraulic systems are in Consequently, there is a high density of popu flattened hills. It seems that in the past there of the lowest lying paddy fields.	infall result in considerable as in both former mangro er paddy fields on adjace fact present). lation in strings of small villa were a few projects in this a	e sediment supply. The main rice oves, and on the thin layer of ent low-lying ground (the three ages on tracks along the crests of zone to control the water systems
Dynamics	Dynamic, constantly evolving sector.		
Stakes	Today, flooding is possible (not desired) during extreme storm events associated with the spates of the two rivers. Maintain small embankments. In the long term, if the sea level rises, develop more dykes/embankments? With the associated impacts to be managed (fertility, alluvial losses, fight against acidification).		
Action	Global reflection to be undertaken on the su improvements to address the context of a rise	istainability of mangrove ric e in sea level.	ce-growing systems and relevant
Priority	High	Monitoring-Observation	Regular

ANTICIPATION				
SL1-c	67 - LUNGI			
Diagnostics	Terrace on continental terminal with hard levels expressed as small headlands. Complex littoral zone with narrow rims isolating channels in a complex of thin terraces (especially in the south). Sediment transport under the influence of Rokel estuary. Central part of the littoral zone of type 4a with wide coves and beaches bounded by small headlands. Rapid development and growth of Lungi, related to the international airport, connected to Freetown by a fast shuttle and ferry. Housing approaches the shore which is not very buildable or built on, as it is isolated by thin rims and channels parallel to the shore. Linear northward growth along a track on a high terrace, linear residential village emerging along a 10 km stretch close to the beach. Vast vegetable growing areas on the periphery of Lungi.			
Dynamics	Dynamic, constantly evolving estuarine sector.			
Stakes	Tourism in the future, sector well serviced in relation to the airport; Anticipation of future tendencies to build on the beach.			
Action	Draw up a sector scheme, preventive reinforcement of land control.			
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation	

			ANTICIPATION	
SL1-d	68 - R	OKEL ESTUARY		
Diagnostics	Strong tendency to siltation upstream of Per	pel and its island. Importan	t alluvial supply from the Rokel.	
	Considerable areas of mangroves cleared (wo	ood for fuel?). No sign of ric	e growing.	
	Pepel: pier for ferry (abandoned?) with two wh	narfs in mudflat.		
	The ferry crossing to Freetown is today by Kupr towards Lungi, an airport town undergoing expansion.			
Dynamics	Probable siltation of the estuary, disappearance of mangrove trees.			
Stakes	Certainly related to the cause of the disap	pearance of mangrove tree	es in certain sectors, especially	
	upstream of Pepel. Asphyxiation of the hydrographic tuft still visible. Exploitation of wood?			
Action	Measures to preserve natural vegetation and control its exploitation.			
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose	
	_		of anticipation	

SL2

URBAN AND PERIURBAN FREETOWN

On sectors SL2-b, SL2-c and no doubt SL2-d, the beaches have very probably been put to use to supply sand for urban growth. Subject to confirmation, this is doubtless one of the major stakes in this littoral zone.

ANTICIPATION				
SL2-a	69 - URBAN SECTOR	ON NORTH/NORTH E	AST FRONT	
Diagnostics	Corresponds to the site of the historical town Kokel estuary, which allows a harbour with r south-south-westerly ocean waves. The few mangrove stands (or mud cleared of trees) ind the interior rocky littoral zone of the estual abundant and the urbanisation seems to be than in the mangroves, as is the case in Monre	n, with a rocky coast cleaner no jetty for protection, sligh creeks are marked with crease in thickness towards ry in open water. Howeve ocated on the hills which ha ovia.	ed by the removal current of the tly sheltered from the prevailing deposits of sand and silt. The the east and the south, isolating rr, the mangrove trees are still ave become "post-forest", rather	
Dynamics	No remarks.			
Stakes	Promote respect for the mangroves or even restore certain sectors. Preservation of the wooded hilly zone			
Action	Draw up a sector scheme, reinforce land control, measures to preserve natural milieus, hillside woods and wetlands.			
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation	

				URBAN
SL2-b	70 - GODERICH URB	SAN SECTOR ON WE	ST FRONT	
Diagnostics	Urban sector facing west. Rocky section and urban wetlands in places, one of which is residential settlements that are potentially at ri	d long coves with beaches isolated from the sea by sk. Vegetable growing perir	s of various widths. Si a narrow rim with a meter.	mall intra- road and
Dynamics	Situations to be analysed on a detailed scale in each particular situation. Limited sediment stocks.			
Stakes	Strong pressure of urbanisation on the residual unbuilt zones: banks of wetlands, wooded hills in this sector. Restructuring of the urban grid, green area to be preserved. Preservation of free access to urban beaches.			
Action	Draw up a sector scheme, reinforce land control, measures to preserve natural milieus, hillside woods and wetlands.			
Priority	High	Monitoring-Observation	Regular	

			URBAN	
SL2-c	71 - HAMILTON – LAKKA			
Diagnostics	Residential sector in which densification is ac	ccelerating. Predominantly	arge huts, some with swimming	
	pool, undergoing densification with no organis	ed urban grid. Tendency to	o urban sprawl on the hillsides of	
	the wooded breakwater. Development of build	ling towards a wetland which	ch should probably be protected.	
	Residential settlements in places on the edge	of the beach and wetland.		
Dynamics	Situations to be analysed on a detailed scale i	n each particular situation.	Limited sediment stocks.	
Stakes	Organisation of a real urban grid system. Sa	ave the last almost treeles	s landforms and the intra-urban	
	wetland. Preservation of free access to urban beaches.			
Action	Draw up a sector scheme, reinforce land control, measures to preserve natural milieus, hillside woods			
	and wetlands.	-		
Priority	High	Monitoring-Observation	Regular	

		URBAN
SL2-d	72 - FACADE WEST – TOKEH	
Diagnostics	Increasingly residential tourism coast. Complex, highly diversified littoral zone with all the possi at the level of detail (classes 5, 4a, 4b, 3c, etc.). Many sites have interesting landscape ac striking hilly landforms. Heritage of beaches interesting, with however: A highway, hard-surfaced in places, cut out more or less on the hillsides, with obvious collatera (erosion, landslides), destruction of vegetation. Urban sprawl of scattered building near the road, tracks and branches for off-road vehicles too littoral zone and the few small housing schemes and villages with a varying tourism compo lodges that were already in existence.	ible cases djacent to al impacts wards the nent, and
Dynamics	Situations to be analysed on a detailed scale in each particular situation. Limited sediment stock	S.
Stakes	The conditions are present for the development of a dense, busy tourism sector no more than 40 the town centre, with, at the beginning, villas with a panoramic view, lodges, hotels and then p densification. A detailed urban scheme is urgent, as is the protection of the wooded b (catchment area for a reservoir that supplies the town with water).	0 km from peri-urban reakwater

Action	Anticipate urban sprawl and tourist development by drawing up a sector scheme.		
Priority	High	Monitoring-Observation	Intensive and regular

				ANTICIPATION
SL2-e	73 - TOI	MBOU - CAPE SHILL	ING	
Diagnostics	Tombou: small town expanding along an axis towards Waterloo Freetown East. Cape Shilling: rocky point with small cliffs and rocky coast.			
	Track with panoramic view on the ocean side. Point served by track. Little building but beginnings of urban sprawl.			
	Remaining wooded vegetation in vigorous	hilly landform, but cleared	enclaves appearing.	
Dynamics	No remarks. Littoral zone with a tendency	towards sandy silt.		
Stakes	Manifest tourist potential. Development to be controlled: Landscapes, hotel establishments, etc. The point of the headland should be classified.			
Action	Drastic limitation of buildings on both hillsides and crests, landscape insertion of possible limited tourist			
	reception facilities. Classification as a conservation unit of the point of the headland to be studied.			
Priority	High	Monitoring-Observation	Watchkeeping for anticipation	the purpose of

			ANTICIPATION		
SL2-f	74 - B	ANANA ISLAND			
Diagnostics	Island consisting of rocky coast and hardpan. fishing villages.	. Beaches, creeks, vegetati	on of coconut trees. Some small		
Dynamics	No remarks.				
Stakes	Manifest tourist potential. Development to be controlled: Landscapes, hotel establishments, etc.				
Action	Implementation of a sector scheme if tourist facilities were to be developed.				
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose		

SOUTH CENTRAL SIERRA LEONE

MANGROVE & RICE GROWING

SL3-a	75 - BAY SOUTH OF THE FREETOWN MOLE				
Diagnostics	Extension in mudflats, littoral zone of mangrove trees, discontinuous, sometimes absent. Important rice-growing area with the two systems: Dyked paddy fields and rice-growing on thin layer of hydromorphic sand (dominant system). Hilly hinterland occupied by agriculture and small plantations to supply Freetown. Relatively dense habitat in villages (strings along the line of the tracks).				
Dynamics	Dynamic, unstable sector, tendency to siltation.				
Stakes	Changes in the shore in mangrove trees and siltation. Rice-growing under the influence of the sea in a context of rise in sea level.				
Action	No recommendations other than general ones regarding rice-growing.				
Priority	Average	Monitoring-Observation	No recommendations.		

			MANGROVES	
SL3-b		76 - SHENGE		
Diagnostics	Complex littoral zone structured by the headland that probably plays an important hydraulic role, with low importance of the "mangrove shores" relayed by sandy spits of type 2a. More intensive land use in the neighbouring sectors in the South West. Appropriation of a few mangrove swamp rice-growing plots, but guite localised in contact with the hilly terraces. Relicts of forests still present.			
Dynamics	Very dynamic, unstable littoral zone. Heavy erosion transferred to the littoral zone of Shenge, as well as on Plantain Island.			
Stakes	Probable densification of the population connected by the network of tracks in easy topography, more or less already in place, with string of small villages more or less distant from each other. It should nonetheless be noted that the post-forest soils, under the high rainfall conditions of the region, can easily turn into savannah if they are developed with crops other than trees. Plantain Island could disappear in the next two decades (source: case study)			
Action	Possible feasibility study of a protective system for Plantain Island if the stakes justify it?			
Priority	High	Monitoring-Observation	Intensive and regular.	

Case study Coastal erosion case study report: Shenge, Plantain Island and Bonthe. See annex 1.



On the left, former Shenge jetty destroyed by erosion, On the right, new infrastructure (source: case study).

SHERBRO - LIBERIA

SL4

This zone is globally very sparsely populated. The natural conditions that characterise this littoral zone: Estuarine and insular milieus, shallows, complex current system, relative aridity of the sands which have been leached despite the high rainfall advocate for a conservation and preservation effort on this unique system on the scale of the sub-region which is visibly still relatively well preserved. Given the extent of the site, the population living there, conservation solutions of the biosphere reserve or regional park type would seem to be the most appropriate. This conservation area could have a trans-border dimension, also encompassing the neighbouring areas of Liberia.

	ENVIRONMENT			
SL4-a	77 – SHERBRO ESTUARY			
Diagnostics	From 5 to 20 km wide on the sea front. Littoral zone almost totally covered in mangroves. Approaching the sea, sandy spits of type 2a. Rare villages, large straw huts (farmers and probably fishermen). The hinterland is moderately inhabited with forest relics on formations of high terraces of continental terminal. Some paddy fields in places on the inside edge of the mangrove.			
Dynamics	Dynamic, unstable estuarine sector.			
Stakes	Mangrove preserved (screen of Rhizophora and a few Avicennia stands). Sites and lands probably suitable for mangrove rice-growing and perhaps shrimp farming. Interesting tree vegetation in fan shaped wetlands.			
Action	Conservation of natural milieus to be envisaged in global action to preserve the ecosystem of Sherbro island.			
Priority	Low	Monitoring-Observation	Watchkeepin anticipation.	g for the purpose of



Protective wall built in the 1950s (Plantain Island), Today submerged during strong tides (source: case study).

		ENVIRONMENT
SL4-b	78 - TURTLE ISLAND BANKS	
Diagnostics	Unique system of sandbanks, shallows, extremely dynamic terraces, fashioned by the of the coastal drift current, tidal currents and fluvial sediment supply in spate season.	ne multiple influences
Dynamics	Totally dynamic and unstable sector, several hypotheses exist about the origin of the	bank⁵.
Stakes	Conservation of natural ecosystems. Zone to be included in a conservation unit that Sherbro islands and possibly the preceding sector.	also incorporates the
Action	Instigate a study of a large conservation unit with an original status such as de B Regional Natural Park, also reconciling the possibilities of developing tourism, ec settlement and fishing. The Turtle bank should legitimately be assigned a rigorous co	tiosphere Reserve or cotourism, residential onservation status.
Priority	High Monitoring-Observation Regular	

⁵ Anthony. E. J. 2004.- The Turtle Bank, Sherbro bay, west Africa: estuarine-modified inner shelf shoal. Marine Sandwave and River Dune Dynamics - 1 & 2 April 2004 - Enschede, the Netherlands. 8p.

				ENVIRONMENT	
SL4-c	79 - SHE	RBRO - MAIN ISLAN	ID		
Diagnostics	Remarkable estuary. Practically uninhabited. Small strategic village and historical port of Bonthe, formerly a relatively important town. Sector not very visible on the high resolution images. Another village to the south with a few huts. Micro-lagoons in the south. Attempts by private investors to promote the unique setting of this insular system.				
Dynamics	Extremely complex current system, importance of fluvial sediment supply, east-westerly coastal drift. Erosion observed on the Bonthe site				
Stakes	Zone to be included in a conservation unit incorporating all the sectors in the zone.				
Action	Instigate a study of a large conservation unit with an original status such as de Biosphere Reserve or Regional Natural Park, also reconciling the possibilities of developing tourism, ecotourism, residential settlement and fishing.				
Priority	Average	Monitoring-Observation	Regular		

			ENVIRONMENT
SL4-d	80 - SHER	BRO - MOUTH OF MO	A
Diagnostics	Highly homogenous littoral zone along a straight stretch of around a hundred kilometres, becomes diversified depending on the proximity of the shore and the depth of multiple channels on terraces. Terraces in ridges and channels composed of recent sands with discontinuous shrubs and tree vegetation.		
	The complex of terraces and channels c (between 500m and 5 km) by a continuous several streams with vast catchment areas islands.	orresponding to successive s "gutter" of interconnected v s, with a final outlet in man	phases of genesis is bordered wetlands, receiving the waters of groves approaching the Sherbro
	Subject to an inventory, this zone pres characteristics of poor, "arid" vegetation in sandy soils.	sents a rich system of flo a weather zone with high r	ora and fauna associated with rainfall (> 3,000 mm) on leached
Dynamics	No remarks, but the morphology of the littoral zone confirms the existence of a component of an east- westerly coastal drift current.		
Stakes	For 10 to 20km landward from the littoral zone, practically uninhabited area, without no sustainable agricultural future on sandy terrace and undetermined potential agricultural use in the wetlands. Little potential for coconut plantations (as in Côte d'Ivoire). Possibly plantations of eucalyptus More certainly, pertinent zone to be included in a conservation approach as mentioned above.		
Action	Instigate a study of a large conservation unit with an original status such as de Biosphere Reserve or Regional Natural Park, also reconciling the possibilities of developing tourism, ecotourism, residential settlement and fishing.		
Priority	Low	Monitoring-Observation	lo recommendations.

