



Sénégal (North)

A major proportion of the Senegalese Coast is affected by growing erosion. Coastal stakes are rising in the meanwhile, triggering more and more common situations of risk.

Senegal has recently adopted an anti-coastal erosion strategy, as well as various framework plans and documents on land development.

SN1 SAINT-LOUIS – GANDIOLAIS – GRANDE COTE

A saltwater wedge progression has been noticed in the whole Gandiolais area. The sea level rise is certainly not the only phenomenon behind what is apparently a general pattern. The impacts of over-pumping in fresh-water lenses must also be taken into account.

The building of the Rufisque-Saint-Louis road should help revitalize developments on the Grande Côte. Note the discovery of an important gas deposit off Saint-Saint, across the Senegal-Mauritania border: exploitation is expected to start in 2020.

However, a climate change adaptation plan for the 2015-2020 period was drafted in partnership with Saint-Louis' traditional fishing council with the support of CSE and the USAID-funded COMFISH project.

URBAN AND PERI-URBAN	
SN1-a	16 - URBAN, PERI-URBAN AND HERITAGE AREA OF SAINT-LOUIS
BASELINE	
Diagnostics	<p>This is a complex area that includes Saint-Louis' urban centre and the historic island of Saint-Louis, the Barbarie Split, a thin and long sandy-arrow as well as lower environment located on the river's left bank. Many sandy islands. Major fishing and tourist activity. The opening of a breach in the Barbarie Split in 2003 following the submersion risks facing the town of Saint-Louis then, has profoundly changed a set of particularly complex hydrological and sediment balances that characterizes a wide and very low delta area.</p> <p>These modifications today affect a good part of the economic activities (fishing, tourism, vegetable growing and salt production). The concentration of population in the town itself, but also and especially in the peripheral villages and districts (Guét Ndar, Ndar-Toute, and Goxxu mbac,- 57% of the population of the municipality of Saint-Louis) determines a high-risk situation. Still uncertain location of a future ore port related to the objective of making the Senegal river navigable (OMVS).</p>
Dynamics	<p>Rapid erosion observed in several sites, but also sectors in accretion in places. The reconfiguration of the mouth following the opening of the breach is still underway, with changes directly affecting not only the exposed sea front, but also the "inland coastline" of the river banks, with a considerable increase in the intertidal zone.</p> <p>Wind erosion is also intense, leading to sand invading infrastructure. The sector is globally low-lying and completely unstable. Disappearance of the village of Doun Baba Dieye located opposite the breach, reduction of surface area the îlot aux oiseaux (from 2 ha to 0.5 ha in less than ten years), collapse of houses at Goxxu mbacc and Guet Ndar in 2010</p> <p>The breach created initially is today more or less in equilibrium, with seasonal oscillations observed (see 1). This new mouth is approximately 2 km wide.</p>

Stakes	Reduction of risks for the populations exposed, conservation of the heritage of Saint-Louis, but also of the entire unusual life system of the delta that is largely dependent on the salinity gradient and the configuration of the delta. Requalification and reorganization of catch landing areas and the areas where the fish is processed once landed.		
	Different protection solutions are being examined with a main alternative, excluding non-intervention, consisting in consolidating the existing breach, also securing its depth (protecting Saint Louis against floods, an advantage for fishermen), but at the cost of a deterioration of the natural delta habitats, or the attempt to restore the initial situation. ³		
Actions	Secure the safety of exposed populations, including through relocation. Prevention plan for submersion risks. 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 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 level	Very high	Monitoring-observation	Intense and regular
Remarks	High involvement of the municipal team of Saint-Louis which could play the role of engine driving observation and monitoring if supported by competent technical and scientific resources.		
Developments since 2010			
Evolution of stakes	Port project and river dredging. Construction of the Saint-Louis-Rufisque road, investment in irrigation-infrastructure, tourist development project; discovery of a major gas deposit off Saint-Louis: 450 billion m ³		
Priority level	Very high	Monitoring - Observation	Intense and regular
Protected Area	YES	Hazards	Many submersion episodes, including recent ones (on 100 to 150 km with destruction of houses), progressive breach enlargement



Dynamics around Baba DIEYE Island from 2003 to 2009 (source: case study)

³ 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.

Senegal river Delta cross-border biosphere reserve (Mauritania) RBTDS: WDPA ID 902502	MR4-c	SN1-a
	MR4-d	SN1-b
<p>The Senegal river Delta cross-border biosphere reserve (Mauritania-Senegal) was classified in the world biosphere reserves network by UNESCO's International Coordinating of the Man and Biosphere Programme on 29 June 2005.</p> <p>The reserve mainly comprises the following protected areas:</p> <p>Mauritania: The Diawling National Park, the Chat Tboul Ramsar Site, Moedina's Reserves Forest.</p> <p>Senegal: The Barbarie Split National Park, the Gandon Classified Natural Reserve, the Mpal-Mérinaguène Reserved Forest, The Massara-Foulane Reserved Forest, the Tilène Reserved Forest, the Djoudj National Birds Park, the Naère Reserved Forest.</p>		

Djoudj National Bird Sanctuary National park WDPA ID 867 Djoudj Ramsar Site WII / Ramsar site: WII ID: 1MR001 – 138 / WDPA ID : 68151 Djoudj bird sanctuary world heritage site 506 / UNESCO WH WDPA ID : 2578 / UNESCO WH WDPA ID : 25	SN1-a
<p>The Djoudj natural reserve was classified on 26 February by decree n°62-065 (3ha).</p> <p>The park was created on 14 April 1971 by decree n°71/41 on the creation and integration into the forest domain of the Djoudj national birds sanctuary (Senegal river's delta) as well as of an adjacent zone (13 000ha).</p> <p>The first classification decree was amended on 10 December 1975 by decree 75 -1222 repealing and replacing articles 2 and 3 of decree n°71/41 of 14 April 1971 on the creation and integration into the forest domain of the Djoudj national birds sanctuary (Senegal river's Delta) as well as of an adjacent zone (13 000ha).</p> <p>The Djoudj was named a Wetland of international importance/ Ramsar site on 11 July 1977 (16 000ha), and the latter was put on the Montreux list on 4 July 1990 before being removed on 16 June 1993.</p> <p>The Djoudj bird sanctuary was put on UNESCO's world heritage list in 1981 for natural criteria (vii) and (x).</p> <p>A five-year integrated management plan (1994-1999) for the park and its bordering area was finalized in June 1994.</p> <p>The 2010-2014 Djoudj national park's management plan was finalised in March 2010.</p>	



