



PROJECT DOCUMENT / DOCUMENT DU PROJET

ESIA terms of reference

Proposed refuse-derived fuel facility in Mauritania

Informal English translation · June 2023

This document outlines the proposed project, its environmental and social context and the scope of the intended assessment. Its title is “Terms of reference”; it is not presented here as a completed environmental impact assessment.

The 33 original pages follow unchanged. This editorial information sheet does not certify the translation, validate its technical terminology or confirm the project’s present operational status.

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Recycling Expert Sarl



Terms of reference

**Environmental and social impact assessment of the project to
create a waste-derived fuel processing plant in Mauritania**



June 2023

CONTENTS :

I. Project context

- I.1. Introduction
- I.2. Objectives, project site and scope of the study
- I.3. Justification for the study and methodology

II. Regulatory framework

III. Project description

- III.1. The CDD processing plant
- III.2 CDD production process

IV. Description of the Project environment

- IV.1. The Mauritanian coastline
- IV.2 The commune of Ndiago

V. Method for identifying and assessing the impacts of the Project

- V.1. Method for assessing the significance of potential impacts
- V.2. Sources of potential impact of the Project

VI. Public consultation plan

Documents consulted :

List of abbreviations :

EIES: Environmental and Social Impact Assessment

NIES: Environmental and Social Impact Statement

CDD: Compounds Derived from Waste

SNEDD: Stratégie Nationale Environnement et Développement Durable

(National Environment and Sustainable Development Strategy) DSM:

Déchets Solides Municipaux (Municipal Solid Waste)

CE: Commission Environnementale

MPA: Marine Protected Area

PNBA: Banc d'Arguin National Park

PND: Diawling National Park

List of figures and tables :

Figure 1: Ndiago region (project site)

Figure 2: Process followed in carrying out the ESIA Figure

3: CDD production process

Figure 4: Map of Mauritania

Figure 5: Sensitive habitats in the Mauritanian marine and coastal

environment Figure 6: Map of the lower Senegal River delta, right bank

Figure 7: The different environments found in the Mauritanian lower delta

List of tables :

Table 1: Regulatory texts likely to apply to the Project

Table 2: Location and population of the main localities in the commune of Ndiago

Table 3: Cross-reference between project activities and environmental components likely to be affected by the project

Table 4: Indicative list of potential impacts and mitigation measures

I. Project background

I.1. Introduction

Recycling Experts Sarl is a young company that produces and distributes fuel derived from waste. Its mission is to provide industries with sustainable, low-emission alternative fuels and to contribute to a cleaner environment by reducing landfill waste and greenhouse gas emissions.

Recycling Experts Sarl plans to set up a waste-derived fuel (RDF) processing plant in Mauritania. The plant will collect, store and transport municipal, commercial and industrial solid waste, and process it to produce RDF for use as an alternative energy source.

This type of project is subject to a prior environmental and social impact assessment (ESIA) in accordance with the framework law on the environment (Law no. 2000-045 of 26 July 2000) and its implementing decrees relating to ESIA's (decree no. 2004-045 and no. 2007-105), which require an ESIA for any activity likely to have harmful effects on the environment.

This environmental impact assessment is being carried out b o t h to provide a management tool for taking environmental considerations into account in the project and to comply with Mauritanian regulations in force in the country.

I.2. Objectives, project site and scope of the study

The overall aim of the ESIA for the project to create a CDD treatment plant is to study the impacts of the project and to propose a design that is in harmony with the biophysical and socio-economic environment in its insertion zone.

Specifically, this study must :

- describe the characteristics of the project, including discharges and nuisances, and explain the context in which it is being carried out (reasons and justifications, etc.).
environmental and technical aspects of the choice of project) ;
- present and describe all the components of the site's natural and human environment likely to be affected by the project. Relationships and interrelationships
between the factors that influence ecosystems, resources and the quality of life of individuals and communities, will be analysed and interpreted;

- demonstrate how the project fits into the environment, by presenting a detailed analysis of the impacts and defining the measures intended to reduce them negative effects on the environment and to maximise those likely to improve it ;
- take into account the opinions, reactions and main concerns of individuals, groups and communities. This will involve report on the way in which the various parties concerned have been involved in the project planning process and take account of the results of the consultations and negotiations carried out;
- include an Environmental and Social Management Plan (ESMP) and monitoring and follow-up programmes to ensure compliance with requirements legal and environmental requirements.

The project site will be in Ndiago (Wilaya de Trarza), covering an area of 30,000 m² (see figure below). However, the waste may come from anywhere in the country, or even from neighbouring countries such as Morocco and Senegal. This means that the scope of the project is potentially the whole country, bearing in mind that large quantities of waste are produced in the country's urban centres and large industrial units.