			ENVIRONMENT	
SL4-e	81 - SULIMA - MOUTH OF MOA			
Diagnostics	Sulima, a small village situated on the coast ju Configuration of the estuary involves a strong of a vast lateral wetland.	ust before Liberia, some agr , westward coastal sedimer	iculture on alluvial deposits. ht drift. This drift blocks the outlet	
Dynamics	Unstable estuarine zone.			
Stakes	Zone to be included in a conservation unit unless, for different reasons relating to the border, Sierra Leone wished to see a densification of human land use in places.			
Action	Instigate a study of a large conservation unit with an original status such as de Biosphere Reserve or Regional Natural Park, also reconciling the possibilities of developing tourism, ecotourism, residential settlement and fishing.			
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation	

+	

П

LR - LIBERIA

SIERRA LEONE - ROBERTSPORT - MONROVIA LR1

				ENVIRONMENT
LR1-a	82 - SIERRA LEC	ONE - ROBERTSPO	RT	
Diagnostics	Vast sector of wetlands behind the littoral zone. Practically uninhabited, but some agricultural clearing on sandy terraces. Straight littoral zone, narrow rims-lidos separating channels parallel to the shore.			
Dynamics	Highly localised situations related to the presence of rocky outcrops and exposure to ocean waves at the level of the Robertsport breakwater. North part very unstable with sandy spits in the lagoon mouth and long rim–lido separating a lagoon channel from the shore towards the north.			
Stakes	Not suitable for agriculture, in wetlands or very fragile sands (white sands leached by the high rainfall as soon as the vegetation coverage has disappeared). Would be suitable rather to be included in a vast binational protected area stretching as far as Sherbro island.			
Action	Instigate study of transborder conservation unit with Sierra Leone (see above).			
Priority	Low	onitoring-Observation	No recom	mendations

			ENVIRONMENT
LR1-b	83 - ROBERTSPORT		
Diagnostics	The intrusion of basic rocks from the Robertsport breakwater plays an important role in the structuring of the coastal current system. Marine protected area of Cape Mount. Robertsport is a small village at the foot of the rocky breakwater connected by a track towards Monrovia. The coast north of Robertsport is straight and fragile.		
Dynamics	Highly localised situations related to the presence of rocky outcrops and exposure to ocean waves at the level of the breakwater. Sandy spits very unstable at the level of the mouth of the lagoon.		
Stakes	Preservation of the biological diversity of a system of more or less well preserved landscape and forestry sites.		
Action	Instigate study of transborder conservation unit with Sierra Leone (see above).		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation

ENVIRONMENT

LR1-c	84	- LAKE PISO	
Diagnostics	Vast lagoon of around 100,000 hectares, subject to the tide with adjoining wetlands. Tendency to siltation, and to filling in of outlets.		
Dynamics	No remarks.		
Stakes	Preservation of the biological diversity of a system of sites and wetlands.		
Action	Instigate study of transborder conservation unit with Sierra Leone (see above).		
Priority	Low	Monitoring-Observation	No recommendations

			ENVIRONMENT
LR1-d	85 - EAST ROB	ERTSPORT - MONRO	AIVG
Diagnostics	Slightly undulating, straight littoral to Lofa estuary, then straight. Almost continuous presence of channels and wetlands parallel to the shore. Very narrow littoral rims. Practically uninhabited littoral zone. Wetlands around the Lofa estuary, the whole area seems to offer great diversity.		
Dynamics	No remarks.		
Stakes	Preservation of the biological diversity of a system of sites and wetlands.		
Action	Instigate study of transborder conservation unit with Sierra Leone (see above).		
Priority	Low	Monitoring-Observation	No recommendations
```
LR2 ZONE UNDER THE INFLUENCE OF MONROVIA
```

The entire zone of Monrovia has been subject to a considerable influx of population during the episodes of instability in Liberia. The requalification of precarious settlements stands out as the priority in terms of urban development, which should be associated with the structuring of a sea front and secured urban beaches. The implementation of proper infrastructure for landing fishing catches on a site which remains to be determined.

Monrovia has a combination of problems that generate real risks, with a high level of settlements concerned:

- \Rightarrow Flood risk.
- \Rightarrow Risks related to a rise in sea level.
- \Rightarrow Erosion of the coasts, including rocky coasts.
- \Rightarrow Instability of the littoral zone which is extremely sensitive to any coastal developments.

Regarding local geodynamics, the Monrovia breakwater plays a structural role on the whole of the Liberian coastal current system.

LR2-a 86 - NORTH SAINT-PAUL RIVER – RIGHT BANK	86 - NORTH SAINT-PAUL RIVER – RIGHT BANK		
Diagnostics Very narrow fluviomarine terrace with the AFRICA hotel complex/village of OUA in an almost inst	ular		
position. Littoral zone in a thin rim bordered with wetlands.	position. Littoral zone in a thin rim bordered with wetlands.		
Dynamics Zone undergoing erosion still subject to impacts of the development of Monrovia harbour.	Zone undergoing erosion still subject to impacts of the development of Monrovia harbour.		
Stakes While the terraces situated in depth can bear urban development as an alternative to the saturation of Monrovia site, the characteristics of this coastal fringe make it unsuitable for the safe, sustainadevelopment of periurban residential districts on the sea front.	While the terraces situated in depth can bear urban development as an alternative to the saturation of the Monrovia site, the characteristics of this coastal fringe make it unsuitable for the safe, sustainable development of periurban residential districts on the sea front.		
Action Anticipate the development of residential districts and possibly planning of such districts in a global	Anticipate the development of residential districts and possibly planning of such districts in a global sea		
front scheme that respects the constraints of the site.	front scheme that respects the constraints of the site.		
Priority High Monitoring-Observation Intensive and regular			



Attempt to erect protection around the Africa - village of OUA (source: Liberian national diagnostic study)

		PERIURBAN & URBAN	
LR2-b	87 – INTERIOR LAGOON		
Diagnostics	Sector with significant amount of precarious human settlement on flood-pron- surrounding more or less planned urbanisation on low fan-shaped hills openi	e former mangrove swamp, ing onto wetlands.	
Dynamics	High risk of flooding/submersion.		
Stakes	Large area of dense habitation in a zone with a high risk of flooding in the event of surges associated with continental spates and/or a future rise in sea level.		
Action	Early warning system. Flood risk prevention plan. In the long term, relocation	of the population.	
Priority	Very high Monitoring-Observation In	tensive and regular	



Habitation in flood-prone area (Monrovia interior lagoon) - Source: Google Earth)



Control of solid waste, wastewater and runoff is still an omnipresent problem in Monrovia (Source: Liberian national diagnostic study)

	URBAN
LR2-c	88 - WEST POINT - MESURADO MOUTH AND HARBOUR AREA
Diagnostics	This sector and the previous one (former interior lagoon, former mangrove) concentrate almost all of the most serious risks in Liberia. Littoral zone in a complex, highly artificialised situation. Harbour sheltered by the sediment systems of the interior lagoon and the St Paul river by two dykes.
Dynamics	Sediment drift current oriented somewhat westward. Tendency to accretion blocked by the South pier and to erosion guided by the North pier on the urban beach North of the harbour, also of fishing landing point. The sandy spit of West point seems to be in a state of dynamic equilibrium in the medium term, with, however, phases of erosion and accretion and serious risks of submersion in the event of ocean surges.
Stakes	Very low area topographically with large sectors of unplanned, very dense, at risk habitation at the level of West Point and North of the port.
Action	Control of sea front urbanisation. Draw up sector scheme allowing for requalification (withdrawal? Relocation?) of the at risk fishermen's districts.
Priority	Very high Monitoring-Observation Intensive and regular



Precarious settlements of fishermen at West Point (source: Liberian national diagnostic study)

	URBA	١N	
LR2-d	89 - MAMBA POINT - SINKOR		
Diagnostics	Historical town with planned grid on peninsular site, with precarious islets of habitation. Littoral zone with headlands, undulating, very exposed to ocean waves, with residential settlements on the sea shore. Vas urban beach, divided by rocky headland but subject to erosion.	ith ist	
Dynamics	Straight littoral zone undergoing erosion in places.		
Stakes	Principal urban beach in Monrovia, sector scheme and sea front development desirable.		
Action	Control urbanisation along sea front. Sector scheme to be drawn up allowing for the implementation of a sea front and a secured urban beach, possible improvements to be planned.		
Priority	High Monitoring-Observation Intensive and regular		

URBAN

LR2-e	90 - SINK(OR - PAYNESVILLE	
Diagnostics	Straight littoral zone sector adjacent to precarious habitation.	wetlands. Urbanised,	mixed residential, islets of
Dynamics	Straight littoral zone undergoing erosion in place	xes.	
Stakes	Low topography, risks of flooding.		
Action	Control urbanisation along sea front.		
Priority	High	Monitoring-Observation	Regular

			URBAN
LR2-f	2-f 91 - PAYNESVILLE - MAMGBALI		
Diagnostics	stics Predominantly residential habitat, concessions on the edge of the sea front.		
Dynamics	Littoral zone with headlands and coves and a tendency to erosion.		
Stakes Control of building gradually becoming more dense along the seashore.			
Action Control urbanisation along sea front.			
Priority	Average	Monitoring-Observation	Regular



Precarious habitations (close to airport) - source: Google Earth and Liberian national diagnostic study

			ENVIRONMENT & TOURISM
LR2-g	92 - MAMGBALI - SOPWE TOWN		
Diagnostics	Urbanisation growing towards the coast, residential huts and some hotels, all on the edge of the beach or North of the lagoon (Schefflin lagoon – approximately 3.5 km ²) on terrain with often very low, complex topography (fan-shaped wetlands). Extraction of materials.		
Dynamics	Highly unstable straight littoral zone undergoing erosion. Reflective beaches on the rim. Marked erosion in the west of the sector (Barnes and Thinker beach).		
Stakes	Schefflin lagoon is managed by the armed forces. It can therefore theoretically be considered protected. However, the opening of new sand extraction sites in the east may further deteriorate an already highly unstable rim.		
Action	Reinforce protection of Schefflin lagoon. Sector scheme to organise urban and residential development.		
Priority	High	Monitoring- Observation	Regular



Drying out - siltation of an outlet from Schefflin lagoon Due to extraction of materials and erosion (source: Liberian national diagnostic study)



Barnes beach and Thinker village breach (source: Liberian national diagnostic study).

				TOURISM
LR2-h	93 - SOPV	VE TOWN - DOLOTA		
Diagnostics	Discontinuous urbanisation extends along a narrow site in a peninsular situation surrounded by a system of wetlands and lagoons landward and isolated from the littoral zone by a series of lagoons and channels closed by a narrow, more or less straight coastal rim-lido.			
Dynamics	Highly unstable estuary outlet site.			
Stakes	Installation on the sandy spit seems to present high risks and should be reserved for temporary, light tourist facilities.			
Action	Total ban on building on the sandy spit. Withdrawal and relocation of at risk habitations			
Priority	Average	Monitoring-Observation	Regular	

DOLOTA - BUCHANAN

				ENVIRONMENT
LR3-a		94 - DOLOTA		
Diagnostics	Very sparsely occupied zone, with numer from Buchanan stretching for around thirt of a lagoon parallel to the coast.	ous wetlands close to the y kilometres. Long, very n	e littoral zone. Track aarrow rim – lido effe	close to the coast active as the shore
Dynamics	No remarks.			
Stakes	The opportunity and the possibility of preserving zones of interest in terms of biodiversity: Wetlands, terraced forests, in particular around Buchanan. The one around the small village of Dolota is connected to an almost intra-urban wetland in the eastern prolongation of Monrovia.			
Action	Validate and define options to protect biod	diversity		
Priority	Average	Monitoring-Observation	Watchkeeping for anticipation	the purpose of

	URBAN
LR3-b	95 - BUCHANAN
Diagnostics	Complex site, artificial, submerged groynes, erosion generalised despite a few sites undergoing accretion in places. Urban habitations sometimes planned near the shore.
Dynamics	Very dynamic site, alternate areas undergoing erosion and accretion.
Stakes	A site undergoing erosion to be controlled, extractions of materials prohibited today and relocated to Upper Buchanan on the St John River estuary in the North. Erosion seems to be largely related to harbour developments and material extraction.
Action	Total ban on building between the urban coastal roads and the shore. Withdrawal and relocation of at risk
	habitations; sector scheme able to incorporate some improvements if cost compatible with the stakes.
Priority	High Monitoring-Observation Intensive and regular



Artificial groynes at Buchanan (source: Liberian national diagnostic study).





Protection of the coast at Buchanan (old tyres, beginning of rock-fill)

LR4	BUCHANAN - RIVERCESS - GREENVILLE - GRANCESS
-----	---

- ⇒ Practically uninhabited sectors on the edge of the littoral zone, apart from a few villages always located in proximity to a headland and a small estuary.
- \Rightarrow Sectors that are very isolated regarding the road network.
- ⇒ Dense network of coastal rivers and five large rivers flowing into the coast in more or less extensive estuarine wetland complexes.
- \Rightarrow Only one significant agglomeration apart from Greenville.
- \Rightarrow Relatively uninhabited, post forest type coastal strip 50 km long. Islets of forestry under exploitation.

In the long term, the stakes concern the colonisation and intensification of clearing (as in Côte d'Ivoire) more in an inland direction. In general, the first two kilometres from the shore are relatively unsuitable for agriculture: wetlands, small terraces of fragile white sands.

The implementation of a programme to preserve the small estuaries (inventory of biological resources, organise and inform population and local authorities, sector schemes for areas under development) would be pertinent, with a view to early promotion of sustainable management methods for these rich, fragile milieus, in a context where human land use is still limited in an isolated environment.

For all of these sectors, the priority is low, and no particular recommendations are given in terms of monitoring-observation.

		ENVIRONMENT
LR4-a	96 - BUCHANAN – RIVERCESS	
Diagnostics	Coastal area of headlands and coves. 50 kilometre strip served by a secondary road significant density of agricultural use.	. Plantations and

	ENVIRONMEN	1
LR4-b	97 - RIVERCESS	
Diagnostics	Small town with landing strip. Complex estuarine site difficult to turn into a port because of nearby reefs.	

LR4-c	98 - RIVERCESS - GREENVILLE
Diagnostics	Relatively uninhabited. Coastal landscape sites of headlands and coves (Sasstown and King William) but tourist developments practically non-existent.

LR4-d	99 - GREENVILLE			
Diagnostics	Agglomeration with planned grid, town structured in several natural islets separated by wetlands and port			
	on the estuary. Headiand with port and pier. Town relatively isolated from the road network.			

	-
END OF DATE OF	

LR4-e	100 - GREENVILLE - GRANCESS
Diagnostics	Almost deserted littoral zone, very marked headlands with rocky banks jutting out into the sea and reefs. Numerous segments of straight littoral zone with narrow rims-lidos, wetlands and channels parallel to the shore.

LR5

П

GRANCESS – CAP PALMAS

				ENVIRONMENT
LR5-a	101 - GRANCESS			
Diagnostics	Vast system of more or less wooded wetlands, coastal white sands and estuarine lagoons. Sector uninhabited in the eastern part. Grancess is a small town with a planned grid, including an attempted housing scheme. Road connection to the north on hills turned into savannah towards Niebo and rubber plantations. Track on a small terrace in the east; oil palm plantations.			
Dynamics	No information.			
Stakes	Conservation unit to be envisaged, development of ecotourism.			
Action	Encourage low impact tourist development in organised circuits.			
Priority	Low Mor	nitoring-Observation	No recomm	nendations

	_
ENVIRONMENT	

		ENVIRONMENT
LR5-b	102 - GRANCESS - HARPER	
Diagnostics	Littoral zone uninhabited except for two small villages. Two rocky headlands of proba Several complexes of estuarine wetlands and lidos.	able landscape value.

			ANTICIPATION	
LR5-c	103 - HARPER			
Diagnostics	Estuarine site, town on rocky, hilly peninsula. Former administrative centre. Wetlands at the back of the estuary to the north. The surroundings of the town have been largely cleared. Future harbour town if the area undergoes significant development.			
Dynamics	No information.			
Stakes	Future centre of border zone development?			
Action	No recommendations.			
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation	

		ENVIRONMENT
LR5-d	104 - CAP PALMAS	
Diagnostics	Small rocky zone extending as far as Harper by a lagoon close to the littoral zone (fragile lido east of Harper, Border zone which will possibly be subject to densification	lake Sheperd). Long

CI – COTE D'IVOIRE

Côte d'Ivoire has a White Paper on coastal development, drawn up within the framework of the coastal environment management project (2001-2003).

LIBERIA BORDER – SAN PEDRO

Echeloned coast with alternate small rocky headlands and creeks or long sandy coves. Change dynamics relate to very localised conditions on each site, surrounded by accentuated hilly landforms.

High density of micro estuarine lagoons, outlets of small coastal rivers.

CI1

Human land use density has long remained low towards the littoral zone and limited around the four agglomerations: Tabou, Grand Bereby, San Pedro and Sassandra. The completion of a full road link, located most often less than 10 km from the littoral zone, has already induced a post-forest agricultural situation that will be almost generalised in the medium term.

Generally, the habitations and villages remain some distance inland from the beaches.