Collapsed houses in Guet Ndar following wave assaults

(Original photograph-March 2010, source: case study)



*Collapse of the protective wall in Guet Ndar (built in 1910 and which is has already crumbled in a major part).
Picture Marsh 2010, Leidi (source; case study).*



The South-Western part of Saint-Louis, observed from a plane (Source: national Diagnostics)

		ENVIRONMENT & TOURISM	
SN1-b	17 - SOUTH SAINT-LOUIS – INSULARIZED BARBARIE SPLIT		
BASELINE			
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 in of the former river mouth.		
Dynamics	High rate of wind erosion, siltation of vegetable plots and tourist facilities. Alternate sites of erosion and accretion. Filling in of the former outlet of the Senegal river at the South limit 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 île aux Oiseaux (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 level	High	Monitoring-observation	Intense and regular
Remarks	High involvement of the Barbarie Split National Park team which could play the role of engine driving observation and monitoring if supported by competent technical and scientific resources.		
Developments since 2010			
Evolution of stakes	Construction of the Saint-Louis-Rufisque road, investment in irrigation-infrastructure, tourist development project; discovery of a major gas deposit off Saint-Louis:		
Priority level	Very high	Monitoring - Observation	Intense and regular
Protected Area	YES	Hazards	Incremental fragmentation of the Barbarie Split and natural opening of a second breach. Salinization of the ground water and impacts on market gardening and access to fresh water in the Gandiolois.

The Gueumbeul Special Wildlife Reserve (IUCN Category IV) RSF Gueumbeul : WDPA ID 11653 Gueumbeul Ramsar Site WII / Ramsar site: WII ID: 1MR001 – 338 / WDPA ID : 68154	SN1-b
The Gueumbeul special Wildlife reserve was classified in 1983. Gueumbeul was identified as a wetland of international importance / Ramsar site on 23 October 1994 (15 600 ha).	

The Barbarie Split National Park (IUCN Category II) National park WDPA ID 869	SN1-b
The Barbarie Split National Park was created on 09 January 1976 by decree N°76/0016 on the creation of the Barbarie Split national park. Its by-law was established by order n°007165/24 JUIN 76/PM/DGT.	

Marine Protected Area of Saint-Louis MPA St-Louis WDPA ID 352704	SN1-b
Saint-Louis' Marine Protected Area was classified by decree n°2004-1408 of 4 November 2004 on the creation of Marine Protected Areas. The development and management plan of Saint-Louis' MPA was revised for the 2014-2018 period. The governing bodies of Saint-Louis' MPA was established on 20 January 2015 by the prefectural order n°0024/PSL/AMP. They include an Organizing Committee, a Management Committee and a Scientific and Technical Committee (prefectural order n°25/PSL/AMP for the latter committee). The MPA's by-law was validated by the prefectural order n° 0026/PSL/MPA on 20 January 2015.	

Gandon Natural Community Reserve	SN1-b
Gandon NCR WDPA ID: non-existent	
Gandon Rural Council deliberation n°05/CRG/ARR/RAD of 16 July 2003 on the designation of a 2 000 ha site as Community Natural Reserve was approved by the prefectural order of 23 July 2003.	
Gandon's CNR is not listed in WDPA.	

		ANTICIPATION	
SN1-c	18-GRANDE CÔTE-NIAYES		
BASELINE			
Diagnostics	Very monotonous coastal area. Scattered vegetable growing in the Niayes. A few tourist sites such as Mboro Beach, with residential settlements related to the phosphate extraction areas. Ambitious project for the improvement and economic development of the Niayes (Grande Côte master plan) centred around the new town located between Lompoul and Diogo, which would balance out the twin centres of Dakar-Saint-Louis. The Grande Côte master plan comprises 5 hubs: (i) Urban development and land structuring; (ii) Agriculture; (iii) Ecology; (iv) Technology and the industrial network; (v) Tourism;		
Dynamics	Strong wind erosion nonetheless offset by a considerable casuarina replanting, siltation of the Niayes, observed advance of the salt water wedge.		
Stakes	Important from the point of view of the application of the Grande Côte master plan, 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 stabilizing plants on the dunes (bands of casuarina).		
Priority	Low	Monitoring-observation	Watch-keeping for the purpose of anticipation
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Following the Grande Côte master plan, this sector is experiencing some progress: A building of pontoon in Lompoul Building of a thermal power plant The final stage of zircon mining prospecting.		
Mining activities	Zircon mine «Grande Côte» of Mineral Deposit and Eramet companies operationalisation is in progress.		
Priority	Medium	Monitoring-Observation	Regular
Protected area	YES	Hazards	Not reported

Local Natural Reserve of Darou Khoudoss	SN1-c
LNR of Darou Khoudoss: WDPA ID: non-existent	
Darou Khoudoss rural Council deliberation n° 04 of 15 October 2003 on the classification of a land area of 1.500 square for Local Natural Reserve has been approved by the prefectural order n°07/AM in Thiès Region/Tivaouane Department/ Méoune District.	
The LNR of Darou Khoudoss is not listed in WDPA.	

Notto Gouye Diama Local Natural Reserve	SN1-c
Notto Gouye Diama LNR: WDPA ID: non-existent	
The deliberation of Notto Gouye Diama rural Council n°03 of 03 July 2003 on the grant of a land area of 1.180 square for Local Natural Reserves has been approved by prefectural decree n°21/1P on 04 September 2003.	
The LNR of Notto Gouye Diama is not listed in WDPA.	



Stabilizing the overall dunes using a band of vegetation (national diagnostics source)

		ENVIRONMENT	
SN1-d	19 - KAYAR - GUEDEWAYE		
BASELINE			
Diagnostics	Important market-gardening sector. Kayar fishing centre. Straight coastline. Areas of extension of the Dakar periphery towards Guediawaye. Large landfill site at Mbeubeuss (Malika) and intense sand extraction site for building.		
Dynamics	Wind erosion always present despite the rows of casuarina. Observed progression of the salt water wedge.		
Stakes	Urban encroachment approaching the agglomeration of Dakar. Sanitation at Malika – resorption of the open landfill.		
Actions	Control land ownership and urban sprawl, in particular regarding the stakes with respect to the protection of the band of casuarina. Where necessary, sector master plan to be anticipated. Analyze impacts of sand extraction.		
Priority	High	Monitoring	Watch-keeping and anticipation
Comment	High priority related to environmental issues in Malika.		
DEVELOPMENTS SINCE 2010			
Evolution of stakes	The development of urbanisation with housing development for the resettlement of toll motorway displaced people, the drop in farming land. Storm water evacuation by draining towards lakes. Construction Project of a tide gauge station (project from Norway); Construction in progress at the 3 th section of the clearing track in the North: Guediawaye side was paved in 2015. Oil prospecting (offshore)		
Mining activities	dune sand extraction		
Priority	Very high	Monitoring-Observation	Intense and regular
Protected area	YES	Hazards	Recurrence of flooding