Figure 1: Ndiago region (project site)

I.3. Justification for the study and methodology adopted

The project to create a plant to process waste-derived fuels is a project that contributes to environmental protection. In fact, the project has more positive impacts on the environment than negative impacts, as it addresses a major source of pollution for all components of the environment (physical, biological and socio-economic).

However, the collection, transport and treatment of this waste can lead to accidental or chronic pollution. Environmental control measures must therefore be an integral part of the design of this industrial unit.

In general, solid waste is burnt to reduce its volume, without supervision or control. It can also end up in sewers, landfill sites or dumped in the environment.

Furthermore, environmental assessment is a process that aims to balance ecological and commercial considerations, of which the Environmental and Social Impact Assessment (ESIA) is an important management tool. The ESIA ensures that the environmental risks and effects of projects are identified and assessed, and that appropriate mitigation and control measures are implemented.

The methodological approach followed is described in the figure below:

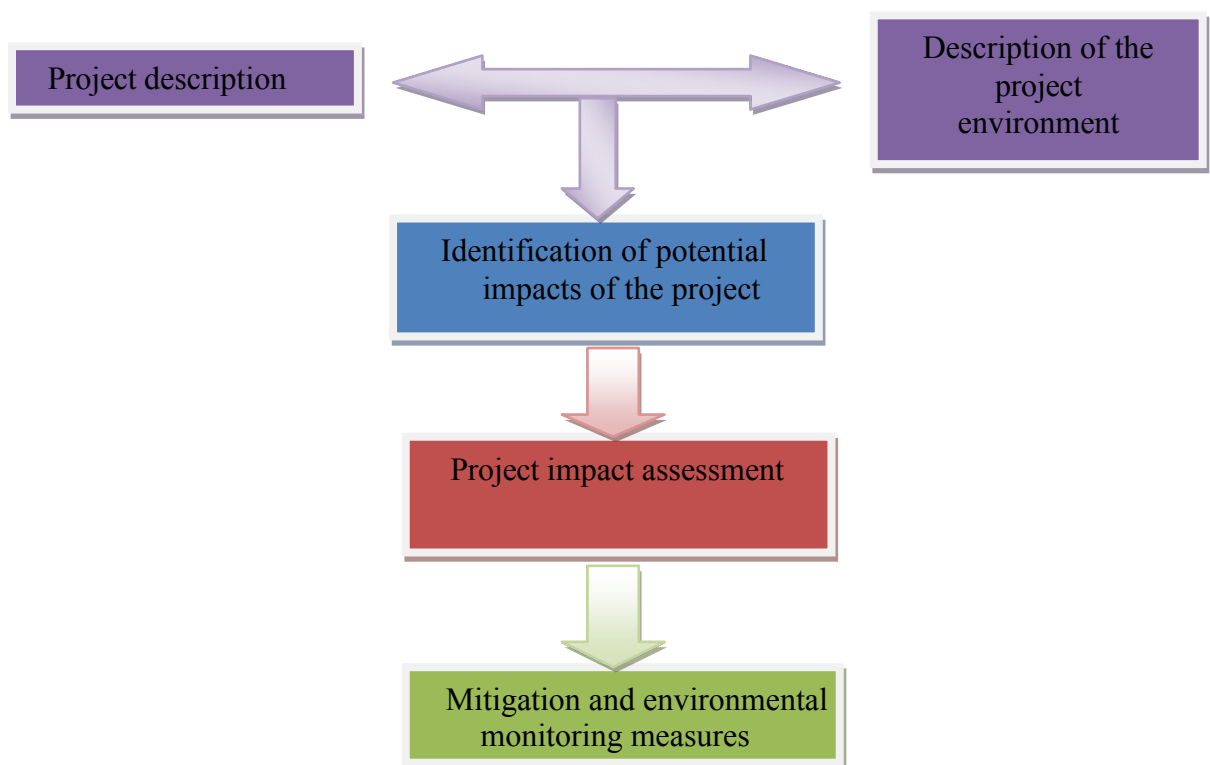


Figure 2: Process followed in carrying out the ESIA

II. Regulatory framework

The purpose of this section is to describe the legal framework in which the project operates. The project's environmental and social impact assessment takes into account the laws and regulations governing environmental management and the institutions involved in natural resource management and pollution control in Mauritania.

The SNEDD defines a strategy and measures for integrating the environment into all sectors of economic and social development and for taking socio-economic factors into account in environmental protection and management programmes.

The project is subject to a number of general regulations relating to the management of water resources, the protection of flora and fauna, waste treatment precautions, etc.