The potential of attractive landscape sites locally sheltered from the ocean waves is important, but use is limited to local populations with motor vehicles. Tourist development projects have been envisaged (1970s and 80s), but were restricted by lack of international investment.

A high densification of agriculture on the accentuated hilly landform highly unlikely and, in this context, maintaining satellite tracks from the coastal road will always remain costly.

Little tradition of fishing among migrants, more centred on the cash crops of coffee, cacao and staples, therefore not much interest for settlements on the sea front or beach.

In the long term, human land use of the littoral zone is only to be expected on sites subject to tourist development, with a national and international clientele.

When the time comes, accompaniment will be indispensable for investments to preserve attractive landscape and environmental resources, as well as caution regarding developments on the edge of the beach.

		ENVIRONMENT		
Cl1-a	105 - CAVALLY ESTUARY - LIBERIA BORDER			
Diagnostics	Particular morphology of the estuary: Sandy spits extending inwards. Two small villages on each side of the border. Complex of wetlands, woodland and various formations of vegetation. Sector largely cleared on the Côte d'Ivoire side to the edge of the littoral zone. Very sparsely populated.			
Dynamics	Highly unstable estuary outlet site.			
Stakes	No particular stakes, possible future densification in the event of a growth in activity on the Liberian side and possible development of a harbour town at Harper.			
Action	Possible set up of transborder protected area of approximately 10,000 hectares on Cavally estuary.			
Priority	Low	Monitoring-Observation	Watchkeeping of anticipation	g for the purpose

RURAL

CI1-b	106 - TABOU WEST		
Diagnostics	Sparsely populated sector. Large clearings.		
Dynamics	No remarks.		
Priority	Low	Monitoring-Observation	No recommendations

				RURAL
Cl1-c	1	07 - TABOU		
Diagnostics	Town planned within the framework of the development of oil palms, with attempt at plot division of a satellite town in the east. Fluvial channel parallel to the sea shore, but separated from it by a wide terrace. Rocky spurs stabilising the river mouth. Today there is a good road connection with Abidian.			
Dynamics	No remarks.			
Stakes	Few stakes in the future, low population density in nearby Liberia, San Pedro, 100 km away, looks more attractive as a centre for services and infrastructure connected towards the exterior.			
Action	No action identified			
Priority	Low	Monitoring-Observation	No recommendations	;

			ANTICIPATION
CI1-d	108 - TABOU EAST		
Diagnostics	Sector of sandy terraces, sparsely populated, straight littoral zone. Oil palm plantations on terraces and flattened hills towards the interior.		
Dynamics	Micro-outlets of estuaries and lagoons, typically filled in, but meanders of the river are breaching the narrow lido. Full reconfiguration of the river mouth in the long term if the lido is breached.		
Stakes	Future tourist development?		
Action	No action identified		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation

			ANTICIPATION
CI1-e	109 - GRAND BEREBY		
Diagnostics	Zone largely cleared with small villages on the edge of the littoral zone, but largely removed from the		
	beach (no danger). Grand Bereby, small	town with an attractive, sl	ightly sheltered cove. South of Grand
	Bereby, seven east-facing, handsome coves with tourist potential		
Dynamics	Unstable beaches (erosion/accretion)		
Stakes	Future tourist development.		
Action	Anticipate development of building a hospitality infrastructure along the line of the beaches.		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of
			anticipation

			ENVIRONMENT
CI1-f	110 -	SAN PEDRO WEST	
Diagnostics	Numerous coastal lagoons, isolated, sp	arsely populated zone of	lespite proximity of San Pedro.
Dynamics	No remarks.		
Priority	Low	Monitoring-Observation	No recommendations

URBAN & HARBOUR

Cl1-g	111 - SAN PEDRO URBAN ZONE AND WEST PERIPHERY		
Diagnostics	New town fully planned in the 1970s during the boom in forestry then in coffee and cacao that are more or less processed locally. Coastal-seafront road. Random, unplanned development of dwellings on the edge of wetlands north of the town, on flood-prone land, as the extension of the lower course of the river does not facilitate drainage and evacuation of spates.		
Dynamics	This sector is part of a system of mixed, echeloned coastlines typical of the west of Côte d'Ivoire. The entry channel to the port is protected against siltation by two piers preceded upstream of the drift by structures transversal to the coast (experimental groyne and rock-fill serving as dykes to stop the sand). This infrastructure has disrupted sediment transport, causing instability of the beaches between the port and the mouth of the San Pedro (reflective profile, scalloped bars). The general trend in the sector is towards are characterized against with however, opicedes of acerdian west of the Pert		
Stakes	Role and place of San Pedro harbour in the country's economy. Airport area in the event of future tourist development. Feasibility and sustainability of intended works to extend the harbour zone (a container park in particular) depending on the coastal dynamics observed.		
Action	Improve drainage and management of rainwater. Relocate precarious settlements located in flood-prone area. Sector scheme for the entire urban coastline. In-depth studies prior to the extension of the port.		
Priority	High Monitoring-Observation Intensive and regular		
Case study	Characterisation of morpho-sedimentary dynamics of the Côte d'Ivoire littoral zone See annex 1.		



Disposition of structures at the level of San Pedro harbour (source: case study).



Horizon restaurant threatened with destruction (Tombolo - experimental groyne beach segment) - Source: case study.



Unearthing of the root of the east pier (East pier beach segment). Source: case study.



Site of the littoral perimeter of San-Pédro (source: case study)



Rates of shoreline change on the San-Pédro littoral perimeter between June 2007 and August 2009. Source: case study.

CI2 EAST SAN PEDRO - SASSANDRA - FRESCO

			ENVIRONMENT
Cl2-a	112 - E	AST SAN PEDRO	
Diagnostics	The west boundary is the San Pedro, the bed of which was shifted to develop the estuary into		
	a harbour. Isolated, uninhabited littoral zone not accessible by road.		
Dynamics	To be analysed in each local situation.		
Priority	Low	Monitoring-Observation	No recommendations

	ENVIRONMENT & TOURISM
Cl2-b	113 - RIGHT BANK OF SASSANDRA
Diagnostics F- Oi SI SI th Cu Ki Si Ui ui ui	Forest reserve severely deteriorated and cleared in proximity to the coastal road and almost completely on the eastern third towards Sassandra. Uncleared patches remain, however, in particular, in the western aart of the forest reserve and on the edge of the littoral zone. A few sites with tourist potential already lightly developed (Monogaga cove). Two small lagoons closed off by a micro barrier are of interest. In the absence of a drastic reduction in the clearing of the forest reserve, which is quite unrealistic given the urrent context, certain forms of protection could be considered at the level of the littoral strip (a band 1 m wide) with a status to be examined. Cassandra is a historical town, tourist centre in the same category as Grand Bassam. Hilly landscaped ite, sheltered in places towards the eastern part. Pier, small harbour shelter with possible impact on the rban beach. Fishing centre. Interior estuarine site, potential for facilities for yachting if there is a passage to the estuary. Sassandra West hills close to the littoral zone, with a read serving all the plantations. On

	the littoral zone, numerous sites of beaches, coves and creeks with tourist potential. Sassandra and the vicinity have been the subject of tourist development studies.		
Dynamics	Each local situation to be analysed. High rate of erosion nonetheless noted on the Monogaga site,		
	threatening residential and tourist buildings (often substandard).		
Stakes	Preservation of the forestry environment and of the landscape and seaside resort appeal of beach sites		
	with a view to developing high value added tourism.		
Action	Sector scheme and anticipation of the development of hotel facilities on the most sought after sites		
	(Monogaga for example).		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of
			anticipation

ENVIRONMENT

Cl2-c	114 - SASSANDF	RA LEFT BANK - DAG	GBEBO
Diagnostics	Site with tourist and landscape potential at the level of Dagbego. Headland oriented eastward and permanent lagoon. Wetland complex on the right bank and island. Site of potential value for biodiversity.		
Dynamics	Numerous fragile and unstable sites at the mouths of small estuaries (spits and lidos). To be analysed in each local situation.		
Stakes	Conservation of a system of wetlands and a potential for tourism and landscape exploration.		
Action	No action recommended		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation

			ENVIRONMENT
Cl2-d	115 - DAGBEBO - FRESCO		
Diagnostics	Littoral zone with little agricultural activity, but a land clearing face is advancing towards the littoral zone. Numerous small lagoons at outlets of small coastal rivers closed off by narrow sand barriers.		
Dynamics	Numerous fragile and unstable sites at the mouths of small estuaries (spits and lidos). To be analysed in each local situation.		
Stakes	Conservation of a system of wetlands and a potential for tourism and landscape exploration.		
Action	No action recommended apart from efforts to conserve sites and natural ecosystems.		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation

CI3

FRESCO - ASSAGNY

Area of land completely cleared to plant coconut groves, scattered relicts of natural vegetation more or less interspersed. Of botanical value and for the biodiversity of the forest vegetation on sandy terraces to be confirmed.

CI3-a	116 - FRESCO			
Diagnostics	Lagoon complex of the South of Fresco. Very narrow littoral rim approximately 20 km long adjacent to lagoon complex, littoral channels, interconnected wetlands as far as the large Tadio lagoon. Ramsar site on the Fresco wetland. The Fresco lagoon is the only one in Côte d'Ivoire to shelter the two types of mangroves found in the country (lagoon and estuarine). The Fresco site is the articulation between the rocky, echeloned coasts in the west and the straight sandy coasts in the east.			
Dynamics	Numerous fragile and unstable sites at the mouths of small estuaries (spits and lidos). To be analysed in each local situation. At the level of the Fresco site, the barrier is undergoing erosion, announcing the situation of most of the sandy coastal zones towards the east. Episodic closures of the passes isolating the lagoons with risks of organic pollution.			
Stakes	Rich and diverse in terms of biodiversity related to wetlands complex, lagoons (varied milieus related to the hydrological system, flora and fauna of interest). Low human land used including on the littoral zone.			
Action	No action recommended apart from efforts to conserve sites and natural ecosystems.			
Priority	Low	Monitoring-Observation	Watchkee of anticipa	ping for the purpose

			ENVIRONMENT
CI3-b	117 - WE	ST GRAND LAHOU	
Diagnostics	Complex and dynamic estuarine zone, reconfiguration of littoral rims in progress in relation to the deficit in sediment supply caused by the dam over the Bandama.		
Dynamics	Straight, apparently stable littoral zone.		
Stakes	Conservation of coastal forest relicts.		
Action	Flora reconnaissance of the coastal forest relicts to be associated with Assagny conservation unit.		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation

URBAN & TOURISM

Cl3-c	118 - GRAND LAHOU, RIGHT BANK AND BANDAMA ESTUARY	
Diagnostics	Initially situated on the rim near the mouth of the Bandama, the town was relocated 18 km inland. The reason given to justify this relocation is erosion of building land. Tourist vocation weakened by the generalised instability observed at Lahou beach. Some evidence of forest vegetation covering twenty or thirty hectares must absolutely be preserved.	
Dynamics	Dynamic zone (average recession rate at the level of the Lighthouse: 1.7m per year). The sandy rim of Grand-Lahou is divided into two parts: To the west, the village of Kpanda and to the east, the town centre. The sandy rim is 365 m wide at the level of the village of Kpanda and 210 m wide in proximity to the river mouth. Impact of the sediment deficit related to Kossou dam built in the 1970s on the Bandama to be confirmed. The morphological variations of Grand-Lahou beach are cyclical, marked by the seasons, with periods of erosion and accretion corresponding to periods of high and low energy ocean waves. The erosion of the littoral rim destroyed the town's lighthouse. Over the period 1985-1990 erosion of approximately 2.5 m per year was observed. The lighthouse in the background was destroyed by erosion and was moved in 1989. The large quantity of sand transported from the west by the coastal drift current and the reduction in the flow of the Bandama contribute to the seasonal siltation of the lagoon passes. ⁶	
Stakes	Value of the biodiversity of the Bandama delta wetlands complex. Threatened stability of all urban and tourist installations situated on the sand spit of the river mouth. Deterioration and deforestation of mangroves, increasing the instability of the lagoon shores. Tendency towards episodic closure of the river mouth affecting fishing activities.	
Action	Inform occupants of the sandy spit in the estuary. Possible development programme to be examined in a highly dynamic context where impacts must be anticipated and properly assessed.	
Priority	Very high Monitoring-Observation Intensive and regular	
Case study	Characterisation of morpho-sedimentary dynamics of the Côte d'Ivoire littoral zone See annex 1.	

			ENVIRONMENT
CI3-d	119 - LEFT BANK OF BANDAMA		
Diagnostics	Very narrow, sparsely populated rim bordered by channels and wetlands, complex terraces with gouged channels. Coconut groves bordered in the north by Assagny canal, south border of National Park.		
Dynamics	Erosion. Impact of the sediment deficit related to the Bandama dam to be confirmed.		
Stakes	Value of the biodiversity of the Bandama delta wetlands complex.		
Action	Apply provisions for management and development of Assagny National Park.		
Priority	Average	Monitoring-Observation	No recommendations

⁶ Koffi.P. 2001.- Some aspects of present day erosion on the littoral unit of Côte d'Ivoire (Gulf of Guinea). 8p.



Grand Lahou sector (source: case study)

CI4 RURAL SECTOR ASSAGNY – JACQUEVILLE - ABIDJAN WEST

Straight, rather homogenous littoral zone, with generalised extension of large coconut groves on sandy terrace.

Planned villages served by road or track on sand parallel to the coast. Positioned inland and not at risk from the sea.

Despite the proximity of Abidjan and the ferry connection that crosses the lagoon, very little evidence of seaside homes other than the huts associated with the plantations.

The attractive littoral zone is rather the Ebrié lagoon, which has numerous residences along the edge of the lagoon, and boating facilities.

			RURAL
Cl4-a	120 - ASSAGNY - JACQUEVILLE		
Diagnostics	End of the hard-surfaced road, but improve scheme as for the following sectors: villages v Assagny canal, very narrow lagoonal channels	ed track on sand some wa with planned grids amidst th s on the edge of the beach.	ay back from the beach. Same ne plantations. At the level of the
Dynamics	Straight shoreline, very slight, practically impe	rceptible undulations (perio	d: approximately 10 to 15 km).
Stakes	No particular stakes, rural coconut groves, except for a few exceptions, localised some distance from the beach		
Action	No recommendations		
Priority	Average	Monitoring-Observation	No recommendations

			ANTIC	IPATION
Cl4-b	1:	21 - JACQUEVILLE		
Diagnostics	Small centre town surrounding an improved lagoon. Like all the planned villages in the sector, the initial grid allows for a natural strip of coconut trees on the edge of the beach. Locally, the buildings are nonetheless beginning to move closer to the beach. Hard-surfaced road connection to Abidian.			
Dynamics	Straight shoreline, very slight, practically imperceptible undulations (period: approximately 10 to 15 km).			
Stakes	Stakes essentially related to human land use on the edge of the lagoon, but also to vigilance regarding the advancement of building between the coastal track and the beach.			
Action	No action recommended			
Priority	Low	Monitoring-Observation	Watchkeeping for the pu anticipation	rpose of

			ANTICIPATION
Cl4-c	122 - JACQUE	EVILLE - WEST ABID	JAN
Diagnostics	This sector runs along the Vridi canal, an area adjacent to the lagoon, where urbanisation is in progress. The littoral part is scarcely used, and comprises sandy terraces that are not very fertile where only a few coconut palms are planted. Practically empty sector (land reserve?)		
Dynamics	Straight shoreline, very slight, practically imperceptible undulations (period: approximately 10 to 15 km). Slight tendency to accretion west of Vridi pier. Green front of coconut trees on the edge of the beach.		
Stakes	Stakes essentially related to land use on the edge of the lagoon.		
Action	Anticipation of the development of land use and sector scheme if it becomes denser.		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

ABIDJAN - PORT BOUET

Continuous urban area, with breaks on each side of the airport, situated directly opposite the Trou sans Fond (deep underwater canyon gouged out of the continental shelf directly below Abidjan). Growth towards the north and east (unplanned habitation east of the airport). Sandy terrace site, easy to equip.