Kayar Marine Protected Area	SN1-d
AMP Kayar : WDP ID: 3527065	
Kayar Marine Protected Area was classified by decree n°2004-1408 of 4 November 2004 on the creation of Marine Protected Areas.	
A diagnostic assessment in order to formulate a land development and management plan of Kayar MPA was finalised in March 2007.	
The management committee of Kayar MPA was created and its status validated by prefectural decree n°139 of Thiès department on 3 November 2010.	
The land development and management plan of Kayar MPA was reviewed during the period 2014-2018.	

SN2 DAKAR

The entire coastline of Dakar is artificialised. Erosion affects as well as Cape Verde peninsula cliffs and the beach of the Bay of Hann. There are significant stakes, namely urban ones relating to the coastline, especially on the Eastern and Western coastal road.

		PERI-URBAN AND URBAN	
SN2-a	DAKAR DUNE COAST NORTH CAMBERENE -YOFF		
BASELINE			
Diagnostics	Considerable stretch of beach at Dakar, landing of catches, urbanization encroaching to the top of the beach, discharge of sewage and solid waste. Extraction of materials. Exposed to ocean swell. Uncoordinated individual initiatives to protect the shoreline.		
Dynamics	Sector undergoing rapid erosion around Yoff, could possibly be related to sand extraction at Malika.		
Stakes	Viability of an old and traditional landing site of Lebou fishermen faced with erosion and shrinking of the space for parking canoes. Habitat and threatened populations in the event of marine incursion.		
Actions	Protection systems could be contemplated but should be associated in a global sector scheme for the coastal area North of Dakar.		
Priority	High	Monitoring	Intense and regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Significant urbanisation development of the seaside. Wall of the beach, landscape significant impacts. Work of VDN establishment 2 nd section.		
Mining activities	Dune sand collection site		
Protection	Several works, often old and dispersed (hotel des Almadies and hotel King- Fadh)		
Priority	High	Monitoring-Observation	Intense and regular
Protected area	NO.	Hazards	Beaches erosion, landslide of rock formations

		URBAN	
SN2-b	21- DAKAR ROCKY COAST WEST YOFF-CAP MANUEL		
BASELINE			
Diagnostics	<p>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.</p> <p>Quite dense, predominantly tourism and residential urbanization 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. Urbanization to the water's edge to the North and South, limited by the recently improved coast road in the central part. The privatization of this rugged coast is underway and almost complete. This sector is highly exposed to ocean swell with predominantly North-Westerly waves. Numerous filling and individual protective schemes, with no overall consistency;</p>		
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 infiltration of water from the continent. Typically, various forms of rock fall, landslides and disconformities.		

Stakes	Viability of recent development to the coastal road and of high-value-added tourism investments. Security of population in at risk situation (habitat on the cliff edge). Development and conservation in a public domain accessible to urban populations of the panoramic, landscaped corridor of the coast road. Planting on embankments and cliff tops.		
Actions	Building prohibition to be respected at all at risk sites. Improve the collection of rainwater and wastewater, and drainage in the most sensitive sites. Time and viability perspectives to be taken into account in impact assessments, which ideally should be carried out for each new implementation in this sector. The requalification accompanied by withdrawal of certain exposed districts should be envisaged. Protective developments justified by the density of the stakes, but should be part of a coherent, overall scheme.		
Priority level	High	Monitoring	Intense and regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Significant urbanization of the seaside (residences, hotels, shopping facilities) Illegal extraction of basaltic materials on cliffs. Building of a fishing wharf in progress in Soumbedioune. Backfills on the sea near the amusement park "Magic land" (between hotel Terrou-Bi and the beach of Soumbedioune). Resort project of seawater desalination in Mamelles/Ouakam		
Mining activities	Illegal extraction of basaltic materials in cliffs.		
Coastal protection	The reinforcement structures of cliffs/ Marina breakwater of hotel Terrou-Bi/Rock fills in front of Radisson hotel.		
Priority	Very high	Monitoring-Observation	Intense and regular
Protected area	YES	Hazards	Fast-growing erosion in several points namely in front of UCAD (Cheikh Anta Diop University of Dakar). Landslides, Exceptional episodes of heavy swells (> a ten-year cycle) with a sea wall in 2013 and 2014.



2008



2015



Buildings on an at high risk site at Pointe Diop (source: SDLAO case study 2010)



The erosion of coastal road formations is largely dependent on storm water management (Source: MOLOA country branch of Senegal)

Backfills for the development of the recreational space "Magic Land" between Radisson Hotel and the Beach of Soumbedioune

The National Park of the Magdalen Islands (IUCN Category II) National park WDPa ID: 870 Proposed world heritage site of the National Park of the Magdalen Islands National park 2077	SN2-b
<p>The National Park of the Magdalen Islands was established on 16 January 1976 by decree n° 76/0033 on the creation of the national park of the Magdalen Islands. The bylaws were defined by order n°007164/24 JUNE/PM/DGT. The National Park of the Magdalen was inscribed on the tentative list of the world heritage that Senegal intended to propose for inscription since 2005. The delimitations of the NP of the Magdalen Islands are not available in WDPa.</p>	