Table 1: Regulatory texts likely to apply to the Project

Applicable texts	Summary of provisions
Impact assessment and review, public consultation and participation	
Law no. 200-45 of 26 July 2000 on the Environment Code	• National environmental policy • Institutional framework of the sector • Protecting natural environments and resources • Environmental impact assessment • Criminal provisions
Decree no. 2007-105 amending and supplementing certain provisions of Decree no. 2004-094 of 4 November 2004 on environmental impact assessments	• Definition of the legal status of the Environmental Impact Assessment • Procedures for the Environmental Impact Assessment under the French Environment Code (Code de l'Environnement)
Order n°83-127 on land and property reorganisation	• An "Impact Survey" is carried out when the hakem (prefect) deems that the application for a provisional concession can cause a negative impact
Protection of the atmosphere	
Law no. 2000-45 of 26 July 2000 bearing environment code	• Smells, dust and light inconvenient

Water protection	
Law no. 2000-45 of 26 July 2000 on the Environment Code	• Provisions relating to water • Provision for an implementing decree defining the procedure for drawing up an inventory of water status • Water quality standards
Ordinance n°2007-037 relating to the Coastline	• Rules relating to the development protecting, managing and enhancing the coastline
Managing explosives and hydrocarbons	
Law 2002-05 on downstream activities in the hydrocarbons sector	• Requirement for a company to obtain a licence to import petroleum products to meet its own needs • Obligation for storage of hydrocarbons to comply with facility safety and environmental protection standards • In the absence of national standards, compliance with international quality and safety standards
Decree no. 2005-024 of 14 March 2005 laying down the conditions governing the import, transport, distribution and marketing of hydrocarbons	• Obligation to comply with the conditions for carrying out hydrocarbon-related activities
Waste management	
Law no. 2000-45 of 26 July 2000 on the Environment Code	• Industrial companies classified by decree are subject to general specifications • Ban on all imports of hazardous waste
Noise and vibration	

Law no. 2000-45 of 26 July 2000 on the Environment Code	Prohibition on producing noise or vibrations that exceed the intensity thresholds set by regulatory standards (not yet adopted)
Protected areas	
Law no. 2000-45 of 26 July 2000 on the Environment Code	Rational management of protected areas to avoid over-exploitation and maintain equilibrium ecological
Protecting endangered species	
Law no. 2000-45 of 26 July 2000 on the Environment Code	Authorisation for the introduction of exotic animal or plant species or products likely to harm local animal or plant species
Law n°97-006 of 20 January 1997 on the Hunting and Nature Protection Code.	- Full or partial protection for certain species - Ban on importing, exporting or marketing certain species or their trophies - Prohibition of all voluntary or involuntary no chemical substances in animal habitats
Occupational health and safety	
Law n°2004-017 on the Labour Code	Hygiene, health and safety measures an establishment must adopt to protect its workers
Law 2000-45 of 26 July 2000 on French Environment Code	Immediate suspension of an industrial or agricultural facility in the event of a serious threat to human health, safety or the environment. property or the environment
Order no. 84-208 of 10 September 1984, on the Hygiene Code	Specific offences for failure to comply with industrial hygiene rules

In addition, Mauritania has ratified several international conventions relating to the environment. Ratification of these conventions obliges Mauritania to introduce legal instruments incorporating the principles and rules laid down by these international conventions into its own legislation. This stage is currently underway for some environmental conventions, but has yet to be completed for the majority.

III. Project description

The project involves setting up an efficient and environmentally-friendly refuse derived fuel (RDF) processing plant in Mauritania. The plant will convert municipal solid waste (MSW) and industrial waste into high-quality, environmentally friendly fuels for use in a variety of industries, including cement, steel and energy production.

This initiative will reduce environmental pollution, create jobs and contribute to a circular economy. The plant will contribute to the country's sustainable waste management efforts and provide an alternative and renewable energy source to support the national energy grid.

III.1. The CDD processing plant

The CDD treatment plant will play a key role in producing sustainable waste management, reducing the country's dependence on fossil fuels and supporting economic growth. The project is aligned with Mauritania's national strategies for waste management and climate change, and offers significant potential in terms of financial returns and social impact.

The main features of the project are

- State-of-the-art technology: The plant will use state-of-the-art RDF processing equipment to ensure efficient waste treatment and high-quality RDF production. This involves sorting, shredding and drying processes to produce a consistent, energy-dense fuel.
- Respect for the environment: The project will comply with strict environmental standards to minimise air, water and soil pollution. It will also support Mauritania's waste management infrastructure and reduce the environmental impact of waste disposal by diverting a significant proportion of municipal solid waste from landfill.

- Economic benefits: The CDD plant will create new employment opportunities for local communities, stimulate economic growth and contribute to national energy security by providing a reliable domestic source of renewable energy. It will also help industries reduce their operating costs by using CDD as a cost-effective alternative to conventional fuels.
- Scalability: The design of the plant will allow for future expansion to cope with increasing waste volumes and demand for CDD, ensuring its long-term relevance and profitability.
- Partnership opportunities: The project will seek to work with government, private sector investors and international funding agencies to secure financial and technical support.

III.2. CDD production process

The quality of CDD depends on a number of factors, including the composition, calorific value and size of the material.