Site of the littoral perimeter of Vridi-Port Bouet (source: case study)

 		URBAN & HARBOUR	
CI5-a	123 - PORT BOUET		
Diagnostics	Structured urban district including habitation and activities related to the port. Added to this are tourist installations (beach edge restaurants) and substandard habitations the most often in proximity to the beach. A protection plan based on a battery of eight 100-metre buoyant breakwaters at 400 to 450 metre intervals was drawn up but never implemented (mainly due to the cost). Works to widen Vridi pass are being considered. Exceptional ocean waves (due to a seismic event) in 2007, then in 2008 seriously affected this sector, with losses of dwellings and a beach recession of more than 15 m (source: national diagnostic study).		
Dynamics	Sector undergoing very active erosion. Impact of Vridi pier and sediment trap of the <i>Trou sans Fond</i> located perpendicular to the sector. Beach still in existence, with highly reflective profile, partly constituted of materials from the initial eroded terrace, large grain size of sand. The drop in removal currents due to the shifting of the water course towards the Vridi canal encouraged this process (case study).		
Stakes	Numerous dwellings and tourism infrastructure seriously threatened and exposed. Local impact of beach walls and "spontaneous" protective structures built by the locals. Stability of the infrastructure of the mouth of the channel giving access to the port.		
Action	Risk prevention plan and preparation of the population. Ideally, dwellings should be requalified and relocated further from the beach. Control of the proliferation of individual installations for defence and protection. Planning and requalification of the seafront (sector scheme).		
Priority	Very high Monitoring-Observation Interview	ensive and regular	
Case study	Characterisation of morpho-sedimentary dynamics of the Côte d'Ivoire littoral a	zone See annex 1.	



Lines of tetrapods placed in front of a protective wall in front of Coco Beach. Port-Bouët, Abidjan (October 2003). Source: case study.



Rock-fill being by-passed at the outlet to the harbour access channel.



Destruction of installations on the backbeach east of the installations of the harbour access channel outlet (source: JJ. Goussard)

	URBAN		
CI5-b	124 - PORT BOUET EAST		
Diagnostics	Dense habitation on a narrow coastal strip bounded by the main road (dual carriageway from the airport). Density increases from the airport. Only green footprint is the break in urbanisation constituted by the airport. Totally privatised area, little organised access to the beach. The progression of the sea contributes to the weakness of the constructions in the immediate vicinity of the beach. Sand extraction at several places.		
Dynamics	Sector undergoing progradation or stable in places. The oscillations due to the effects of the storm in 2007 and the consecutive reconstitution of the beach in the years that followed should not conceal the very unstable nature the sector.		
Stakes	Progressive privatisation of the beach. Continued densification of urbanisation north of the coastal road, as the plots to the south on the edge of the beach are already used. Future densification by division into concessions should be considered. Urban sprawl with the corresponding costs of equipment, roads, etc. Management of urban effluent.		
Action	Risk prevention plan and preparation of the population in the event of surges. On the whole eastern part of the sector, requalification and relocation of habitations further back from the road. Planning and requalification of the sea front (sector scheme).		
Priority	Very high Monitoring-Observation Intensive and regular		
Case study	Characterisation of morpho-sedimentary dynamics of the Côte d'Ivoire littoral zone. See annex 1.		

CI6

PERIURBAN AREA EAST ABIDJAN – GRAND BASSAM

			URBAN
Cl6-a	125 - ABIDJAN	EAST PERIURBAN A	REA
Diagnostics	Vast terrace with no channels or lagoons. Coastal road inland (300m). "Rurban" residential strip along the beach, surveyed and continuous with coconut plantations. Vast "projects" to create plots for building inland from the beach. Progressive densification of habitation approaching Abidjan.		
Dynamics	Sector undergoing active erosion.		
Stakes	Progressive privatisation of the beach. Continued densification of urbanisation north of the coastal road, as the plots to the south on the edge of the beach are already used. Future densification by dividing into concessions should be considered. Urban sprawl with the corresponding costs of equipment, roads, etc. Management of urban effluent.		
Action	Urban organisation and structuring of the districts divided into building plots (centre district?), equipment. Inform the populations and residents on the edge of the beach.		
Priority	High	Monitoring-Observation	Intensive and regular

URBAN & TOURISM

Cl6-b	126 - GRAND BASSAM V	VEST COAST		
Diagnostics	Habitation on very narrow rim-lido. Strong tendency to but party, widening of the terrace. Coastal road near the beach	Habitation on very narrow rim-lido. Strong tendency to build, including in at risk zones. In the western party, widening of the terrace. Coastal road near the beach (60 to 200 m).		
Dynamics	Sector undergoing active erosion. Sector was subject to associated with ocean swell.	Sector undergoing active erosion. Sector was subject to damage and flooding during storm surges associated with ocean swell.		
Stakes	Strong tendency to build on the edge of the beach (linear sprawl of coconut groves), development of residential buildings close to urban Abidian. Progressive privatisation of the beach.			
Action	Reconquer land ownership control, supervision and limitation of the development of building. Inform the populations and residents on the edge of the beach. Sector scheme to supervise the development of building.			
Priority	Very high Monitoring-Obs	servation Intensive and regular		
Case study	Characterisation of morpho-sedimentary dynamics of the Cô	te d'Ivoire littoral zone. See annex 1.		

	URBAN
Cl6-c	127 - GRAND BASSAM
Diagnostics	Historical town on a narrow terrace adjacent to a lagoon, almost insular position, area suitable for urbanisation on the site is practically saturated, hence growth spreading north and east. Road link to Abidjan.
Dynamics	Precarious stability. Risk of a combination of continental flooding and storm surge.
Stakes	High risks for all the dwellings on the edge of the beach (residential, tourism, old habitations and precarious dwellings spreading east along the very narrow rim-lido and on the low-lying land on the shore of the lagoon).
Action	Detailed flood-submersion risk prevention plan. Inform the population and residents on the edge of the beach. Resorption and relocation of precarious dwellings on the edge of the beach.
Priority	High Monitoring-Observation Intensive and regular
Case study	Characterisation of morpho-sedimentary dynamics of the Côte d'Ivoire littoral zone. See annex 1.

	TOURISM		
Cl6-d	128 - BASSAM ESTUARY LEFT BANK		
Diagnostics	Narrow terrace with coconut groves adjacent to a lagoon served by a permanent road, connected to the Bonoua, Grand Bassam, Abidjan main road. Materials extraction sites. Off-road vehicles drive on the sand of the estuary which is blocked most of the time.		
Dynamics	Erosion observed (Mondoukou). Dynamics of siltation and temporary openings of the estuary. Fragility of the rim – lido at very low elevation. Sensitivity to surges and flooding of the lagoon system.		
Stakes	Tendency towards residential development in coconut groves for wealthy urban population. Annex of Grand Bassam, but coastal habitations at risk.		
Action	Detailed flood-submersion risk prevention plan. Inform the populations and residents on the edge of the beach. Resorption and relocation of precarious dwellings on the edge of the beach.		
Priority	High Monitoring-Observation Intensive and regular		
Case study	Characterisation of morpho-sedimentary dynamics of the Côte d'Ivoire littoral zone. See annex 1.		

Nombre				Taux d'évolution c	Taux d'évolution calculé à partir des dates extrêmes de levés topographiques					
cumulé de profils	Evolutions mesurees (m)		Moyen	nes calculées	Surface accumul	ce accumulée ou érodée		Localisation des secteurs mesurés		
•	-2,5 -:	Eros 2 1,5	sion -1	-0,5 0	Moyenne sur la	Moyenne annuelle	Total (m2)	Taux d'évolution	5730	00 574000 හට දුර
1					peride (m) 0	(m/an) 0	0	(mz/an) 0	418000	418000 Cr 2
3					-0,44 m	-0,28 m/an	-6212,44	-3923,64	1 +	
8									42500	0800 m
Cinématio	lne	P	ositions de	la ligne	de rivage		E	uipements Cour	vert végétal	Fond de carte extrait de Google Earth de 2010
Ero	sion			Mai 20	08		Es	tran Hydr	ologie	(image 2010 TerraMetrics)
Zon	ie non cou	verte		Novem	bre 2009		Ha	bitat Rout Profi	le Is	Projection : Universal Transverse Mercator, zone 30 Nord, Ellipsoïde WGS84 Amorces du quadrillage métrique UTM (chiffrées tous les 1000 m)

Rates of shoreline change on the littoral perimeter of Grand-Bassam. Source: case study.

SANDY TERRACE AND COCONUT GROVES IN EASTERN COTE
D'IVOIRE

CI7

ANTICIPATION

CI7-a	129 - GR	AND BASSAM – AS	SINIE
Diagnostics	Wide terrace bordered by the Assinie canal in the north. Vast coconut palm plantations, scattered dwellings (plantation huts), practically no villages. "Sand" track used by traffic including off-road vehicles on the edge of the beach. Connected to road system by a north branch towards Bonova. The Assinie canal is not very functional today.		
Dynamics	Straight shoreline with a tendency to wide undulations (period approximately 10 km) rather unstable.		
Stakes	Residences conquering the coconut groves, with no strong densification of habitation or population.		
Action	Implementation of a sector scheme if land use were to become significantly more dense.		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation

*

	ENVIRONMENT & TOURISM
CI7-b	130 - ASSINIE AND MOUTH OF THE ABI LAGOON
Diagnostics	Long lido of Assinie isolating a longitudinal lagoon from the shore. Estuary of the lagoon system Abi + river Bia (nearby dam) and river Tano originating in Ghana. Estuarine islands and lagoon-ocean contact. Protected site, biologically valuable. Ehotile islands national park. Centre of tourist activity with installations essentially located on or in proximity to the lido.
Dynamics	Estuary mouth clearly open and symmetrical, however, naturally fragile and unstable site. Straight shoreline with a tendency to wide undulations (period approximately 15 km) rather unstable. High rate of erosion observed towards Assinie.
	"Assouindé and Assinie beaches are tourist resort sectors <i>par excellence</i> . Given the narrow rim (sea-lagoon) and its very low coast, the tourist infrastructure is frequently and periodically submerged in this zone. Erosion and especially submersions during exceptional storm or equinox tides in this part of the littoral zone, have become a cause for concern to the extent that some of the economic operators installed in the zone move their facilities and others totally abandon them (VALTUR holiday club and Club Med). This state of affairs has a considerable effect on the principal economic activity (tourism)." Source: case study.
Stakes	Maintain a secure tourism potential. Principal mangroves stands on the coast of Côte d'Ivoire. Conservation of protected milieus in the context of the National Park.
Action	Detailed flood-submersion risk prevention plan. Inform population and residents on the edge of the beach. Seek suitable architecture solutions to maintain reception capacities in an at risk situation. Relocation of the most threatened facilities. Developments are certainly not recommended on this site.
Priority	Very high Monitoring-Observation Intensive and regular
Case study	Characterisation of morpho-sedimentary dynamics of the Côte d'Ivoire littoral zone. See annex 1.

The tourist site of the Club Méditerranée and the neighbouring facilities constitute a typical example type of seaside resort catering on the edge of a straight littoral zone: Dangerous beach, therefore boating and bathing in a natural environment in the permanent saline lagoon (or in swimming pool).

This type of estuarine site with diversified landscape could inspire other promoters in the future along the entire littoral zone (Liberia, Côte d'Ivoire and Ghana). However, these are estuary sites or sites close to estuaries, which are by nature unstable and not suitable for heavy installations on the edge of the ocean beach.

One of the major stakes for the development of tourism on coastal and lagoonal areas remains the privatisation of beaches and shores.

			ANTICIPATION
CI7-c	131 – E	AST ABI LAGOON	
Diagnostics	Terraces partially planted with coconut palms Ghana). Isolated sector, except for small track	. Sparsely populated zone (towards Ghana	compared to the adjacent part in
Dynamics	No remarks.		
Stakes	Zone included in the Ehotile islands Nationa terraces and in the National Park.	I Park, compatibility of this	status with farming activities on
Action	No recommendations		
Priority	Low	Monitoring-Observation	Watchkeeping for the purpose of anticipation



GH – GHANA

GH1	

SANDY TERRACE AND COCONUT GROVES WEST GHANA – COTE D'IVOIRE

The main characteristics of the zone are summarised as follows:

Sandy rims – lidos frequently isolated by long lagoonal channels very close to the littoral zone (around forty segments not all drawn at 1:500,000).

Habitations in numerous large villages, served by roads and tracks on terraces stretching along the littoral zone. Indirect connection to the main road. Little communication with Côte d'Ivoire.

Some villages installed right to the edge of the beach, some adjacent to the nearby lagoon. Risks related to storm surges, alternating accretion/erosion of beaches related to the sediment wave. Straight – undulating littoral zone (sediment "trains").

It was not possible to detail the characteristics of the three sectors due to a lack of pictures of useable quality.

<u> </u>			ANTICIPATION
GH1-a	132 - COTE D'IV	OIRE – BONYERE BO	ORDER
Diagnostics	Wide sandy terrace and dense habitation beh value, but strong human pressure on the perip	ind vast complex of diversi ohery. Numerous villages lo	fied wetlands. Probable biological ocated on the edge of the shore.
Dynamics	Apparently stable littoral zone apart from outlets and small estuaries.		
Stakes	No information.		
Action	No recommendations		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

ANTICIPATION

GH1-b	133 - B	ONYERE – EKWE	
Diagnostics	Narrow rims and lagoonal channels more of located on the edge of the shore.	r less parallel to the shore	e of type 3C. Numerous villages
Dynamics	Apparently stable littoral zone. Straight, slightly undulating littoral zone. Lagoonal channels behind.		
Stakes	Numerous villages situated on the terrace between littoral zone and channels, especially in the western part of the zone.		
Action	Anticipate tourist development as a prolongation of Axim.		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

			ANTICIPATION
GH1-c	134 - EKWE - KIKAM		
Diagnostics	Wide terrace. Start of rocky Ghana coast on the	ne east end of the sector.	
Dynamics	Apparently stable littoral zone. Straight, slightly undulating littoral zone.		
Stakes	No information.		
Action	Anticipate tourist development as a prolongation of Axim.		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

G	Н	2
_		

CAPE THREE POINTS

Zone which has considerable potential in sites with a tourist vocation:

- \Rightarrow Landscape of interest: landform and vegetation surrounding the sites with creeks and coves.
- \Rightarrow Position sheltered from the prevailing ocean waves on numerous sites.
- ⇒ For a large part, road connection by tracks connected in branches to the main road (with, however, maintenance constraints due to the nature of the soils and landform). The road network on hillsides could generate the start of erosion, to be controlled.

				TOURISM
GH2-a	135 - TI	HREE POINTS WEST		
Diagnostics	Numerous sites with tourist potential, some with a lagoon behind the rim. Connected by more or less permanent tracks, close to the littoral zone for certain sections. Start of a "panoramic track" leading to accommodation or lodges offering view points. Principal centre, the small town of Axim, landscape site with rocky islet. Fishing point connected to the major coastal road, lagoon and estuarine system.			
Dynamics	Sandy beaches, fragile creeks and coves, in particular the rims and lidos on the edge of the lagoon which are attractive for tourist facilities. Prevailing exposure to ocean swell.			
Stakes	Same as East sector for controlled tourist development, roads, tracks and facilities on the edge of the beach respecting the natural areas and the surrounding landscape.			
Action	Anticipate tourist development as a prolongation of Axim. Organise tourist operators with a view to harmonising facilities with the landscape and the environment. Anticipation of tourist development.			
Priority	High	Monitoring-Observation	Watchkeeping for th anticipation	e purpose of

			ENVIRONMENT & TOURISM
GH2-b	137 - THREE POINTS CENTRE		
Diagnostics	Main rocky coast site of the whole littoral zone studied; Still isolated; Very hilly, wooded agricultural vegetation and slash-and-burn staple crops.		
Dynamics	High energy ocean waves on the rocky headlands. Narrow, fragile coves and sandy creeks with low sediment reserves.		
Stakes	Status of protected area desirable, natural area of value in terms of landscape, aesthetics and leisure activities. Restrict access of vehicles and equipment on rambling paths.		
Action	Organise tourist operators with a view to harmonising facilities with the landscape and the environment. Regulatory initiatives to be taken to strengthen the preservation of the zone.		
Priority	High	Monitoring-Observation	Watchkeeping for the purpose of anticipation

			TOURISM
GH2-c	138 - THREE POINTS EAST		
Diagnostics	Numerous sites exposed east - south-east and cape. Tourist lodges already present.	d therefore quite sheltered.	Small villages on each sheltered
Dynamics	Beaches adjacent to narrow terraces, with low sediment reserves but systematically anchored on small headlands and points.		
Stakes	Tourist facilities will be developed in the future. Local impact to be assessed for installations on the sea edge and for the connecting road network. Control of future installations in terms of both landscape and ecology, with the maintaining of green spaces to be protected.		
Action	Organise tourist operators with a view to harmonising facilities with the landscape and the environment. Anticipation of tourist development.		
Priority	High	Monitoring-Observation	Watchkeeping for the purpose of anticipation

GH3	URBAN SECTOR AND PERIURBAN EXTENSION
	OF SEKONDI - TAKORADI

Urban site with complex topography, numerous small breaks of wetlands. Predominantly rocky coast, two main ports and annexes with piers intended to improve the natural position of sheltered cape. Beaches of coves and creeks with low sand reserves, very sensitive to harbour developments.