		URBAN AND PE-RI-URBAN	
SN2-c	BAY OF HANN-RUFISQUE		
BASELINE			
Diagnostics	This sector includes the port of Dakar, the urban beach, Bay of Hann and the coastal area from Rufisque to Bargny; 87% of industries in Dakar are located in this sector. The sector is densely populated, and the land used down to the shoreline. Many protection systems, rock fills, groynes, protecting walls, often weathered or destabilised. Building project of dykes underway. 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 groyne). Depending on the site, recession estimated at between 1 and 2 metres per year.		
Stakes	In spite of 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 of Hann, generating a real health risk for the local population. At sub-regional level, the port of Dakar has considerable development potential as a top 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 of Hann.		
Priority	Very high	Monitoring-observation	Intense and regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Increased urbanisation in Thiarye-Mbao area; Processing area of sea products (Bata Beach). Storm water sanitation and industrial effluents project (decontamination project of the Bay of Hann). Project of "future port". Building of a bulk carrier area. Urban restructuring following a sanitation project of Hann and petit Mbao. Building of a thermal power plant;		
Characterisation of port installations	<p>The port autonomous of Dakar is located in the Bay of Hann of Dakar. It is made of an internal anchor and several piers protected by two jetties both in the north and south of the entrance of harbour. It comprises namely one ore terminal of phosphate, a petroleum terminal and a fishing area.</p> <p>The concession of the containers terminal of Dakar port was granted to <i>Dubai Ports World</i> in 2007 for a 25 year-term after being run for 80 years by Bolloré group.</p> <p>It is the third port in West Africa (behind that of Abidjan and Lagos).</p>		
Mining activities	Offshore oil exploration. Dune sand extraction.		
Protection	<p>Construction of Rufisque dyke (Thiawléne) (5 m x 730 m) works started since May 2012 and inaugurated in July 2013. Dyke project of Diokoul. Protecting project of Goree Island.</p> <p>The existence of previous works in the north and south of the port: breakwater (i) of the east coastal road (ii) and the float base (built before 1942)</p> <p>Some isolated groynes in the bay of Hann in front of Rufisque and Grand Mbao.</p>		
Priority level	Very high	Monitoring-Observation	Intense and regular
Protected area	NO	Hazards	Marked erosion, pollution of the Bay of Hann. Exceptional episodes of high swell (> a ten-year cycle) with surge in 2013 and 2014 having affected the built protections.



*Dakar port in 2015 (Source: Google earth)
No major work done in the port of Dakar since 2010 except renovation and refurbishment of existing piers*



*Rock fall in front of the mosque of Gorée Island (in yellow, background)
Source: MOLOA country branch of Senegal, May 2014*



The Bay of Hann Dalifort: destruction of homes in December 2013 (source: country branch of Senegal)



The Bay of Hann Dalifort: destruction of homes in August 2015 (source: MOLOA Senegal country branch)



High erosion in Mbao in May 2014 (source: MOLAO country branch of Senegal)



Building of Thiawlene dyke in 2012



Dyke of Thiawlene (cost > 3 000 000 000 CFA)



*Wake waves on Thiawlene dyke during an exceptional storm surge (May 2014)
(Source: MOLOA Senegal country branch)*



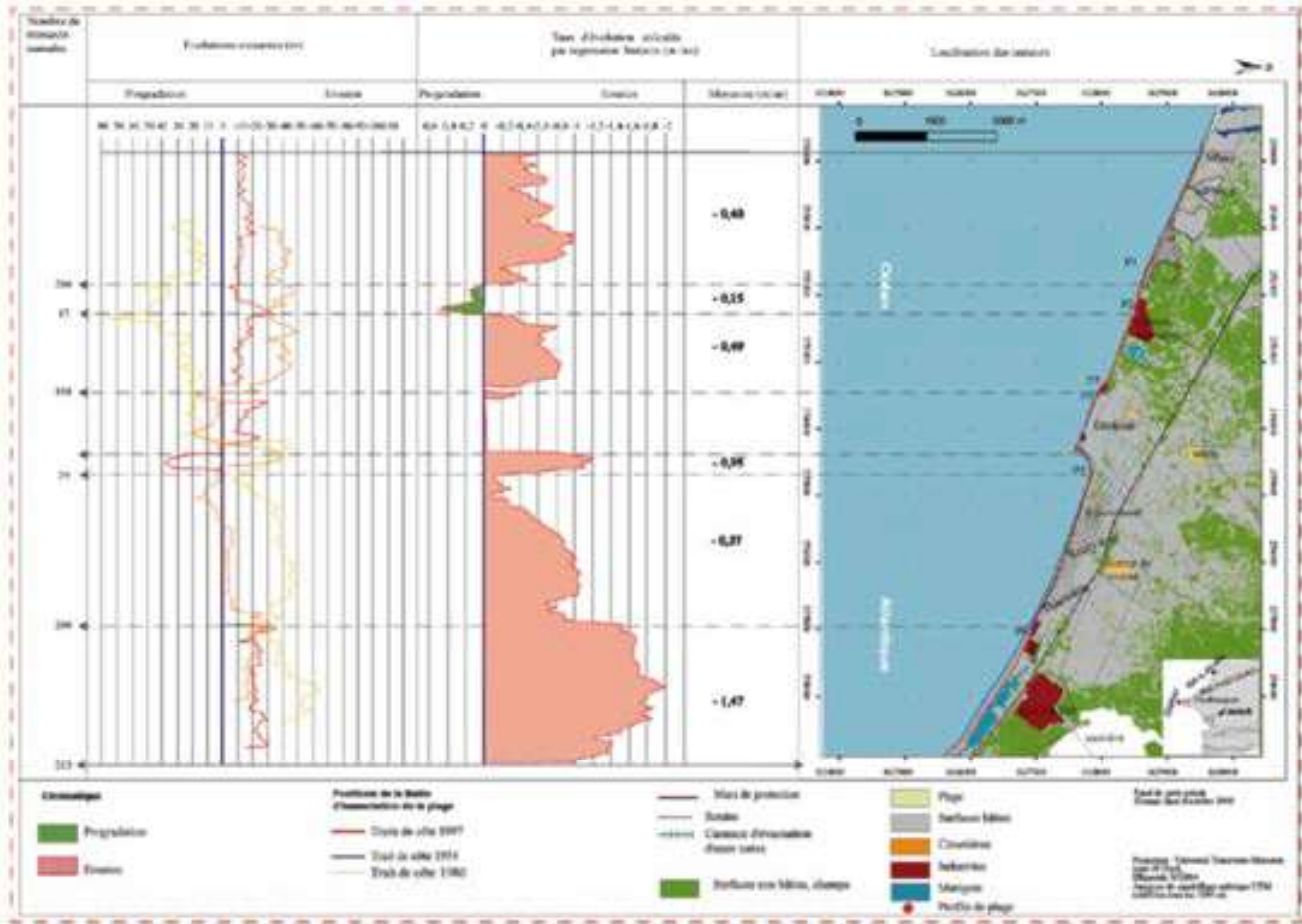
*Damage after Thiawlene wave surge during an exceptional storm surge (May 2014)
Source: MOLOA Senegal country branch*



*Cemetery flooding
(source: MOLOA Senegal country branch, May 2014)*



*Protecting wall construction in progress in Mbao
(Source: national Diagnostics)*



Rufisque coastline progress 1954-2006 (source: MOLOA case study 2010)

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 full review of the development methods of the Petite Côte, within a consistent sector scheme arbitrating among conflicting uses.