Here are some key specifications for a high-quality CDD:

- Calorific value: The calorific value of RDF indicates the energy content of the fuel. High-quality RDF must have a high calorific value, generally 15 to 20 MJ/Kg or more, depending on the composition of the waste and the treatment process. A high calorific value ensures greater energy efficiency when CDD is used as a fuel source.
- Moisture content: The moisture content of CDD affects its combustion efficiency and calorific value. High-quality CDD should have a low moisture content, ideally below 15%. Lower moisture content translates into higher combustion efficiency and reduces the need for additional energy to evaporate the moisture.
- Ash content: The ash content of CDD has an impact on combustion efficiency and the amount of residual waste generated after combustion. High quality CDD should have a low ash content, typically less than 10-15%. A low ash content minimises the formation of slag and bottom ash during combustion and reduces the need for waste disposal after combustion.

- Size and homogeneity: High quality CDD must be uniform in size and composition to ensure consistent combustion characteristics. Shredding, screening and air classification can produce CDD particles of the desired size, typically between 20 and 100 mm. Consistent size and homogeneity ensures efficient combustion and avoids problems with the operation of combustion systems.
- Chlorine content: The chlorine content of CDD should be low, ideally less than 1%. A high chlorine content can lead to the formation of harmful emissions, such as dioxins and furans, during combustion and increase the risk of corrosion in combustion systems.
- Heavy metal content: High-quality CDD must have low concentrations of heavy metals, such as lead, mercury, cadmium and chromium. Low heavy metal content reduces the risk of harmful emissions and limits the environmental impact of burning CDD.
- Low inert content: CDDs must contain a minimum of inert materials, such as glass, sand and stones. These materials do not contribute to the calorific value and can cause operational problems during combustion, such as equipment wear.
- Stable and consistent composition: High quality CDD must have a stable and consistent composition to ensure predictable energy output and avoid fluctuations in combustion efficiency. This can be achieved through appropriate waste sorting and treatment techniques.

In summary, high quality CDD must have a high calorific value, low moisture and ash content, consistent size and homogeneity, low chlorine and heavy metal content, a minimum of inert materials and a stable composition. These specifications ensure efficient combustion, reduced environmental impact and reliable energy production when using CDD as a fuel source.

The CDD production process follows the following stages:



Figure 3: CDD production process

IV. Description of the project environment

Mauritania is a transitional country between the Sahara and the Sahel, bordered to the west by the Atlantic Ocean, to the south by Senegal, to the east and south by Mali, to the north by Algeria and to the north-west by the Western Sahara (Figure 4), with a total surface area of around 1,030,000 km². Mauritania's total population in 2021 was around 4.8 million, with an average density of 4 inhabitants per km².