			ANTICIPATION
GH3-a	139 - AP	OWA – TAKORADI	
Diagnostics	Clear green break in urbanisation by estuarin edge of the beach. Agriculture encroaching, ro often limited by small wetlands. Handsome cov	ne wetland. Three tradition esidences in large huts. Po ve beach.	al villages with dwellings on the ossibility of building on the zone
Dynamics	No remarks.		
Stakes	Risks for habitations in villages on the edge of	the beach.	
Action	Land ownership control, to avoid urban s development on Apowa–Takoradi beach.	sprawl on the break in	urbanisation. Anticipate tourist
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

			URBAN & HARBOUR
GH3-b	140) - TAKORADI	
Diagnostics	Seaside road in the north of the sector on installations.	rock fill. Residential distric	cts at risk north of the harbour
Dynamics	The beach will very probably disappear, in a c	ontext of a littoral zone with	poor sediment reserves.
Stakes	Possible restoration of an urban beach. The north port road is flood-prone and unstable, fully exposed to ocean waves. Deterioration of harbour installations (including underwater pipeline) following erosion and extraction of materials.		
Action	Stop the extraction of materials in the littoral zone. Monitor the shoreline and the stability of harbour developments. Anticipate the development of a tourist sea front south of the harbour.		
Priority	Average	Monitoring-Observation	Regular

URBAN & HARBOUR

GH3-c	141 - SEKONDI		
Diagnostics	Port and important fishing centre. Complex site, improvements to natural headlands for shelter effect.		
	Impact on the beach probable, but extent difficult to assess.		
Dynamics	The port developments have consequences for the stability of the beaches, the extraction of building		
	materials also seems to play a decisive role.		
Stakes	Segment of coastal road north of the harbour very close to the shore. Development of an urban beach in		
	the northern part of the sector.		
Action	Restriction of extraction of materials. Close monitoring of the stability of infrastructure.		
Priority	Average Monitoring-Observation Regular		

			ANTICIPATION	
GH3-d	142 - SEKONDI – SHAMA			
Diagnostics	"Rurban" prolongation of Sekondi with dense development of buildings at Aboadi, including on the edge of the shore. One part is a long cove, the remainder is short coves and creeks. 16 th century Portuguese Fort at Shama.			
Dynamics	Fragile littoral zone, but free of impact of harb	our developments.		
Stakes	Periurban development, sites suitable for tourism.			
Action	Sector scheme should be considered if the tendency to building development is confirmed. Anticipate, with a view to preserving the green breaks in urbanisation to avoid the development of a continuous conurbation which has already begun between Takodari and Selondi. Industrial activity areas should be located inland of the littoral zone.			
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation	

```
GH4
```

SHAMA – ELMINA HINTERLAND

0114-a	145 - 5		7
Diagnostics	Littoral zone away from the coastal road. Some large villages. Several wetlands sites, one of which is		
	significant. Some tourist facilities.		
Dynamics	Apparently stable littoral zone.		
Stakes	Knowledge of the sector. Possibilities of protecting the sector's complex of wetlands, mangrove lagoons and estuaries (5 to 10,000 hectares). Important relay of the network of fluviomarine protected areas between the Volta delta and the systems of wetlands and lagoons of western Ghana and West and Côte d'Ivoire.		
Action	Identify potential fluviomarine sites that could be subject to protective measures.		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

|--|

URBAN ZONES AND EXTENSIONS ELMINA - CAPE COAST - SALTPOND

			ANTICIPATION
GH5-a	146 - ELMINA		
Diagnostics	Fort and fishing centre, estuary and sheltered cove with north easterly exposure. Historical site largely disconnected from the coastal road. Growth of luxury flats in the direction of Cape Coast. Western wetland equipped with ponds.		
Dynamics	Discontinuous beaches, with frequent segments of type 4b rocky coast. Very attractive cove beach in the town of Elmina, supplied by river sediment, anchored at the cape, but equilibrium seems precarious towards the east (erosion?). Beyond this, discontinuous, very fracile beaches		
Stakes	Control current residential urbanisation towards the beach.		
Action	Control and planning of residential habitation on the peripheries. Planned withdrawal of at risk buildings from the edge of the beach.		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation.

ANTICIPATION

GH5-b	147 - WEST CAPE COAST		
Diagnostics	Narrow fluvial marine terrace, rim-lido isolatir town. Main coastal road very close to the beau	ng wetlands and several lag ch (50 m).	goons, one of which touches the
Dynamics	Straight littoral zone/slightly undulated types 3	b/3c therefore at risk.	
Stakes	Respect the natural break in urbanisation, but a point very close to the beach for the coastal road at risk. Installations between the lagoon and the road seem to be on very low land, with risks of flooding by the lagoon and storm surges.		
Action	Preserve the green break of the wetlands between the peripheries of Elmina and Cape Coast. Restrict urban development. Monitor the shoreline and the stability of the road in places close to the shore.		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation.

			//////////////////////PERIURBAN
GH5-c	148	- CAPE COAST	
Diagnostics	Bipolar town, older part to the east, more re Partially urbanised littoral zone, narrow, discor	ecent part to the west, bunt inuous beaches, rocky he	t also historical centre and fort. adland.
Dynamics	Beaches and rocky coasts more or less stron from one site to another. Necessity for an appl	ngly exposed to the ocean roach at a level of local deta	waves, exposure varies greatly ail.
Stakes	Fishermen's districts at risk to the east of the rocky breakwater. Preservation of breaks in urbanisation to the east and west, to avoid the development of a continuous conurbation all the way to Saltpond.		
Action	Preserve the green breaks to the west and east of the town. In the long term, withdraw at risk settlements east of the cape.		
Priority	Average	Monitoring-Observation	Regular

				ENVIRONMENT
GH5-d	149 -	EAST CAPE COAST		
Diagnostics	Hilly zone still only sparsely built on protected?	the eastern edge of t	he town, break	in urbanisation
Dynamics	No remarks.			
Stakes	Break in urbanisation to be preserved a	ind strengthened.		
Action	Land control, to prevent urban sprawl acros	s these natural areas.		
Priority	Average	Monitoring-Observation	Watchkeeping for anticipation	or the purpose of



Corridorization of urban spread on Cape Coast landward and in conurbation along the littoral zone (Ghana). (source: Johanna Baro)

			ANTICIPATION
GH5-e	150 - PERIURBAN SEC	CTOR CAPE COAST -	SALTPOND
Diagnostics	Sector very well connected by the main coa undergoing growth, like Saltpond, separated residential settlements. Sites of small beac increasing.	stal road which approache by an agriculture hinterlan ches oriented east/south-e	es the littoral zone. Small towns d already colonised in places by ast. Human land use globally
Dynamics	Mixed littoral zone of type 4a and 4b, some segments of type 3. Sites highly individualised in places, often fragile, many beaches undergoing erosion.		
Stakes	Control of residential and leisure urbanisation developing towards the beach.		
Action	Anticipate development of buildings on the edge of the shore in agreed, equipped development zones. Select sites suitable for limited protective measures in order to secure sites of high value in terms of landscape and leisure activities. Sector scheme could be useful		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

G	H	6

RURAL HINTERLAND OF URBAN AREAS OF CAPE COAST AND ACCRA

				RURAL AT RISK
GH6-a	151 - SA	LTPOND – MFANTS	IMAN	
Diagnostics	Villages situated on the edge of the sea estuarine sites. Series of small agglomera vast system of wetlands.	a at high risk (5 importan tions some distance back	t sites + huts in from the lagoon a	coconut groves) on and channels. Inland,
Dynamics	Rims-lidos of type 3c, very fragile and uns	table, outlets from wetland	ds system in place	es.
Stakes	Situation of villages on the edge of the b Value of the wetland connected to the esti	each, very exposed and r uary with two water course	no possibility of w	vithdrawal to the lido.
Action	Planned withdrawal of the most exposed estuarine systems.	I installations. Sites to be	preserved for bi	ological value of the
Priority	High	Monitoring-Observation	Regular	



Location of habitations in sector GH6-a within the estuarine system, including on the lido (source: Google Earth)

			ANTICIPATION
GH6-b	15	6 - WINNEBA	
Diagnostics	Succession of large towns-villages on headla sites with tourist potential, perhaps already satellites 10-15 km from the main coastal ro breaks in urbanisation to be preserved.	nd sites and fishing ports partially occupied. Road ad. Portion of the littoral z	(Winneba, Apam, etc.). Possible connection by north and south cone isolated. Large, successive
Dynamics	Mixed littoral zone with alternating type 4b coast and 3 segments. No remarks.		
Stakes	Sector intended for residential tourism in the more or less near future depending on road connections. Anticipation of an overall land planning scheme.		
Action	Sector scheme anticipating probable residential developments. Anticipate development of buildings on the edge of the shore in agreed, equipped development zones. Select sites suitable for limited protective measures in order to secure sites of high value in terms of landscape and leisure activities.		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

GH7	ACCRA WEST URBAN AREA
-----	-----------------------

Clear break in urbanisation close to the littoral zone between the two sectors of this zone Littoral zone of alternate coasts of types 4b, 4a, 3 a, 3b, in small segments not all identifiable at 1:500,000. All of these small towns are associated with headlands sheltering from the ocean waves, small estuaries and traditional fishing.

			ANTICIPATION
GH7-a	157 - SE	ENYA - NYANYANO	
Diagnostics	Tendency to urban sprawl over rural areas fro zone connected by North-South satellites.	om small agglomerations. R	elative isolation of the near shore
Dynamics	Alternating rocky coast 4b with creeks oriented South-east, segments not all marked off at 1:500,000.		
Stakes	In the long term, rurbanisation will continue, under the impulse of improved road access towards Accra and its current extension.		
Action	Land control and global scheme for the zone to prevent urban sprawl. Enforce a littoral strip of at least 100 m in the developing of a sea front for tourism and residential purposes promoting the small, sheltered resort sites.		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

			ANTICIPATION
GH7-b	158 - NYANYANO -	ACCRA WEST URBA	AN AREA
Diagnostics	Despite the proximity of Accra, loose urbani isolated areas of agriculture still present.	sation predominantly luxur	y flats, some hotels. Intra urban
Dynamics	Fragile zone, tendency to erosion – smoothing of beaches in coves by dyke effect of headlands. Numerous, somewhat reflective beaches.		
Stakes	Future of the agricultural plain facing urbanisation, as a green enclave undergoing urban sprawl.		
Action	Land control and global sector scheme, preserving the large break in urbanisation. Enforce a littoral strip of at least 100m m in the developing of a sea front for tourism and residential purposes.		
Priority	Average	Monitoring-Observation	Watchkeeping for the purpose of anticipation

GH8

ACCRA URBAN AREA AND EASTERN PERIPHERY

			PERIURBAN & TOURISM
GH8-a	159 - ACCRA V	VETLAND DENSU DE	LTA
Diagnostics	Complex of wetlands locally reached by risi urbanisation. Vast development of salt produ- vegetation (sharp sand?), with precarious so RAMSAR site	ng tide, the contours of v uction fields. Littoral rim ir ettlements and tourist carr	which mark the current limits of n extremely narrow lido with no aps in places. Densu delta is a
Dynamics	Extreme fragility of the very narrow rim-lido, hy	/drologic system stabilised	by the Weija dam built in 1978.
Stakes	Strong tendency to diffuse urbanisation in wetland especially on right bank. Urban pollution from various		
	sources to be managed. Over-exploitation of impact in the event of storm surge on the lido	fishing resources and man	ngroves. Very low elevation and
Action	Imperative to maintain the break in urbanisat wetland. Restrict installations on the lido to te tourist traffic on Bojo beach, and in any case measures and restrict urban effluent. Reinforce and apply the management provisio	tion with blockage of urbar imporary fishing and leisure e, of permanent installations ins of the RAMSAR site.	n sprawl on the periphery of the e facilities. Possible restriction of s. Reinforce collective sanitation
Priority	High	Monitoring-Observation	Regular

			URBAN
GH8-b	160 - ACC	CRA CENTRE WEST	
Diagnostics	Littoral zone predominantly straight type 4a precarious fishermen's settlements. Narrow ur	undulating. Very dense har rban road, inland and at a d	abitation right to the beach and istance from the littoral zone.
Dynamics	Littoral zone undulating in short periods, with sectors undergoing erosion probably related to the dam and the wetland. Small zone undergoing accretion on the eastern part of the zone upstream of Jamestown rock fill (proximity to fishing port). High rate of erosion at Jamestown.		
Stakes	Very dense habitation at high risk in the event	of surges.	
Action	Requalification and withdrawal of dense settlements on the edge of the littoral zone to be examined strategically. Implement preventive measures and prepare the population.		
Priority	Very high	Monitoring-Observation	Intensive and regular

	UR	BAN
GH8-c	161 - ACCRA CENTRE	
Diagnostics	Undulating type 4b littoral zone fully urbanised to the limit of (small) coastal cliffs or beaches, conner by an urban motorway which approaches the shore locally when passing the wetland (same as 7 West). Eastern part occupied by public beaches and important residential and hotel area. Na compartmented beaches, given the high frequentation.	ected Fema Irrow,
Dynamics	Tendency to erosion, beaches thinning at the foot of the cliffs, the small headland that is the boundat the sector acting as a natural groyne, reinforced by a pier in rock fill (fishing port). Tendency to erol less marked to the east of the zone.	ary of osion
Stakes	The start of organised development of a sea front should be considered from Labadi Beach eastwich Fragile sector where it crosses the wetland. Complex restructuration, given the diversity of type settlement. Evolution of the fishing port in an increasingly restricted space.	ward. es of
Action	Secure the heritage of very busy public urban beaches. Monitor the quality of the waters. Secure segments a small distance from the littoral zone. Preserve wetlands and breaks in urbanisation and a to the east of the zone.	road areas
Priority	Very high Monitoring-Observation Intensive and regular	

PERIURBAN & ENVIRONMENT

GH8-d	162 - WETLAND BREAK TEMA WEST - SAKUMO		
Diagnostics	Wetland and artificialised lagoon. System marked in the south by the passage of a main coastal road (dyke road). Linear rock fill for stabilisation. Tendency to reclamation of the wetland and development of building on reclaimed sites. Sakumo is a RAMSAR site		
Dynamics	Risks concerning the stability of the dyke road if undercutting occurs at the foot of the protections. Risks of marine intrusion in the event of surge. Risks related to drainage capacity in periods of spate.		
Stakes	Preservation of a break in urbanisation in a zone with an industrial vocation: different ecological services and hydraulic regulation.		
Action	Preserve the zone. Monitor status of developments. Restrict building on the banks of the lagoon. Reinforce and apply the management provisions of the RAMSAR site.		
Priority	High	Monitoring-Observation	Regular

		URBAN & HARBOUR	
GH8-e	163 - TEMA		
Diagnostics	Eastern limit marked by a wetland partly equipped with ponds. Fully urbanised site, complex urban fabric, average and substandard classes, industrial sites, developments and installations of the port. Zone of dense substandard habitation east of the port. Tema is a commercial and fishing port.		
Dynamics	Rocky littoral zone, very thin beaches (units 4b, limit 5). Impact of the harbour pier accretion to the west and erosion to the east controlled by structural work and the characteristics of the shoreline structured on small cliffs.		
Stakes	Future evolution of the port, sufficient depth. Erosion in the eastern part and habitation east of the port possibly threatened. Absence of sea front development.		
Action	Close monitoring of the shoreline east of the port. Planned withdrawal (relocation) of habitations in immediate proximity to the east of the port.		
Priority	Very high Monitoring-observation	Intensive and regular	

	PERIURBAN		
GH8-f	164 - PRAMPRAM		
Diagnostics	Tema cut-off by estuarine zone, no road passage. Served by a secondary road close to the littoral zone and connected to Accra by a satellite of the main inland road. Large, growing town (Prampram, Old and New Ningo connected by a bridge). Ponds in the wetland, material extraction area; In interurban spaces, residential type growth in agricultural milieu (large huts) with private tracks. Human land use of the coastal strip still moderate, but growing.		
Dynamics	Continuous, very narrow beaches. Undulating shore subject to erosion, particularly in the east. Lagoons isolated by extremely narrow rim lidos adjacent to harder formations of the sandstone type.		
Stakes	Zone destined for accelerated urbanisation if a road across the estuary is built enabling direct access to Prampram and Tema.		
Action	The stakes do not really justify coastal defence structures given the relatively low rate of land use outside the urban centre. Close monitoring of the effectiveness of the developments carried out, particularly in the east.		
Priority	High Monitoring-observation Regular		

	-	
	_	

VOLTA DELTA RIGHT BANK NINGO - ADA FOAH

Fluviomarine rim-terrace adjacent to a vast system of wetlands (Songaw Lagoon – RAMSAR site) formerly subject, before the Akossoumbo dam was built, to the spates of the Volta. Current catchment area flowing into this system with limited surface area (unlike Keta Lagoon on the left bank). The control of flooding of the Volta has led to profound alterations:

- \Rightarrow Contraction of lagoonal zones.
- \Rightarrow Drying out and encroachment by agriculture or salt flats.
- \Rightarrow Development of villages close to the littoral zone on the highest points (which remain at a relatively low elevation).
- ⇒ Development of a network of tracks and service roads: North-South satellites connected to the coastal road. Secondary tracks more or less usable in the rainy season.
- \Rightarrow Numerous points for fishing catch landing.