Regaining control of land ownership and the regulation of spontaneous land development to combat pollution (undertaken in the public domain) are the key preconditions before envisaging new protection investments. These “spontaneous” developments should also be associated with 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 may hardly boost the economy, given the past experience, and a better integration of coastline dynamics. These developments also constitute an opportunity to draw up a new doctrine in terms of coastal tourism. The building of an airport and a future ore port in Bargny, with

extension in the South of Dakar, will not simplify the management of erosion on the Petite Côte characterised by the weakness of the low sediment supply.

In Senegal, tourism yields 4.6% of the GDP and accounts for 100,000 employments. It is the second sector for foreign currencies source after fishing. A survey conducted by MOLOA has pointed out to what extent this sector on the pole area of Saly is devastated, especially because of erosion resulting from the exposure of hotel constructions nearby the beach.

The initial service of Bargny international airport and the Special Economic Zone (SEZ) of Diamniadio /Ndiass should result in a population influx and a fast-growth of the tourist sector anticipated by the master plan for territorial planning and development of Dakar area-Thiès-Mbour designed in January 2015.

		PERI-URBAN & ANTICIPATION	
SN3-a	23 - BARGNY – KENE - NDIOGOM		
BASELINE			
Diagnostics	Practically urban sector, linear. Characterized by an often very narrow but continuous strip (even when the coast is adjacent to wetland) of seafront residential settlements, with a few traditional villages included. Rocky coast to the South of the sector.		
Dynamics	Generalized erosion as witnessed by the number of protection systems.		
Stakes	General stakes of the Petite Côte, numerous improvements, dykes, walls, rock fill to protect individual homes. Materials available nearby. Highly likely growth and extension of coastal settlements inland beyond the coastal road. Uncertain future of low-lying land in the vicinity of the South of Bargny, depending on the growth 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 more probably the shoreline will be completely backfilled and artificialised, with a view to delaying withdrawal which is probably inevitable in the long run.		
Priority level	High	Monitoring-observation	Regular

DEVELOPMENTS SINCE 2010			
Evolution of stakes	Construction project of an ore port and coal-fired thermal power plant in Sendou. Diamniadio development centre/Ndiass integrated ZES. The urban encroachment reaches the isolated South of Bargny which remained relatively unpopulated.		
Priority level	Very high	Monitoring-Observation	Intense and regular
Protected area	NO	Hazards	Marked erosion. Exceptional episodes of high swell (> a ten-year cycle) with Storm surge in 2013 and 2014 having affected the built protections.



The destruction of twenty houses and canoes damaged in Bargny during an episode of high swell and storm surge in May 2014(source: MOLOA Senegal country branch)



Destruction of home in Yene (source: MOLOA Senegal country branch)

		PER-URBAN & TOURIST	
SN3-b	24 - POPENGUINE		
BASELINE			
Diagnostics	Very particular type of coast, segments of cliffs in hardpan, substrate soft in depth, natural tendency to crumble. Alternating small cliffs and more or less narrow beaches. Surrounding landscape practically bare of plants (hardpan exposed). Rock fill materials available locally facilitating individual protection initiatives at low cost: dyke protecting a hamlet (fishing point), a few residences on the edge of small cliffs with risk of rockslide. In the North, still relatively unurbanised, numerous plots closed off awaiting construction, scattered residences on the sea front, etc.		
Dynamics	Very dynamic shoreline and narrow unstable beaches		
Stakes	Anticipation of human land use on an unstable coast where encroachment is underway. Efficiency and viability over time of walls-dykes and protective armoring.		
Actions	Actions to prevent installations on at-risk sites. Sector scheme recommended, taking into account the kinds of substrates and the risks of rock fall.		
Priority	High	Monitoring-observation	Regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Marina construction project in Ndayane		
Priority level	High	Monitoring-Observation	Intense and regular
Protected area	YES	Hazards	Marked erosion. Exceptional episodes of heavy swell (> a ten-year cycle) with storm surge in 2013 and 2014.

Popenguine Natural Reserve Popenguine NR: WDPA ID: 12263	SN3-b
<p>Popenguine natural reserve was created on 21 May 1996 by decree n°86/605.</p> <p>The bylaws were defined by decree n°0053-3 JANV.87/MPN on the bylaws of Popenguine Natural Reserve</p> <p>Popenguine NR has no delimitation in WDPA.</p>	

		TOURISM	
SN3-c	25 - SALY – PORTUDAL –SOMONE		
BASELINE			
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 groynes in rock fill, small marina with piers, various protections, walls and beach armouring. Several coves with visible erosion. Obvious conflicting uses between tourism and fishing in a context of gradual decrease in the width of the beach.		
Dynamics	Generalised erosion throughout the sector. A few sites undergoing accretion upstream of the protection works.		
Stakes	A coordinated sea front scheme is required to avoid disrupting a fragile balance of the dynamics of the coastal current system. Bringing together the different stakeholders and broader awareness raising work targeted at all the players concerned with risk prevention.		
Actions	Actions to prevent installations on at-risk sites. Sector scheme recommended, with evaluation and harmonisation of spontaneous protections. Improvements should be planned within the framework of an overall, coordinated approach. Regaining control of the land ownership system is in any case a prerequisite.		
Priority level	Very high	Monitoring-observation	Intense and regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Construction project of tourist facilities (SAPCO). Development of artificial beaches on terraces with beach wall aggravating erosion.		
Coastal protection	Construction project of different protection works (World Bank). Proliferation of uncoordinated individual protection actions, especially rock filling in the West of Lamantin Hotel between 2010 and 2013 in the crafted port of Saly in 2015.		
Priority level	Very high	Monitoring-Observation	Intense and regular
Protected area	YES	Hazards	Generalised erosion, beaches disappearing

Natural Reserve for Somone Community interest. NRCI of Somone: WDPA ID: non-existent	SN3-c
<p>The natural reserve for Somone community interest was established on 25 October 1999, following the prefectural approval of deliberation n°003 of Sindia Rural Council of 19 July 1999.</p> <p>The bylaws were defined by Mbour prefectural order n° 0033/ASD-of 22 October 2008.</p> <p>The order providing the governance bodies, was taken on 18 January 2013. The management committee was established in March 2013.</p> <p>The land development and management plan was updated for the period 2014-2018.</p> <p>Somone NRCI has no delimitation in WDPA.</p>	