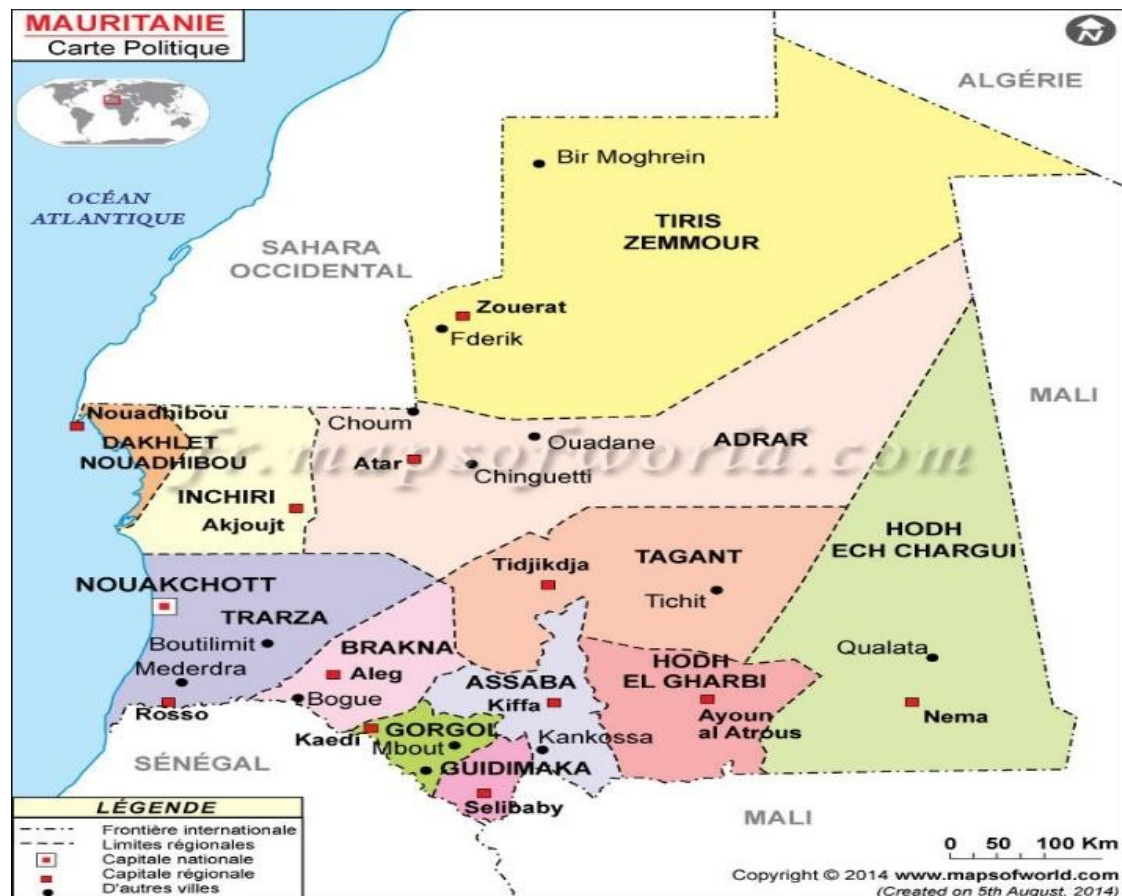


Figure 4: Map of Mauritania

Mauritania is divided into 4 major ecological zones:

- *The arid zone*: This zone is the largest ecological entity in the country, representing 80% of the national territory or 810000 km² ;
- *The Sahelian zone*: This zone lies between the southern limit of the arid zone and the northern limit of the river zone, covering 175,000 km² , or 17% of the world's land area.
national surface area ;

- *The river zone*: This zone contains the bulk of the country's surface water, i.e. the Senegal river, its tributaries and defluents, with a surface area of 22,000 km², i.e. 2% of the country's total surface area;
- *The seafront*: this is the narrow coastal strip stretching from Nouadhibou to the shore of the Senegal River, covering a length of approximately 750 km and a 50 km long, i.e. around 1% of the national territory.

The project will be installed on the coastal strip, making the plant a coastal infrastructure in its own right. The project area is part of an ecoregion subject to a variety of pressures, particularly anthropogenic. These impacts are generally accentuated by the effects of climate change and its corollaries.

The West African marine ecoregion covers an area of more than 1.5 million km² and includes no fewer than 22 million habitats. Around 60% of this population lives on the coastal strip, with the fishing industry the main source of economic development.

This region is one of the richest in fish in the world, particularly along the Mauritanian coast, thanks to the cumulative effects of a number of factors, the most important of which are: upwelling, fertile desert dust, diverse habitats rich in biodiversity, the balancing of temperate and tropical waters in the area...

IV.1. The Mauritanian coastline

Mauritania's coastline is over 750 km long, stretching from Cap Blanc in the north to just south of the town of Ndiago, on the border with Senegal. It can be subdivided into two parts according to geomorphological features, the rocky northern part formed by capes, cliffs with small bays and perched beaches (Cap Blanc - Cap Timiris) and the sandy southern part known as the great Mauritanian beach between Mamghar and Ndiago, a vulnerable zone exposed to the effects of coastal erosion.

Mauritania's coastline is made up of rich and diverse ecosystems:

- The dune systems, with their associated flora and fauna, are made up of the bare dune of the fore-beach, topped by lightly vegetated living dunes and ending with the well-established grey dune with dense, stabilised vegetation. It separates the sea from the hinterland.
- The bays (Etoile Bay, Archimède Bay, Cansado Bay, Lévrier Bay, Saint Jean Bay, Tanoudert Bay, etc.) are sites of high eco-biological and socio-economic interest due to the important role they play in stock renewal (spawning and nursery areas for several species of fish).

species). These areas are relatively quiet and are home to port infrastructures and where towns generally develop, particularly the Bay of the Greyhound. The other bays are used for tourism (ecotourism).

- Mangroves are a very rich habitat with prolific biodiversity. In fact, these plant species live in specific zones characterised by an alternation of salt water with fresh and brackish water, which partly explains the presence of a wide range of species in these ecosystems. In addition to their aerial extensions, mangroves develop an extensive root system, enabling a multitude of small species to find shelter and refuge from predators. Mangroves contribute to carbon sequestration. They are located in the Ndiago zone (PND). However, some relict species can be found on the Banc d'Arguin.
- Sea grass beds, found mainly on the Banc d'Arguin and Baie du Lévrier, form a complex and rich ecosystem. Made up of several species, seagrass beds are a refuge for juvenile fish and other species (molluscs), and a spawning site for certain species, notably the yellow mullet. According to a study commissioned by the PNBA, the seagrass beds are renowned for their ability to sequester carbon and could enable the RIM to honour its commitment to the Paris Agreement.