The eastward coastal drift is scarcely supplied upstream (Accra zone). A littoral rim very narrow in places isolates lagoonal channels and the distributaries of the delta system. The sediment supplies to the delta system are completely cut off, the system is maintained by the sediment stocks of the terrace rims of the delta.

The coast is of very flat topography and at a very low elevation. Habitation and road connections probably at risk, but with very variable degrees of risk in places; the situations should be analysed on a case by case basis.

			RURAL AT RISK
GH9-a	165 - NEW NINGO – LEKPOGUNO		
Diagnostics	"Atypical" littoral zone, undulating but with very narrow rim-lido isolating lagoons and fields. Villages on high terraces set back from the channels-lagoon system/littoral lido. Situation practically peri urban at Accra.		
Dynamics	Thin, fragile lido.		
Stakes	Sector with potential for densification in a context of a fragile littoral zone (nearby lagoons and narrow lido), including production infrastructure that also contributes to the fragility of the system.		
Action	Absolutely avoid any installation on the lido or in the areas in immediate proximity to the sea. Monitor the		
	shoreline and the status of the lido. Maintain the break in urbanisation east of New Ningo.		
Priority	Very high	Monitoring-observation	Intensive and regular

			RURAL AT RISP	
GH9-b	166 - LEKPOGUNO - AKPLABNYA			
Diagnostics	Succession of large villages connected by a conternace) very variable, but always adjacent to proximity of the littoral zone and elevation of the shore. Wetlands typically developed.	oastal road with North-Sout o the wetland. Sensitivity he zones in use. Certain ins	h satellites. Width of the lido (rin very variable depending on the stallations are extremely close to	
Dynamics	Straight to undulating littoral zone. Lido of variable width. Unstable zone subject to risk of surge and flooding by continental waters;			
Stakes	To be analysed on a case by case basis depending on the elevation of the sites and the distance from foreshore and from the channels and lagoons.			
Action	Maintain the break in land use and urbanisation. Monitor the status of the lido in particular in the rainy season and/or during storm surges.			
Priority	High	Monitoring-observation	Intensive and regular	



Lekpoguno - Akplabnya Sector (source: Google Earth)

			ENVIRONMENT
GH9-c	167 - AKPLABNYA – TOTOPE		
Diagnostics	Extremely narrow littoral rim – lido (under 50 metres in places), no human land use. Interruption of the coastal road, track on the top of the beach. Songaw Lagoon is a RAMSAR site		
Dynamics	Extremely unstable and fragile sector		
Stakes	Sector not used and not suitable to be equipped		
Action	Maintain the break in land use and urbanisation.		
Priority	Low	Monitoring-observation	Intensive and regular

RURAL AT RISK

GH9-d	168 - ADAFOAH		
Diagnostics	Large agglomeration extending north (saturation of buildable land close to the littoral zone). Situation very like Keta, with however the possibility of continuing the prolongation of urbanisation landward (North direction), already exploited. Hard surfaced road to the north, urban development corridor to the edge of the Volta, on alluviums of raised bank, but flooding excluded today. Even though the densest urbanisation is away from the littoral zone, the tendency is for it to move closer at the level of the estuary mouth. Islets of at risk habitations.		
Dynamics	Slightly undulated littoral zone (erosion/accretion). Certain sites present a quite marked reduction in the beach in places.		
Stakes	Colonisation of the beach by random land use, leading to high risks for the installations (some located 30m from the foreshore).		
Action	Natural strip to be implemented. Withdrawal of random installations on the beach desirable.		
Priority	High Mon	itoring-observation	Intensive and regular

```
GH10
```

VOLTA DELTA LEFT BANK

			RURAL AT RISK
GH10-a	169 - DZEITA - LEFT BANK OF THE VOLTA		
Diagnostics	Very narrow fluvio-marine rim (sandy spit), with lagoonal channels adjacent to a zone flood-prone in places, islets of alluvial terraces with habitations.		
Dynamics	Very unstable, "thinned" mouth rim, partially composed of sharp sands, further inland than its opposite on the right bank.		
Stakes	Small villages in a situation of high exposure to very high risks in the event of storm surges or episodes of high rainfall. No alternative for relocation or withdrawal.		
Action	Radical restriction of the development of dwellings or infrastructure on the site. Inform the population.		
Priority	Very high Monitori	ng-observation	Intensive and regular

KETA SEA DEFENSE PROJECT

The entire zone has been subject to considerable developments on the scale of the sub-region, starting in 2000 for a budget of US \$84 million. These developments have been conducted within the framework of the Keta Sea Defence Project since 2000. They comprise:

- Six rock fill groynes (61,000 tonnes each) 220 m in length.
- An armouring of rock fill (153,000 tonnes).
- A pass to control flooding 80 metres long with passage of a road.
- 14 km of hard-surfaced road network equipped with 14 drainage mechanisms.
- 225 hectares of embankments suitable for equipment.
- More than 5,000 m of protective banks planted with local tree species.

These structures have made it possible to stop the shoreline recession which was particularly marked at the level of the lagoon outlet and to re-establish the sandy spit. However, erosion has resumed between the groynes, as attested by the formation of a berm at the top of the beach. These developments are not, therefore, radical, and allow a sediment flow towards neighbouring Togo to exist. An important monitoring mechanism was implemented as part of the developments.

The risks of submersion are especially related to the low elevation of the lido on the lagoon side⁷, or to flooding – submersion of continental origin.



Overview of the developments in the Keta sector (source - Google Earth).

⁷ Boateng; I.. 2009.-. Development of Integrated Shoreline Management Planning: A Case Study of Keta, Ghana. 19p.



Erosion resumes between the groynes of the Keta development (formation of a berm at the top of the beach)



Vegetable fields on the banks of Keta lagoon (source: J.J. Goussard)


Mapping of flood risks (1m, 2m, 5m scenarios) for the Keta zone (source I. Boateng)



The very low elevation makes it difficult to limit the risk of flooding from the rising water table.

			RURAL AT RISK
GH10-b	170 - KETA		
Diagnostics	Slightly undulated terrace. Numerous micro-channels flowing into the lagoon in the north. Average density of dwellings, but building land saturated. Main road route outside the littoral zone, on the edge of the lagoon, connected to satellites. Practically insular situation. Important vegetable-growing zone on the edge of the lagoon. The lagoon and its surroundings form a RAMSAR site covering 53,000 hectares.		
Dynamics	Shoreline with curved profile "atypical" for the accretions isolating the channels. Limited acc	e region, of deltaic origin. I retion still noted. Current dy	Historical deposits by successive namic equilibrium fragile.
Stakes	Dwellings saturate the area to the edge of buildable land that is not flood-prone (channels, lagoon edge). High risk of flooding on the bank of the lido on the lagoon side. The major risk in the current configuration is related to the extremely variable level of the Keta lagoon and to a conjugation of continental spate/storm surge. There is also a possibility of flooding due to the water table rising. Preservation of the RAMSAR site of Keta Lagoon		
Action	Restrict the development of dwellings on the site. Adaptive management of installations with planned relocations. Monitor the impact of developments and of changes in the lagoon shore. Preserve the natural shore vegetation on the lagoon side. Implement preventive measures to face the risk of submersion (warning systems and prepare the population.) Opportunity to assess the feasibility of architecture adapted to the risks of submersion (embankments, stilts?)		
Priority	Very high	Monitoring-observation	Intensive and regular

			RURAL AT RISK
GH10-c	171	– KETA DYKE	
Diagnostics	Small sector of the dyke road		
Dynamics	Extremely fragile sector connected to the artifi	icial outlet of the lagoon	
Stakes	Dyke road improves access to Keta. Very high risk for nearby dwellings. Plant coverage of bare sand. Installations at very high risk on the sandy spit separating the lagoon from the foreshore and on the extremity of the lido towards the east (habitations less than 20 m from the foreshore). Effectiveness of the drainage connection of the lagoon?		
Action	Plant coverage of bare sand. Close monitoring of the status of the mechanism and of infrastructure. Relocate installations from the sandy spit.		
Priority	Very high	Monitoring-observation	Intensive and regular

	RURAL AT RISK		
GH10-d	172 - ADINA		
Diagnostics	Same as for the next sector, but rim and terraces extremely narrow. Variable density huts and concessions of coconut palms. Numerous canoes on the beaches.	of habitation in large	
Dynamics	Formation in a narrow lido in the west (less than 150 m between the wetlands on t the foreshore in places).	he lagoon shore and	
Stakes	Zone at risk in the event of surge. Not possible to relocate the installations in places.		
Action	Total control of the densification of dwellings and installations. Withdrawal of installations too close to the beach. Monitor the shoreline and impacts of the anti-erosion mechanism at Keta.		
Priority	High Monitoring-observation Intensive	and regular	

	PERIURBAN		
GH10-e	173 - EAST GHANA – TOGO BORDER		
Diagnostics	Rurban sector in continuity with Lomé. Homogeneous terrace adjacent to a lagoon and channel. Agricultural land with small and medium-sized concessions of coconut palms. Main road far inland from the shore, zone undergoing densification on both sides of the road corridor. Discontinuous beach edge track. Encroachment through installations on the edge of the beach.		
Dynamics	No remarks.		
Stakes	Colonisation of the beach by random land use, leading to high risks for the installations (some located in immediate proximity to the foreshore).		
Action	Total control of the densification of dwellings and installations. Withdrawal of installations too close to the beach. Monitor the shoreline and impacts of the anti-erosion mechanism at Keta.		
Priority	High Monitoring-observation Intensive and regular		

*	TG – TOGO

TG1	TOGO		
	Characterisations of the status of beaches in two coastal drift cells.		
Case study	The coasts to the west and east of the port of Lomé See annex 1.		

The sectors situated east of Lomé present high risks of submersion related to conjugations of high rainfall and continental spates and storm surges.

URBAN				
TG1-a	174 - GHANA	BORDER - LOME WE	EST	
Diagnostics	Vast, homogeneous sandy terrace. Dense separated by a coastal road very close to the has been subject to the beginnings of se encroachment near the border. Numerous sig transfer of pollution via the coastal drift curren	e, diversified urban habit beach (approximately 100 eafront development, but gns of wastewater outlets o t. This concerns the sectors	ation (eastern part residential) m or less). The road-beach strip this strip is undergoing urban in the beach. Probable eastward s Lomé centre and east.	
Dynamics	Developments on the backshore in the vicinity of the border post influence-compensate for the accretion this sector should normally experience. Stable in places, erosion noted towards the west in the zones developed on the beach.			
Stakes	Control of urbanisation on the beach beyond the coastal road. Numerous installations and habitations at risk in the event of storm surge.			
Action	Control development on the beach beyond the coastal road.			
Priority	Average	Monitoring-observation	Regular	

URBAN				
TG1-b	175 - LOME CENTRE			
Diagnostics	Zone of recent sandy sediment supply isolating a wetland from the former littoral zone. Dense urban habitation, urban effluent outlets on the beach (outlets on the beach to be related to the accretion of the sector and the burying of the sewage outlet) Vast vegetable growing area between the road and the beach; large housing scheme being built at the top of the beach			
Dynamics	Sector undergoing accretion following the installations of the Lomé harbour. Width of beach 100 to 300 m.			
Stakes	Future of the urban facilities on the sea front. Sanitation and impact of the housing being built on the beach. Examine possibilities for extracting materials in the zone undergoing accretion.			
Action	Coastline monitoring. Urban waste and rainwater runoff management plan.			
Priority	Average Monitoring-observation Regular			



Lomé: Housing scheme on the part of the beach undergoing accretion (West of the port)

			URBAN & HARBOUR
TG1-c	176 - LOMÉ	URBAN - EAST POR	т
Diagnostics	Average quality housing quite dense right to the beach. Diversified urban fabric, warehouses, dwellings. Main road route lies outside the littoral zone.		
Dynamics	High rate of erosion, to be weighed up against the beachrock freed by the erosion.		
Stakes	Control of future new installations in the area between the road and the shore, from the point of view of the probable future densification of residential habitations.		
Action	Monitor the shoreline and the status of the beachrock. Anticipate installations possibly subject to withdrawal measures. Measures to preserve the beachrock and seek alternatives to the extraction of materials. Sector scheme recommended		
Priority	Very high	Monitoring-observation	Intensive and regular

				PERIURBAN
TG1-d	177	- LOME EAST		
Diagnostics	Homogeneous terrace, variable densities of habitation, of very unequal quality, seaside flats, hotels, relicts of agricultural concessions on standby. Road route outside the littoral zone.			
Dynamics	Straight littoral zone, tendency to "undulate", very unstable, subject to high erosion in places (cell east of Lomé harbour). The clearing of the beachrock by erosion has made the beach relatively stable.			
Stakes	In the long term: Urban consistency of the gr shore. High risk of flooding from continental wa	reen sea front type avoidin aters.	g coastal ro	ads too close to the
Action	Avoid the building of dwellings and hotels too close to the beaches. Conserve green agricultural breaks in urbanisation that are still present. Monitor the shoreline and the status of the beachrock. Measures to preserve the beachrock and seek alternatives to the extraction of materials. Implement a sector scheme to frame periurban residential and tourist development.			
Priority	High	Monitoring-observation	Intensive	and regular

		RURAL AT RISK
TG1-e	178 - TOGOVILLE – AGBODRAFO - A	NEHO
Diagnostics	Sandy littoral rim bounded in the east by the mouth of the outlet of lak channel- outlet of the lake. Low elevation. This sector is situated within which stretches from east of the harbour to Lomé. Habitation of variable urban centre of Aného. The system is subject to heavy metal pollu	te Togo and to the north by the the morphodynamic erosion cell e density in urban zones in the tion related to waste from the

Dynamics	Very high instability at the level of the Aného lagoon mouth. High erosion noted across the whole sector			
	since the 1980s (shore recession of 6 to 8 m	n per year). Improvements	have been made, which, for the	
	systems of protection of Knámá Cumukoná a	er, these groynes are rapid	coll subject to rapid erosion with	
	a recession of approximately 100 m to 600 m	between 1988 and 2008, ar	n average of 5 m/yr.	
Stakes	High risks of destabilisation of the unit of the wharf and the infrastructure of the National Phosph			
	Company plant with considerable economic	impacts. The environme	ental impacts of this phosphate	
	concentration plant (Kpémé). Heavy threat to	o the sparse population ins	stalled on the sandy spit east of	
	Aného. High risk of flooding from continental waters.			
Action	Monitor and possibly strengthen the developments at Kpémé and Aného. Deliberately restrict building on			
	a coastal fringe 200 metres from the shore. Preserve or even restore the natural vegetation on the			
	of the mouth and relicts of mangroves.			
Priority	Very high	Monitoring-observation	Intensive and regular	