*Saly, residence Les Filaos, situation in 2007
(source: MOLOA Senegal country branch)*



*Saly, residence Les Filaos, situation in 2013
(source: MOLOA Senegal country branch)*



Saly, consequences of individual protection actions (source: MOLAO Senegal country branch)

		URBAN & TOURISM	
SN3-d	26 - URBAN SECTOR OF MBOUR		
BASELINE			
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 markets and trucks). 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 coastal area, 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 development 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 level	Very high	Monitoring-observation	Intense and regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Significant extension of agglomeration		
Coastal protection	Numerous protection works		
Priority level	Very high	Monitoring-Observation	Intense and regular
Protected area	NO	Hazards	Generalised erosion, beaches disappearing



*Destruction of homes in Mbour
 (source: MOLOA -Senegal country branch)*

			TOURISM
SN3-e	27 - MBOUR – POINTE SARENE		
BASELINE			
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. Coastal area 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 groyne 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 area, planned breaks in residential urbanisation to preserve beach accesses for the inland population, to prevent the complete privatisation of the coastal area outside the village enclaves.		
Actions	Sector development 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 area, planned breaks in residential urbanisation to preserve beach accesses for the inland population, to prevent the complete privatisation of the coastal area outside the village enclaves.		
Priority level	High	Monitoring-observation	Intense and regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Significant extension of Mbour agglomeration. Tourist development project of Pointe Sarène by SAPCO: roadway under development		
Priority level	Very high	Monitoring-Observation	Intense and regular
Protected area	NO	Hazards	Generalised erosion, beaches disappearing

			TOURISM
SN3-f	28 - NORTH JOAL – MBODIENE BEACH		
BASELINE			
Diagnostics	This sector marks the end of the tourism and residential settlements on the Petite Côte, with vast residential concessions and the latest luxury hotel complexes. One of these closes off the coast along a stretch of several hundred hectares. Apart from the hotel complex built in a potentially flood-prone area South of the village of Pointe Sarene, most of the hotels and holiday homes have been situated further back, reducing the risks of settlements closer to the shore. Urban sprawl in progress inland around Mbodiène. The functioning of the estuary zone is largely disturbed by the blocking of sediment supply East of the village of Pointe Sarene.		
Dynamics	The coastal area South of Pointe Sarene takes the form of a narrow lido that ends in a sandy spit in the vicinity of Joal. Unstable coastal area. 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 urbanization before Joal and Sine Saloum.		
Priority level	Medium	Monitoring-observation	Watch-keeping for the purpose of anticipation
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Joal back dyke, Desalination project; mouthpiece migration of the Mbodiène lagoon affecting the two tourists complex of North Mbodiène		
Priority level	Medium	Monitoring-Observation	Regular
Protected area	YES	Hazards	Located erosion

Marine Protected Area of Joal- Fadiouth	SN3-f	SN4-a
PMA Joal-Fadiouth: WDPA ID: 352706	SN3-g	SN4-b
<p>Joal-Fadiouth Marine Protected Area was classified by decree n°2004-1408 of 4 November 2004 on the creation of Marine Protected Areas.</p> <p>A management plan 2009-2013 of Joal-Fadiouth PMA was established in October 2008 and a review of the document during the period 2014 is effective.</p>		

		Anticipation
SN3-g	29 - JOAL	
BASELINE		
Diagnostics	<p>Growing town forming a conurbation with Fadiouth. 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 considerable concentration of boats.</p> <p>The cape acts as a relative shelter. A certain number of scattered buildings on the beach, more or less protected by walls and armouring exposed to storms.</p>	
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 Fadiouth see following sector).	
Actions	Inform local residents and authorities of the risks related to densification of built-up area.	
Priority level	High	Monitoring-observation Regular
DEVELOPMENTS SINCE 2010		
Evolution of stakes	Improving fishing dock and fish product processing, tourist development of pointe Fignon.	
Coastal protection	Building of defense works of fishing port in 2012-2013.	
Priority	High	Monitoring-Observation Regular
Protected area	YES	Hazards Localised erosion affecting fishing facilities



Joal anti-salt dyke
 (source: MOLA O Senegal country branch)

SN4 SINE SALOUM

		PERI-URBAN & URBAN	
SN4-a	30 - FADIOUTH PENINSULA AND ISLAND		
BASELINE			
Diagnostics	<p>Rim and urbanised terraces in continuity with Joal in a more continental situation. Interesting site, but fragile and exposed. Narrow beach built-up to the limit of the tide. Only the vast cove where canoes are landed, which extends to the port of Joal, has conserved a segment of beach between the densely built-up part and the sea. On the residential point, three hotels and residences, built on the tide limit, with protective systems (walls, armouring). The extreme point, with no buildings, is partially planted (to be protected) and is in danger of disappearing. Vast zone of salt production.</p> <p>A densely urbanised island (shell island), but more sheltered from the ocean waves and storm surges, connected by walkways to (i) the peninsula; (ii) the nearby cemetery island.</p> <p>Peninsula connected to the North-East by a dyke track that crosses the salt wetlands.</p>		
Dynamics	Unstable sector undergoing erosion.		
Stakes	<p>Possible development of built-up area in a high-risk situation on the extremity of the peninsula, visibly already subdivided into plots. Maintain the current footprint of constructions in the future in a situation where shoreline recession is more than likely.</p> <p>The most at risk sector seems to be situated in the residential part with walls/armouring on the beach. The extreme point should be more vigorously planted with casuarina type plants (the low, ligneous vegetation seems to be vigorously used as wood for fuel, as is the case for what remains of the mangroves). As the buildable urban site is saturated, future growth (in addition to that on Fadiouth) could well attack the area more or less dyked by the dyke road (but the majority of which is taken up by fish drying). Possible future reclamation on the tannes (brackish swamp) islands?</p>		
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 level	High	Monitoring-observation	Intense and regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Not reported		
Priority level	High	Monitoring-Observation	Intense and regular
Protected area	YES	Hazards	Not reported

National Park of Saloum Delta National park WDPA ID: 866	SN4-a
Ramsar Site of Saloum Delta ZHII / site Ramsar : ZHII ID : 1SN003 – 288 / WDPA ID : 68153	SN4-b
Biosphere Reserve of Saloum Delta RBDS WDPA ID: 3044 /	SN4-c
World Heritage Site of Saloum Delta RBDS WH ID: 1359	SN4-d
Cross border Ramsar Site of Saloum - Niimi complex WDPA ID: non-existent	SN4-e

The National Park of Saloum Delta was established on 28 May 1976 by decree n° 76/577 on the creation of the national park of Saloum Delta.