Mauritania's coastline is also home to two marine protected areas (MPAs), the PNBA and the PND, the Cap Blanc satellite reserve, the Chat Tboul, the Aftout Essahili and the Baie de l'Etoile, which is due to become an MPA in the very near future. The richness of the coastline in terms of habitat diversity and biodiversity is extended offshore by the presence of canyon systems, deep corals, turtle feeding areas, upwelling cores, etc. (Figure 5).

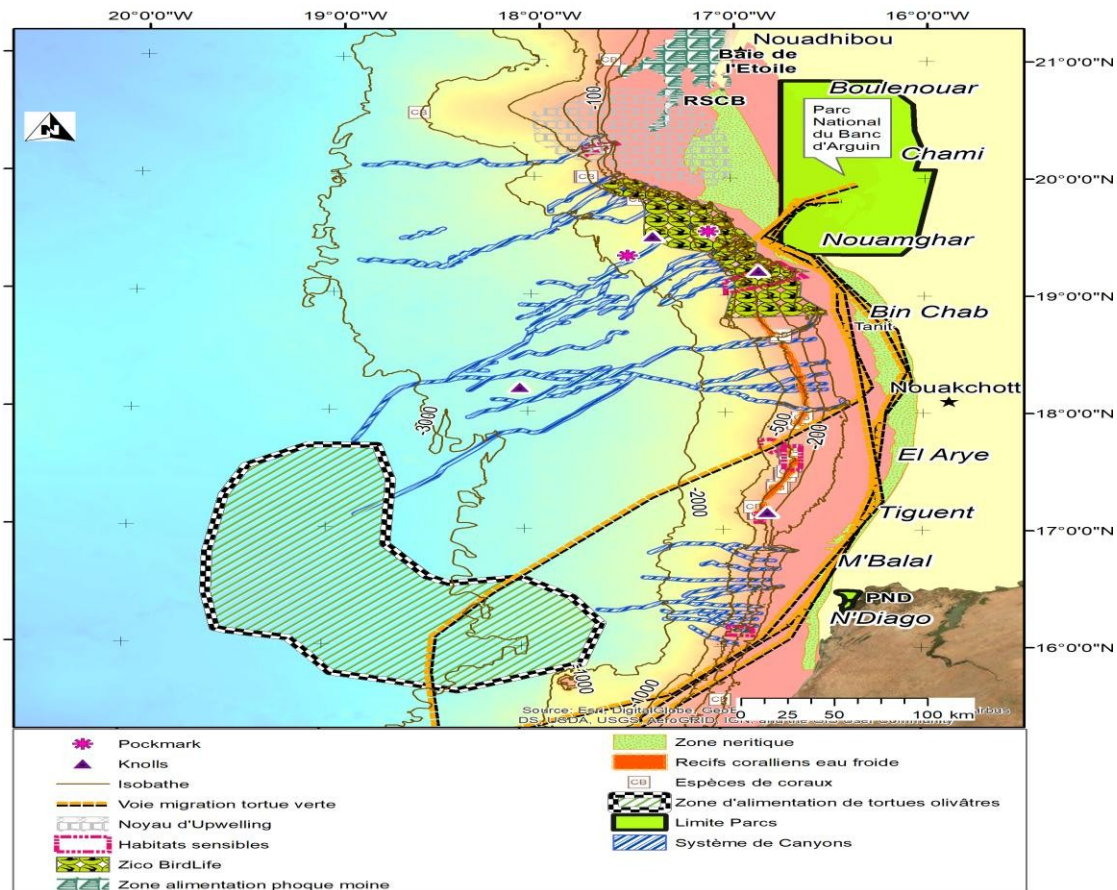


Figure 5: Sensitive habitats in Mauritania's marine and coastal environment

For a long time, this area was untouched by any activity and/or urban development, with the exception of the towns of Nouakchott and Nouadhibou, which alone are home to more than a third of the national population. In recent years, however, there has been a spectacular revival of interest following the discovery of huge oil and gas deposits, and the ambitions of the national strategies of the sectoral departments (Fisheries, Tourism, Trade and Industry, etc.). This new situation is putting further pressure on the fragile and sensitive ecosystems that make up Mauritania's coastline, including coastal dunes, sebkhas, mudflats, mangroves, seagrass beds, bays, estuaries, and so on.

The project environment is closely linked to the reality of the coastal strip. This includes the town of Ndiago, the Diawling National Park, the Port of Ndiago and the marine part of the coastline in the Ndiago area. This area is made up of several compartments (physical, biological and socio-economic environments).

IV.2 The commune of Ndiago

IV.2.1. Geographical location

The commune of Ndiago is located in the Wilaya of Trarza in south-west Mauritania, which covers an area of 67,800 km² and accounts for 6.6% of the national territory (1,030,700 km²). The Wilaya is divided into 2 main natural regions: in the north, the relief is made up of a desert zone (70% of its surface area), and in the south, the Chemama (30%) is a forestry and agro-pastoral zone.