Rock fill and groynes at Aného (source: case study)



Aného fluvio-marine system (the groynes and rock fill can be seen at the bottom of the picture. (Source: Google Earth)



Reflective beach at Aneho (source: JJ Goussard)



Groynes at Aneho (source: JJ Goussard)



BJ – BENIN

BJ1

GRAND POPO – WEST COTONOU

	TOURISM			
BJ1-a	179 - TOGO BORDER - GRAND POPO			
Diagnostics	Narrow terraces in a practically insular position bordered by continuous lagoons and channels. Coconut groves densely inhabited in islets separated by strips of less dense dwellings. Hard-surfaced road corridor back from the beach, but too close in places.			
Dynamics	Beaches and very unstable and dynamic sandy formations. Formation of bars on the fore shore an duplication of the rim.			
	Along to Grand Popo: This zone is in dynamic equilibrium and is subject to average seasonal fluctuations approximately 25 metres. In the event of an exceptional storm this value may reach 60 metres. Real tendencies erosion are felt at certain places.			
	From Grand Popo to the border: This portion of the littoral zone has been highly eroded in the past, then a tendency to accretion between 1985 and 1990 and then a tendency to dynamic equilibrium since this period (Benin National Diagnostic Study).			
Stakes	Security of the population settled practically on the beach. Densification of human land use foreseeable with the corresponding stakes. In the long term, exposure of the buildings, infrastructure and populations of the Grand Popo site.			
Action	Monitor changes in the coastal system. Restrict new buildings and locate them back from the beach. Draw up a flood/submersion risk prevention plan. Preserve natural areas behind the channels parallel to the coast.			
Priority	Very high Monitoring-observation Intensive and regular			

	ENVIRONMENT & RURAL AT RISK		
BJ1-b	180 - MONO AND KOUFFO ESTUARINE LAGOONS		
Diagnostics	Vast complex of channels, lagoons, wetlands, fresh and saltwater milieus. Hydric systems connected during seasonal spates of the Mono and the Kouffo. Littoral rim very narrow in places, broken at two points, final outlet of the Kouffo and its lagoons. Rural habitation in places in a high risk situation. The dynamics of the "Bouche du Roi" river mouth were greatly affected by the Nangbéto dam built on the Mono in 1987.		
Dynamics	Completely unstable sector with fluvio-marine dynamics: At the mouth of the river Mono called "LA BOUCHE DU ROY" , where the river flows into the sea, complex morphological changes have taken place and the outlet is shifting along a stretch of around ten kilometres between Avlo and Djondji. The situation has greatly deteriorated since 1990 with the implementation of the NANGBETO dam and there has been a great deal of erosion during the period of spates; several dwellings and installations have been washed away. In August 1999, the village of Djondji was affected following the submersion of the village of Docloboé in previous years. This deterioration has continued since 2000 (source: case study).		
Stakes	High risks (flooding-submersion) for the few small villages. Important hub of the coastal fluviomarine system of undoubted biological value.		
Action	Monitor changes in the fluviomarine coastal system. Secure the population and habitations at risk (of submersion/flooding from continental waters and storm surges or conjugations of both) and totally restrict installations in the dynamic zones. Measures to preserve and conserve this unique system of wetlands.		
Priority	Very high Monitoring-observation Intensive and regular		

			ANTICIPATION
BJ1-c	181 - WEST OUIDAH - COTONOU		
Diagnostics	Relatively homogeneous sector. Sandy terrace bordered on the landward side by a network of lagoons and channels practically connected, but with few intermediate channels between this network and the littoral zone.		
	Land use predominantly coconut palms, interspersed with staple crops on small/average properties with "large huts". Residential dwellings on the edge of the beach approaching Cotonou. Appropriate land ownership regime. Registered concessions?		
	Coastal track the line of which approaches the beach (sometimes approximately 100 m). Precarious settlements in segments or in concessions inserted between the track and the beach. Wetlands of Ouidat to be preserved in association with the listed historical site.		
Dynamics	Littoral zone which is homogeneous, longitudinal, straight profile, slight tendency to undulation near Cotonou expressing the presence of waves of "sediment trains" along the coastline. Alternate areas undergoing slight erosion and progradation. Presence of bars on the shoreface.		
Stakes	In the medium term, accompaniment and supervision of the development of a West Cotonou residential and tourism area which will require:		
	The defining and drawing of boundaries of a littoral strip that is not secured and not suitable for equipment (road and dwellings)		
	 The most exposed segments of road should be moved landward. 		
	Withdrawal landward of dwellings on the edge of the beach.		
	The probable densification of the periurban zone of West Cotonou in a residential area should be accompanied.		
	Agreed development zone, and implementation of a sector scheme comprising improvement works structured by the building of a road or new, secured track more than 500 m from the beach with satellites towards the beach, which would be a powerful engine for densification. In this scenario, the former track would be abandoned.		
Action ⁸	This mechanism could propose a natural seafront (essentially plantations of coconut palms?) preparin the land for a possible future change in the shoreline. Supervision of the preservation of the wetlands of Ouidah should enable better promotion of these areas which are an integral part of the historical site. Such an operation would require expropriations and a replotting of land with a view to withdrawin existing installations on the beach to the landward side of the road. This operation would have a hig impact on land ownership (winners and losers regarding real estate and land property values). Supervise and officialise the preservation of the wetlands and sea marshes of Ouidah;		
.			
Priority	High	Monitoring-observation	Watchkeeping for the purpose of anticipation

The "Fishers road" tourist project (Municipalities of Cotonou, Abomey-Calavi and Ouidah)

The whole of this zone is directly concerned by the Fishing Road tourist development project which will be conducted in the form of a public-private partnership. This is a land planning and regional development operation under the aegis of the government of Benin. The first section of the coastal road will be moved northward 150 to 200 m, taking it to mid-way between the edge of the coast and the coastal lagoon. The zone extends from Fridjrossè to Ouidah along a stretch of around thirty kilometres. More precisely, the area covers a total surface area of 5,000 ha, including1,500 ha for building and 3,500 ha devoted to leisure facilities⁹. For a total cost of approximately 132 billion, the Fishing Road Project is one of the most ambitious undertaken by the government of Benin.



The project was conceived of several years ago, and this perspective has encouraged land speculation on the whole littoral zone, especially on the Fishing Road where a hectare of land today costs more than 20

⁸ These remarks are general and do not specifically take into account the fishing road project mentioned above, about which the national diagnostic study did not provide more information.

⁹ Source: République du Bénin. Ministère du Tourisme et de l'Artisanat. 2005.- Projet de Développement de la Route des Pêches. Fiche synthétique. 16 p.

million CFA francs (source: national diagnostic study). Conflicts are emerging over usage, in particular with the fishermen's coastal establishments which fear expropriation and having their access to the beaches reduced. The zone has been listed since 2005 (Decree no.2005-684 of 3 November 2005 classifying the fishing road as an area with an exclusively touristic vocation).¹⁰

BJ2 COTONOU

ANTICIPATION				
BJ2-a	182 - WEST AIRPORT			
Diagnostics	Dense urbanisation in proximity to the airport, followed, towards the west, by luxury housing. Precarious settlements and "informal" land use in proximity to the shore along its length. Catering and leisure facilities along the beach on the whole of the zone on the backshore served by a coastal track in immediate proximity to the beach.			
Dynamics	Longitudinal, slightly undulated profile, beach foreshore with some development in the eastern part, but restricted (approximately 100 metres) to the west. Zone undergoing accretion (related to the harbour works at Cotonou). Low topography and exposure to storm risks.			
Stakes	In the medium term, accompaniment of building development, which will undergo high densification in this sought-after, connected area. Management of precarious installations on the back beach.			
Action	Restrict new buildings in the areas close to the shore, planned withdrawal of habitations at risk on the edge of the beach. Closely monitor the changes in the shoreline along the entire zone. Anticipate installation of facilities and development through a sector scheme.			
Priority	Average	Monitoring-observation	Watchkeeping for the purpose of anticipation	

	URBAN		
BJ2-b	183 – HARBOUR AIRPORT		
Diagnostics	Very diversified and dense urbanisation, besides the airport footprint. Residential habitation at various levels of quality (swimming pools), large hotel infrastructure, unbuilt land, but projected increasingly close to the shore or encroachment of precarious, random buildings. Vegetable growing area. Urban effluent outlets on the beach at the level of the harbour. Large quantity of solid waste.		
Dynamics	Slightly undulated longitudinal profile, foreshore and beach highly developed (accretion favoured by the harbour developments). Zone exposed in the event of storm waves. This zone, situated immediately to the west of the harbour, is undergoing constant accretion under the influence of the harbour structures. The recession of the sea in this zone is estimated at between 20 to 25 metres per year (Benin National Diagnostic Study).		
Stakes	In the medium term, implementation of a coherent project to develop the seafront and control the extension of building. Restrict new buildings in the areas close to the shore. Closely monitor the changes in the shoreline along		
Priority	High Monitoring-observation Regular		

¹⁰ More information: http://laroutedespeches.bj



(Source: Benin national diagnostic study). See case study for more information.

URBAN & HARBOUR

BJ2-c	184 - HARBOUR SECTOR AND COTONOU CHANNEL			
Diagnostics	Complex, highly urbanised sector, habitation and harbour facilities, random dwellings at risk of flooding on the left bank of the lagoon outlet. Right bank in rock fill ending with a pier in the sea.			
Dynamics	Beach on the right shore in a complex situation: The western part is undergoing accretion at a high rate, the eastern part possibly has a tendency to erosion or is stabilised (anchorage to two piers at the ends of the beach).			
	Littoral zone situated between the lagoon outlet and a second protective structure built at the same time as the harbour: this zone is in dynamic equilibrium under the influence of the protective groyne commonly known as "east groyne or Siafato groyne". Littoral zone situated between the port and the outlet of Cotonou Channel. This zone is protected by a groyne of rock fill (commonly known as West groyne). The zone is currently in dynamic equilibrium. The lagoon outlet is a zone of variable morphology which has been subject to considerable changes since Cotonou Harbour was built (Benin National Diagnostic Study).			
Stakes	In the medium term, preservation of the buildings and infrastructure close to the shore.			
Action	Restrict new buildings in the areas close to the shore. Urban requalification accompanied by a withdrawal of habitations situated on the edge of the left shore of Cotonou Channel. Possible additional structures against erosion. Close monitoring of changes in the shoreline on the entire zone.			
Priority	High Monitoring-observation Regular			
Case study	The beaches of Benin in the Gulf of Guinea in West Africa: changes and socio-economic consequences. See annex 1.			

	URBAN		
BJ2-d	185 – AMBASSADEURS SECTOR		
Diagnostics	Largely urbanised, the eastern part is structured in quadrats. High density right to the edge of the beach. No development of the sea front. Since the 1980s, in the West part of the sector, affected by erosion, beach sandstone (beachrock) has appeared, unearthed by erosion.		
Dynamics	Sector subject to high rate of erosion upstream of the channel and the port of Cotonou, despite several old structures (groynes + stabiplage).		
	This zone is currently undergoing strong erosion at rates of approximately 20 metres per year in the east in		
	immediate proximity to the Siafato groyne. These rates decrease eastward and remain greater than one metre per		
	year towards Kraké on the border with Nigeria. This part of the littoral was also where the largest sand quarries		
	were situated. More than 800.000 m ³ of sand were extracted annually (source: Benin national diagnostic study).		
Stakes	In the short term, considerable shoreline recession threatening dense urban districts.		
	Absolute restriction on new buildings in the areas close to the shore. Defensive project underway		
Action	involving a groyne mechanism. Close monitoring of the impact of the developments.		
Priority	Very high Monitoring-observation Intensive and regular		
Case study	The beaches of Benin in the Gulf of Guinea in West Africa: changes and socio-economic consequences.		
	See annex 1.		



UTM 31N WGS 1984 Satellite image taken December 2002 Sand Sample Location

Baird

Project currently being implemented involving 7 protective groynes on the segment of coast east of Cotonou (Source: Benin national diagnostic study). See case study for more information.



Land use by fishermen in the west part of the sector. Note the highly reflective beach profile subject to active erosion (source: case study.

			ANTICIPATION
BJ2-e	186 - EAST COTONOU		
Diagnostics	Littoral area sparsely populated, despite the proximity of urban centres. Coastal road between 1.2 and 1.6 km from the shore. Large plantations (coconut palms). Land reserves destined for future use on terrains close to Nigeria. Zone suitable for equipment (high, well-drained terraces).		
Dynamics	R ecession of the shoreline to be anticip Ambassadeurs zone.	ated depending on the de	evelopments planned for the
Stakes	Urbanisation respecting the seafront with no buildings and developed, anticipation of developments and land use/urbanisation of the sector		
Action	Anticipate equipment and development. Closely monitor the changes in the shoreline.		
Priority	High	Monitoring-observation	Watchkeeping for the purpose of anticipation



The realisation of a project to protect the Ambassadeurs zone, a view of which is presented with sector BJ2-d, would have the consequences shown in this photo. In this photo, we can see that after the last groyne of sector BJ2-d, the sea

would have advanced approximately 200 m after 20 years and more than 500 m 40 years later (source: Benin national diagnostic study).

ANNEX 1

Summaries of the case studies

(This annex was written by the Centre de Suivi Ecologique in Dakar)

MAURITANIA

Evolution of the littoral zone of Nouakchott: Characterisations and associated risks

Author(s):

Dr Abdoul Jelil Niang, researcher, geomorphology, IRC-consultant Dr Ahmed Senhoury, researcher, Nouakchott University Dr Abderahmane Khalifa, Director general IRC-consultant

Summary: the Nouakchott littoral zone is characterised by sandy, arid beach, exposed to ocean swell and wind with a high degree of sediment transport estimated at approximately 1 million m³ per year. It is intrinsically fragile and rapid change has occurred following anthropisation and in particular since Amitié harbour was built in 1986. This study allowed us to characterise the way this littoral zone is changing and determine the associated risks. A diachronic analysis of the shoreline kinematics was produced through a comparison of the digitised reference line (moisture limit) on the satellite data (images and aerial photographs) acquired at different dates between 1980 and 2007.

The results obtained by an automatic method incorporated in the DSAS module (*Digital Shoreline Analysis System*, extension compatible with ArcView 3x software), show that among the structures installed on the Nouakchott littoral zone, Amitié Harbour is by far the leading cause of the spectacular changes currently experienced. For example, north of the Harbour, the shoreline is undergoing strong accretion (estimated at 860 m between 1980 and 2007) and south of the Harbour, the beach has undergone severe erosion of up to 18 m per year.

This situation represents a serious threat of submersion for the town of Nouakchott which is largely situated at an elevation below sea level.



Photo 1: View of the harbour, siltation to the north and erosion to the south.



Photo2 : Aerial view of the port in 1991 with materialisation of the shoreline in 1980 (red line) and in 2002 (yellow line)



Photo 3: Erosion at the fish market



Photo 4: Flooding south of the harbour after the storm in 1997



Photo 5: View of the north of the harbour (accretion)



Photo 6: Erosion of the littoral zone in the part situated north of the fish market 2010



Photo 7: Erosion and undermining of the goyne south of the harbour

SENEGAL

Study of the dynamics of the littoral rim at Gandiolais on the Saint Louis –Niayam (Potou) corridor

Author(s):

Boubou Aldiouma SY, teacher and researcher in geomorphology Moussa Sall, *Centre de Suivi Ecologique* Kader BA, doctorand, Department of Geology, Faculty of Sciences and Technology, UCAD Amadou Abou SY, doctorand in geography, *UFR de Letters et Sciences Humaines*, UGB Awa Diane, master's degree in geography, *UFR de Letters et Sciences Humaines*, UGB

Summary: The littoral rim of the Barbarie spit, in particular at the level of the Saint-Louis-Niayam corridor, is characterised by dynamics with an essentially erosive tendency, under the action of natural factors (marine hydrodynamics) and anthropic factors (evacuation channel, uncontrolled land use, illegal extraction of sea sand). As regards the geomorphology, the field data taken from the beach profiles on the sector of Gadga Lahrar, shows a dune recession of 0.21 to 1.14 cm per year on the first site and 0.17 to 1.29 cm per year on the second site. Between 2003 and 2010, changes in the shoreline corresponding to the mean high tide level, determined from a series of Radar images, illustrate highly erosive coastal dynamics with phases of accumulation in places. To the right of the town of Saint-Louis, Goxxu Mbacc district is the most affected with an erosion rate 9 to 16 m per year over the period under consideration, while those of Guet Ndar and Ndar Tout at times recorded sediment accumulation at a pace of 2 to 6 m per year.