The bylaws were defined by order n°008127/13 JULY/PM/DGT.

One part of Saloum Delta joined in 1980 the international network of Biosphere reserves.

Saloum Delta was nominated as a wetland of international importance/ Ramsar site on 03 April 1984 (73 000 square).

A process of classification of Niomi-Saloum on cross-border Ramsar site was initiated in 2008.

UNESCO World heritage Committee has nominated Saloum Delta as a cultural landscape on the list of world heritage on the criteria basis (iii), (iv) and (v) has sent the proposal of Saloum Delta Inscription on the criteria basis (x) to allow Senegal to continue additional studies on endangered species and biological diversity (decision 35/COM/8B.14, June 2011).

Management plan 2010-2014 of National Park of Saloum Delta was finalised in January 2010.

ENVIRONMENT

SN4-b

31 - SOUTH FADIOUTH

BASELINE

Diagnostics	Coastal area physiographically diversified (narrow, discontinuous sandy rims, mudflats, tannes, etc.). Sector hemmed in (track along the edge and then crossing the area in a difficult situation, wetland and flood-prone areas) and practically uninhabited. Limited tourist developments not excluded in the future.		
Dynamics	Very unstable sector.		
Stakes	Conservation of an unconstructible wetland area of biological interest.		
Actions	Maintain the break in urbanisation		
Priority level	Medium	Monitoring-observation	Intense and regular

DEVELOPMENTS SINCE 2010

Evolution of stakes	Not reported		
Priority level	Medium	Monitoring-Observation	Intense and regular
Protected area	YES	Hazards	Not reported

ENVIRONMENT

SN4-c

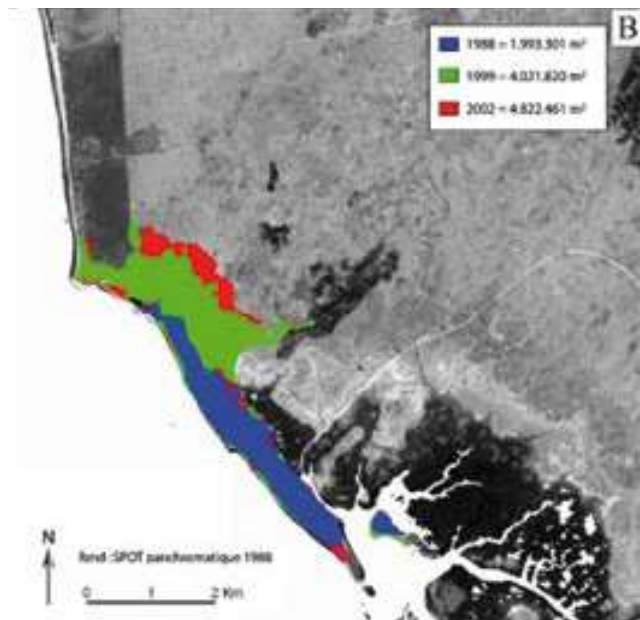
32 - PALMARIN-FACAO-NGALOU PENINSULA

BASELINE

Diagnostics	Linkage with the continent by track, very fragile in sections crossing saltwater marshes. Important salt extraction activity (sites sensitive to rise in sea level but locally more easily relocated). Despite a very exposed situation, presence of beach edge settlements, tourist facilities being developed and residential cabins (Palmarin – Ngalou), located in the places where the terrace is slightly higher and of even topography.		
Dynamics	Terrace very low, littoral rim interrupted in places, very complex, changing coastal area. Unstable sector.		
Stakes	Human settlements at risk (erosion and especially storm surges).		

Actions	Encourage plant coverage of the coastal area (defensive measures, etc.). Relocation of certain settlements should be considered in the long term. Moderate the development of building, in particular for tourism, on the whole of the sector.		
Priority level	Medium	Monitoring-observation	Intense and regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Not reported		
Priority level	Medium	Monitoring-Observation	Intense and regular
Protected area	YES	Hazards	Not reported

Local Natural Reserve of Palmarin facao	SN4-c
LNR Palmarin: WDPA ID: non-existent	SN4-d
<p>The Palmarin Facao Rural Council deliberation n°20/AF/CRPF of 14 May 2008 on the adoption of compounds exploitation and Local Natural Reserve management and economic interest group (GIE) of ecoguide and the game guard.</p> <p>An assessment of development and management plan of Palmarin local natural reserve was conducted and a review of this plan for the period 2014-2018 was delivered.</p> <p>The LNR of Palmarin Facao is not listed in WDPA.</p>	

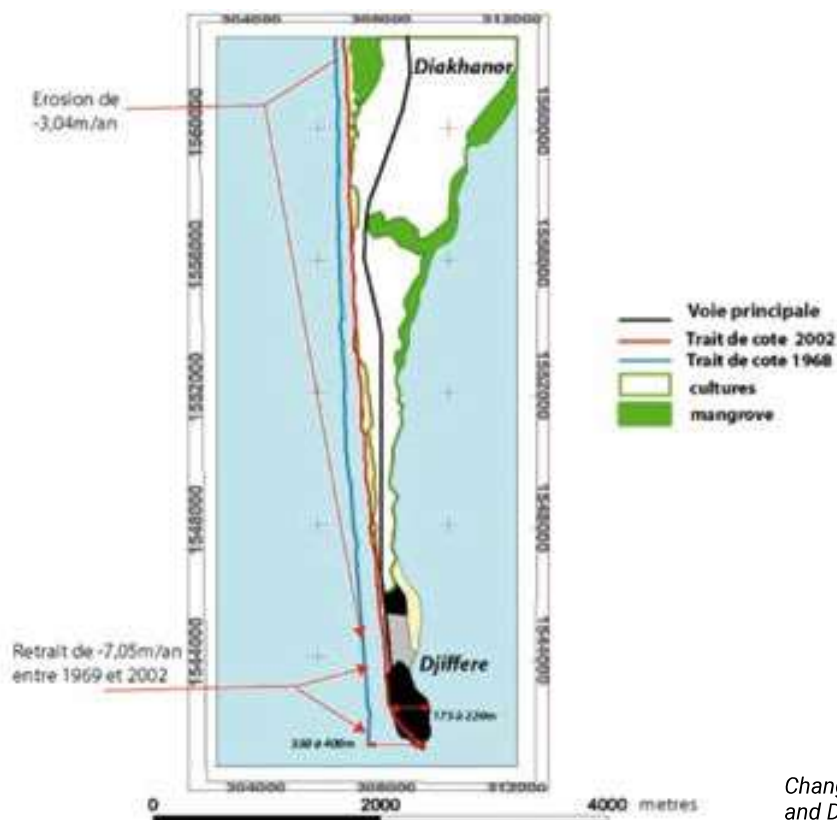


Evolution of developed areas in Fadiouth between 1988 and 2002
(According to Ackermann, G. & al. 2006.- Dynamics of sustainable development landscape and prospective on the Petite Côte in the delta of Sine-Saloum. Vertigo. 7(2) : 9p)