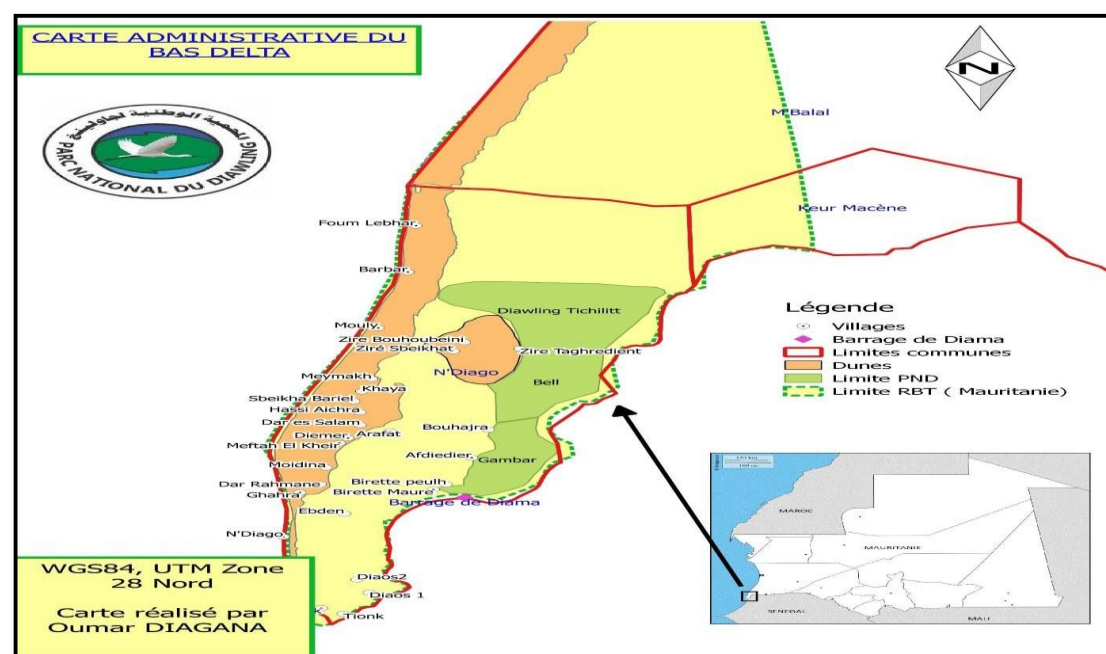


Figure 6: Map of the lower Senegal River delta, right bank

IV.2.2. Administrative status

The wilaya is divided into six Moughataa (Boutilimit, Keur Macène, Mederdra, Ouad Naga, R'kiz and Rosso), 5 arrondissements, 25 communes and over 597 permanent settlements. Its capital is Rosso and the other major towns are Boutilimit, R'kiz and Mederdra. The commune of Ndiago is located in the Moughataa of Keur Macène and covers the territory of three communes (Keur Macène, M'Balal and Ndiago).

As far as land use in the Mauritanian delta is concerned, patterns are complicated by the fact that land is not the exclusive property of one community, but is instead subject to a multitude of access, use and exploitation rights that can vary according to the season. What's more, the community that controls the area is not necessarily the one that uses it.

Moreover, it is the resources of the flood basins rather than the land areas that are 'appropriated', and the use rights of the same community are differentiated according to the types of fish, plant and grazing resources.

The commune of Ndiago is 70 km south-west of Keur Macene, the capital of the moughataa. The commune comprises a number of small residential villages, generally dedicated to agro-sylvo-pastoral activities, unlike the villages of Ndiago and Birette, which offer a number of basic and commercial services in addition to agro-sylvo-pastoral activities. The village of Ndiago is only accessible by the beach or by the Diawling track, which is only passable at certain times of the year.

IV.2.3. Demonography

The commune of Ndiago is made up of 32 villages and has a population of around 16,700 (Table 2), with a relatively low average density of 9 inhabitants/km² in 2018. According to 2013 census data from the Office National des Statistiques, Ndiago is a commune dominated by young people. As a result, the under-15 population accounts for 37% of the total population and people of working age (between 15 and 64) account for 57% of the population.

Land use in the area is relatively diversified. In addition to watercourses (permanent and temporary), there are floodplains, the Diama dam reservoir, coastal and other continental dunes, a coastal strip with several fish landing sites, rice-growing areas, a multi-purpose port, a globally important MPA, the Dawling, the Tchat Tbool reserve, and so on. This makes the area not only rich in terms of ecosystems and biodiversity, but also of great socio-economic importance, given the diversity of activities.