There is generalised erosion at the level of the evacuation channel, with a mean recession rate of 8 to 28 m per year on the north part and 13 to 33 m per year on the south part. In the centre of Doun Baba Dièye

island, facing the evacuation channel, erosion rates of 24 to 61 m per year were recorded, while the north and south extremities experienced accumulations of 5 to 26 m per year and 8 to 23 m per year respectively.

Lastly, the former outlet, which quickly closed up after the evacuation channel was opened, is the seat of generalised accumulation of 4 to 7 m per year in the north part and 1 to 6 m per year in the south part.



Photo 1: Inn being built on the dune rim of the hydrobase, 04 April 2010, photo Leïdi

Photo 2: Collapse of houses at Guet Ndar following wave assault (photo Leïdi, 28 March 2010)

Factors influencing changes in the shoreline along the coastal cliffs in a highly urbanised milieu: Case of Dakar Peninsula.

Summary of studies carried out on the instability of the Dakar coastal road.

Author(s): Dr. Mamadou Gueye Ing. Geol. Abdoulaye Ndoye

Summary: The erosion of the rocky coast of Dakar between Cap Manuel and Almadies point is determined by three types of factors: intrinsic (geomorphology, fracturing and alteration); external dynamics (oceanic agents and hydrology); anthropic, from human exploitation, and the resort developments on the coast. The diachronic analysis of aerial photographs shows that the rate of erosion of the Dakar coastal road at the level of the three sites studied (Cap Manual-*pointe des abattoirs*, Mermoz, Mamelles), varied between 1946 and 2003. The mean recession of the coast (between Cap Manuel and *pointe des abattoirs*) over that period of 57 years is estimated at 30 cm per year. The maximum recession is estimated at 118 cm over a similar period at Pasteur beach. The findings from the study of the three sites reveal the important role played by fracturing. The action of the waves on the foot of the clay-marl cliffs, in particular during stormy periods, in conjunction with the action of meteoric water, causes mass erosion which continuously destabilises the rocky Dakar coast.

Keywords: Shoreline, rocky coast, Dakar Peninsula.





Photo 2- The north-south extension joints and their effect on the toppling of Pointe des Madeleines (Gueye, May 2001)



Photo 3- Opening of fractures and boulders tumbling into Mermoz quarry (Gueye, July 2002)

Changes in the shoreline at Rufisque between 1954 and 2006.

Summary: The littoral zone of Rufisque has long been threatened by coastal erosion, which led to the building of protective structures which were consolidated in the 1980s, causing a deterioration in the natural environment of certain beaches or even their disappearance. The comparison between the positions of the moisture limit on the foreshore, observed from aerial photographs and satellite images between 1954 and 2006, shows a radical regression of the beaches of 0.4 to 1.5 m per year, with the exception of the beach of the Cap de Biches power station which is in equilibrium or even progradation (+0.15 m per year). These changes underwent significant spatio-temporal variation especially after the hardening of almost the whole of the foreshore by protective walls. Thus, the study of the long term changes (mi-secular) in the shoreline at phases prior to and after the construction of these walls enabled an assessment of their impact on this evolution. Beyond the attenuation in shoreline recession they allowed just after the period following their construction and the protection they afford to residents against the strong ocean waves in the rainy season and which is currently minimal, the protective walls have intensified the recession rates of the Rufisque shoreline especially at the extremities of these structures owing to by-pass phenomena. This spatio-temporal variation and intensification are currently more manifest with the assumed increase in sea level attributable to changes with rates of up to minus 3 m per year.

Keywords: Rufisque, shoreline, moisture limit of protective structures, progradation, erosion.



Disappearance of the beach along the wall with rock-fill



Micro cliff caused by erosion of the end of the rock fill of Keuri Souf-Thiawlène. (Photo taken on 19 October 2005) wall, to the right of the Thiawlène cemetery (by-pass effect) (photo taken on 19 October 2005)

Changes in the shoreline between Ngaparou and Mbour (Petite Côte) between 1954 and 2007.

Author(s):

Marième Soda Diallo, Centre de Suivi Ecologique Moussa Sall, Centre de Suivi Ecologique

Summary: the south coast of Senegal (petite côte) is the country's principal seaside tourist resort area. The rich biodiversity along with enormous fishing resources make it a central pillar of the Senegalese economy. Today, this coast is undergoing extreme erosion under the effect of the random urbanisation it has been subject to over the past few years. Management of this phenomenon has up till now been restricted to the implementation of rigid protective structures that disrupt the distribution and volume of coastal sediment.

The diachronic study of the shoreline changes is based on the interpretation of aerial photographs and satellite imagery. The aim is to highlight and measure the phenomena of erosion and accumulation along the coast over the period 1954-2007.

The study zone stretches from Ngaparou to the town of Mbour, a distance of approximately twenty kilometres.

Over the period 1954-2007, the shoreline receded overall at a rate of 0.11 m per year. This trend hides the local variations which seem to be related, firstly, to the natural configuration of the coast (composed of segments protected by points and more exposed segments) and the action of the waves and, secondly to the small quantities of sediment supplied by the coastal drift current (10 to 25,000 m³ per year for the whole coast according to Barusseau 1980) and also to the absence of streams capable of providing a sufficient sediment supply to counteract the losses.

The sectors undergoing erosion concern the segments: South of Ngaparou-South limit of the "Residence" district (-0,16 m per year); the segment of coast with the "Espadon", "Bougainvilliers" and Saly Niakh niakhal hotels over 1.8 to 2 km (-0.36 m per year); South of the "Les cocotiers" hotel up to the "Golf" district of Mbour over approximately 4 km (-0.61 m per year); North of IRD centre (-0.21 m per year).

Two sectors are undergoing accumulation: The one located south of the harbour residence to the right of the outlet of the stream and the segment from the fishing village (Mbour Tefess) to the north part of the bay south of Mbour Tefess at rates of 0.71 and 0.41 m per year respectively.

The following sectors: the segment from the "Récifs" complex to the north limit of the stream, the segment starting from the "Cristallines" complex to the Espadon hotel and lastly, south of Mbour Tefess present a certain stability with respective rates of: 0.09 m per year, 0.08 m per year and 0.07 m per year.



Photo 1: Destruction of the wall of a house at Ngaparou, CSE June 2010



Photo 2: Abandoned houses in the Golf district, CSE June 2010

Changes in the shoreline of the littoral zone of Palmarin.

Author(s):

Jean Kaly, Sohna Diop Direction de l'Environnement et des Etablissements Classés (DEEC) Accc Project Agence Nationale de l'Aménagement du territoire (ANAT)

Like the petite côte where it is situated, the Rural Community of Palmarin is highly subject to coastal erosion. Changes in the shoreline, represented by the foreshore moisture line, were monitored over a period of 34 years, using a Corona photograph (1968) and Spot satellite imagery (2002).

In the northern zone of the rural community, the average rate of erosion over the period is estimated at 1.78 m per year with a greater intensity on the sector of Djiffère hamlet, where it exceeds 7 m per year, causing the destruction of roads and other infrastructure. Habitations and tourist infrastructure are also threatened in the other sectors. A low rate of accumulation of 0.09 m per year is recorded south of Fata Ngoussé only.

To the south of the rural community, the phenomenon of erosion is more intense with an average rate of recession of 4.42 m per year. The erosion rate is at its highest – 9.23 m per year - on the northern half of Sangomar island, leading to the widening of the new channel. On the other hand, the southern half of the island recorded progradation of 2.43 m per year.

GUINEA

Case study of coastal erosion at Koba (Boffa) and Kaback (Forecariah prefecture)

Author(s):

M. Ibrahima Diane Dr. Mohamed Lamine Keita Dr. Ibrahima Kalil Keita Dr. Kandet Bangoura Dr. Seny Conte Dr. Sadou Barry

M. Pierre Koivogui

Koba and Kaback plains stretch behind the swampy coastal zone of Guinea and constitute a rice basket for a population estimated at over two million, with annual rice production of thousands of tonnes of rice. In Koba, the coastal strip is shrinking year after year under the effect of the marine dynamics and the total destruction of the mangrove vegetation. In this plain, the shoreline recession rates were under 22 m per year, between 1953 and 1980; in addition, during this period, a phenomenon of sediment accumulation was observed at a rate of 80 m per year: the zone was stable. Under the combined effect of the ocean waves and man (destruction of the mangrove), the shoreline recession rate reached 100 m per year, in the southern, sea front sector, between 1980 and 1988. There was no accumulation phase recorded during this period.

At Koba



Photo 1: formation of an erosion amphitheatre south of Koba plain

At Kaback



Photo 2: Damage to the dyke protecting Kaback plain by wave assaults and ocean swells at Kaback

COTE D'IVOIRE

Characterisation of the morpho-sedimentary dynamics of the Côte d'Ivoire littoral zone

Summary: The characterisation of the morpho-sedimentary dynamics of the littoral perimeter zone of Côte d'Ivoire was carried out, for the period 2007-2009, by analysing the data from the topographical surveys of the beaches at the following sites: San-Pédro, Grand-Lahou, Vridi-Port-bouët (Abidjan), Grand-Bassam, and Assinie – Aforénou (border with Ghana).

The spatio-temporal variation of the sediment movements on the beaches and the kinematics of the shoreline on the sites studied, are influenced by changes in hydrodynamic conditions and anthropic action. The beaches generally undergo erosion from May to August and accretion from November to February.

On the segments of coast of San-pédro and Abidjan, the downwind beach sectors are marked by considerable erosion, following the disruption of longitudinal (West-East) sediment transport by the harbour developments. The mean recession rates, in the order of 1.20 to 3.8 per year, are higher at Abidjan in Port-Bouët Bay. At Grand-Lahou, the thin littoral rim to the west of the river mouth is threatened by the natural erosion of the shore, with an average rate of 0.92 to 1.72 m per year, and the shifting of the river mouth. The section of coast between Grand-Bassam and Aforénou (Ghana border) shows good stability more or less interrupted in certain places (Mondoukou, Assoindé-Assinie Mafia). The flat littoral rims isolated between the lagoon and the sea on this section of coast, are particularly subject to frequent submersion during equinox tides and storm tides.



Destruction of colonial houses Due to the shifting of the pass at Grand-Lahou (CRO, May 2007)



Erosion of the shore opposite the tourist site of Valtour in Assinie (Assouindé) (CRO, July 2009)

TOGO

Characterisations of the status of beaches in two coastal drift cells. The coasts to the west and east of the port of Lomé

Author(s):

Adoté Blim Blivi Houédakor Koko Bawa Dangnisso Gatogo Etsè Afoudji Koba Adjaho Kuami Wilson-Bahun Kpotivi Kpotor Komlan

Centre for Integrated Coastal and environmental Management Research Division - University of Lomé

The coastal area of Togo belongs to the hydro-sediment geosystem between two rivers, the Volta and the Mono, which supply the coastal drift current with sandy sediment, redistributed along the coast in a west to east direction. Its geomorphologic configuration is relatively homogeneous, limited by the sandy-clay formations compartmented into plateaus, formed by the differentiated rims and the lagoon water bodies of variable geometry which the rivers flow into. The quite continuous hydrological, sedimentological and oceanographic effects reveal the transborder characters of the variates.

The coast, 50 kilometres long and comprising reflective and dissipative beaches, is positioned on two morpho-dynamic cells, independent from the point of view of causes and modes of functioning. The pier at Lomé port, a maritime structure 1,200 m long, which lies crosswise with respect to the sediment transport current, is the boundary of two physical sections: the accumulation segment of the western coastal drift cell, which stretches for 10 km and the erosion segment, 30 km long, of the eastern coastal drift cell.



Photo 1: The sea port, cutting the beach into two beach statuses the coast: the siltation and erosion beaches

The fundamental question which serves as a pillar of the methods used to obtain better scientific knowledge of the coast is shoreline recession, originating from coastal erosion; the predominant phenomenon of the coastal morpho-dynamics, due to its implications for infrastructure and negative affectations incurred, its relatively high rates of change and for political importance and the developments implemented. Knowledge of the question is sufficiently advanced, having been studied since 1980; there are several publications on the subject. It is taken into account in the strategic poverty reduction programme and in national communications on climate change by the study of coastal vulnerability and adaptation.

The major aims are focused on the vision of the continuous control of physical manifestations which take place at very high rates of change, several metres of shoreline recession and advance per year, which are easy to interpret on a renewed base map.

The present study combines cartographic data (aerial photographs and topographic maps) and field measurements (topographic surveys) with a view to calculating the rates of change for the period 1955-2010. The results show for the period 1955-2009, in the siltation segment, a western sub segment presenting an average of 244.48 m, equivalent to 4.28 m of progradation per year and a second, 6 km long, where an advance of 8.38 m per year is noted, showing a regressive westward accumulation of the pier.

East of the port, the coast undergoing erosion presents three sub segments: a first where the recession rate is 15.79 m per year; a second sub segment with an annual recession of 6.35 m (255.37 m on average) and a last segment which receded 15.31 m per year.



Photo 2: Shoreline recession at Kpogan, in the second sub segment

BENIN

The beaches of Benin in the Gulf of Guinea in West Africa: changes and socio-economic consequences

Author(s): Raoul Laibi

Summary: The coastal area of Benin stretches for 125 km and is subject to strong morphosedimentary dynamics, in particular since the construction of the port of Cotonou in 1962 (in the vicinity of the Ouémé-Sô estuary mouth) and of the Nangbéto hydroelectric dam in 1987 (on the river Mono). These phenomena have been monitored from changes in the shoreline corresponding to the instantaneous waterline, on the basis of topography maps (1963), aerial photographs (1981 and 1995), satellite imagery from Landsat (1984, 1988 and 1998), Ikonos (2002) and QuickBird (2006 and 2009).

The construction of the port engendered an erosion zone east of the shoreline at a rate of 21 m per year between 1963 and 1981; this erosion rate changed to 10 m per year between 1981 and 1995 and 11 m per year between 1995 and 2000. On the other hand, west of the shoreline, accumulation phenomena favoured accretion of 450 m between 1963 and 1981. The construction of Nangbéto dam considerably changed the functioning of the Mono-Couffo estuarine system, marked by migrations of the tidal river mouth, the "Bouche du Roi", especially from 1995 onwards. This last shifted 3 km eastward between 1996 and 1999, which is an average rate of approximately 750 m per year. This migration reached 7 km, between 1999 and 2009, which is an annual rate of 700 m. In 2007, this caused the displacement of some of the inhabitants of the village of Docloboé, which was badly flooded. Each time, these migration episodes are artificially stopped by opening an outlet which alters the sediment dynamics leading to the closing up of the "Bouche du Roi".



- Photo 1: Photograph (taken facing westward) showing the position of the "Bouche du Roi" in August 2007 and the negative effects of erosion. Picture Laibi Raoul, 26/08/2007
- <u>Caption</u>: (1)- Position of the "Bouche du Roi" in August 2007; (2)- Sandy spit FL_87-99 under the influence of fluvialmarine erosion; (3)- Lagoon arm invaded by fluvial waters following the submersion of the sandy spit in 1999; (4)-Cliff of beach relicts revived by fluvial waters submerging the sandy spit in 1999; (5)-Ruins of the village-hamlet of Docloboé



Photo 2: Photographs showing operations to open the artificial outlet at AvIo. Pictures Laibi Raoul, 27/08/09 <u>Caption:</u> F- Back photograph showing the initial ditch separated from the sea and the lagoon by two cutting fronts; I-Stripping of the sea-side cutting front by mechanical digger (1-sea; 2- ditch); II- Stripping of the cutting front on the lagoon side by mechanical digger (2- ditch; 3- lagoon); III- Communication between the sea and the ditch after I); IV-Communication between the lagoon and the ditch after II.