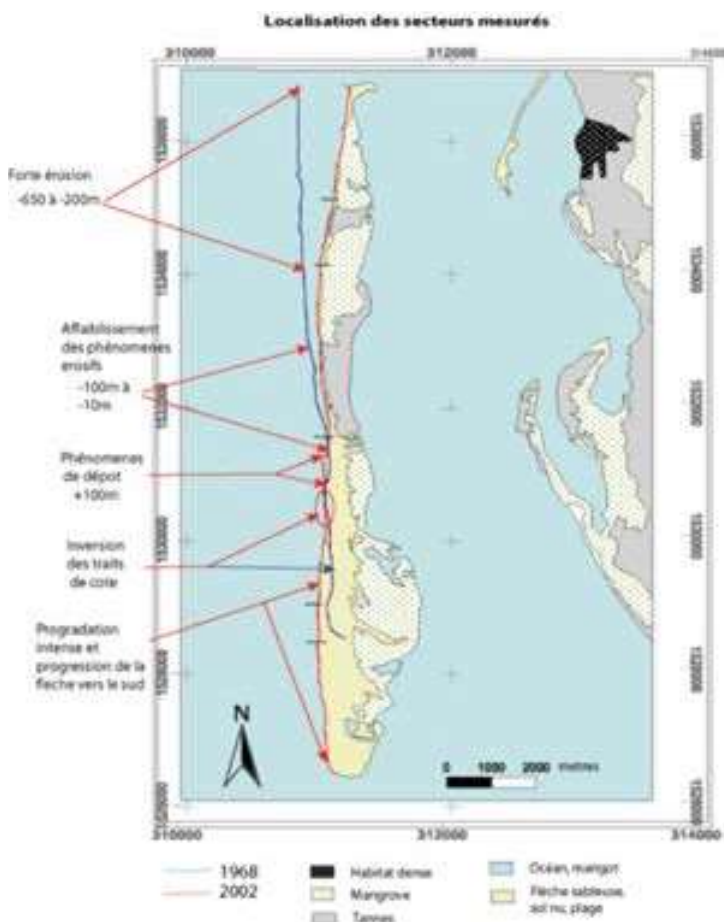
Palmarin, the consequences of exceptional marine weather episode
From 20 August 2013 (Source: MOLOA Senegal country branch)

			RURAL
SN4-d	33 - DJIFFER PENINSULA – PALMARIN		
BASELINE			
Diagnostics	Extremely unstable area in particular for Djiffer, fishing center in the estuary. Particularly exposed and risk of being cut off from road network by the disappearance of part of the track linking Djiffer and Joal Fadiouth. The breach of the Sangomar spit (Lagoba breach) in 1987 corresponds to an episode of recession with a rate of 137m per year recorded. This beach led to the displacement of the village of Palmarin and of Djiffer camp.		
Dynamics	Extremely unstable sector.		
Stakes	Withdrawal of population outside the critical area of Djiffer.		
Actions	Protective stabilising plants to slow down for a time the uncontrollable dynamics. Relocation of populations and permanent installations.		
Priority level	Very high	Monitoring-observation	Intensive and regular
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Discovery of an oil deposit; Establishment of oil extraction infrastructure ; Project to build a protection structure for Sangomar spit		
Priority level	Very high	Monitoring – Observation	Intensive and regular
Protected area	YES	Hazards	Not reported



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

		ENVIRONMENT AND RURAL	
SN4-e	34 - SINE – SALOUM SOUTH		
BASELINE			
Diagnostics	Coastline 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 portion of the Saloum delta marine national park with another, mangrove zone nearby (community marine protected area of Bamboung). Settlements at Niodon and Dionewar in at-risk sites.		
Actions	Comply with the National Park management provisions. Limit the development of agglomerations in at-risk situations. Stabilising plants to slow down the rate of siltation.		
Priority level	High	Monitoring-observation	Regular
Case study	Changes in the shoreline of the coastline of Palmarin.		
DEVELOPMENTS SINCE 2010			
Evolution of stakes	Construction of a quay-equipped port in Foundiougne; Project for the construction of a 700 m bridge connecting Ndangane and Mar Lodge; SAPCO Tourism Facilities		
Priority level	Very high	Monitoring – Observation	Intensive and regular
Protected area	YES	Hazards	Not reported



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

The Marine Protected Area of Sangomar	SN4-e
The MPA of Sangomar : WDPA ID : inexistent	
The Marine Protected Area of Sangomar was designated by Decree n°. 2014-338 of March 25, 2014 establishing the Marine Protected Area of Sangomar.	
The MPA of Sangomar has a development and management plan covering the period 2014 to 2017.	
The MPA of Sangomar is not listed in the WDPA.	

The Marine Protected Area of Gandoul	SN4-e
The MPA of Gandoul: WDPA ID : inexistent	
The Marine Protected Area of Gandoul was designated by Decree n° 2014-416 of March 31, 2014 establishing the Marine Protected Area of Gandoul.	
The MPA of Gandoul has a development and management plan covering the period 2014 to 2017.	

The Marine Protected Area of Bamboung	SN4-e
The MPA of Bamboung WDPA ID : inexistent	
The Protected Marine Area of Bamboung was created on October 10, 2002 by deliberation n° 06/CR of the Rural Council of Toubacouta and designated by Decree n° 2004-1408 of November 4, 2004 creating Marine Protected Areas.	
A Management Committee was established on March 28, 2003. Bamboung MPA entities were created on May 28, 2013 by Prefectoral Order n° 014/AT/SP.	
A Steering Committee of Bamboung MPA was established on December 10, 2013 by Prefectoral Order n° 118/AT/SP	
The MPA of Bamboung has a development and management plan covering the period 2014 to 2017.	
The MPA of Bamboung is not listed in the WDPA.	