Table 2 Location and population of the main localities in the commune of Ndiago

Location	Status	Latitude	Longitude	Men	Woman	Total
Ndiago	Capital of the municipality	338 502	1 788 140	587	653	1 240
Birette 1	Village	347 298	1 794 938	328	414	742
Zire Sbeikhat	Village	348 607	1 815 305	171	290	461
Ebden	Village	341 947	1 791 248	137	200	337
Ziré Taghrédient	Village	352 230	1 813 798	140	138	279
Ziré Angor	Village	348 362	1 813 532	117	153	270
Dar Rahma	Village	340 653	1 795 277	121	140	261
Bouhajra	Village	350 389	1 802 802	130	117	247
Ghahra	Village	339 211	1 793 455	93	124	218
M'Boyo 2	Village	338 694	1 781 481	95	98	193
Diahoss 1	Village	343 298	1 780 390	73	108	181
Birette 2	Village	347 764	1 795 286	49	125	174
Diahoss 2	Village	342 593	1 782 186	61	97	158
Thionk	Village	343 629	1 778 783	54	80	134
N'Diemer	Village	342 224	1 801 645	77	54	131

Moïdina 1	Village	340 864	1 797 637	51	75	126
M'Boyo 1	Village	339 395	1 782 354	47	76	123
Moïdina 2	Village	341 374	1 797 913	42	72	114
Foum Lebhar	Village	346 334	1 830 758	60	49	109
Khaye	Village	343 061	1 808 039	34	37	71
Dar Esselam	Village	343 212	1 802 863	32	38	70
Arafatt	Village	342 359	1 802 506	29	38	67
Hassi Achra	Village	343 020	1 805 036	26	33	59
Gad Hemdiya	Village	340 653	1 778 963	27	28	55
Meftah Elkheir	Village	341 729	1 800 940	26	23	50
Berbare	Village	345 820	1 824 405	17	29	46
Mouly	Village	344 067	1 816 744	15	25	40
Avdieidjir	Village	349 327	1 798 797	18	18	36
Meymakh	Village	343 529	1 809 707	14	19	33
Sbeikhat Bariyel	Village	342 672	1 807 084	19	15	33
Lormo	Village	338 985	1 780 009	18	10	28
Gad Mbarek	Village	340 535	1 778 259	9	17	26
Total				2717	3393	6112

IV.2.4. The physical environment

The commune of Ndiago is characterised by the diversity of its continental, maritime and coastal habitats. As part of the bas-delta, it has exceptional landscapes in terms of the diversity of its ecosystems, the richness of its biodiversity and the importance of the ecosystem services it provides.

In fact, this locality is the second largest maritime area in Mauritania, with almost 15,000 inhabitants living in a string of villages built on the coastal dunes. On the sea side, the agitated conditions, with a breaking bar forming regularly, make fishing difficult and expose the town of Ndiago to increased coastal erosion.

Geomorphological setting :

Changes in both palaeo-climatic and sedimentological conditions during the Quaternary and Holocene periods gave rise to a complex organisation of deposits and diversified landforms in the southern delta of Mauritania. It outcrops from the large erg of red dunes (ferruginous levels): this is the Ogolian.

This facies corresponds to a period of regression contemporary with an arid climate 10,000 to 15,000 years before the present day. The transgression that followed has been dated to 5,500 years BC. Along the coast, it advanced eastwards

over a depth of 10 to 200 km and in the river valley as far as Boghé.

On these surfaces it left a terrace of fine sand and shells at an altitude of 2 to 3.5 m: this is the Nouakchottian. The retreat of the sea was gradual and was marked by the accumulation of successive barrier beaches, the yellow dunes, which blocked the Nouakchottian terraces and isolated the lagoons.

To the north, in the Aftout-Essaheli region, a series of depressions with meridian axes have formed, enclosed between the red dunes of Trarza on the east side and an almost straight, powerful barrier beach on the west side. The mechanism of filling in during the rainy season and evaporation during the dry season has favoured the formation of the sebkhas.

In the Centre and South, the action of the swells was slowed down by the extent of the shoals, red dunes, and the sea was only able to creep in between them. As the recession progressed, terraces and eolian facies were created in a north-south direction.

During the Quaternary period, the morphology of the delta was shaped by alternating dry and wet climatic episodes, which affected the region's hydrological regime and marine conditions.

The geomorphological landscape of the lower delta is made up of floodplains with poorly drained halomorphic soils formed by clay or clay-loam alluvial deposits.

The post-Nouakchottian sandy landforms, which include the coastal dunes, both current and sub-current, and the inland yellow dunes of the Nouakchottian period, the most important of which are the Birette and Ziré dunes.

These two types of facies, alluvial and sandy, are divided into three units: the barrier beach, the floodplain with its mudflats, settling basins and depressions of fresh or brackish water and the barrier beach.

The current evolution of the sandy substrata continues to be conditioned by the volumes of input and the nature of the transport agent regimes (hydro-eolian). The coastal dune, although relatively thin in the southern zone, remains sufficiently well supplied in terms of detrital input. The hydro-sedimentary balance is generally disturbed by human intervention, particularly in areas where there are infrastructures.

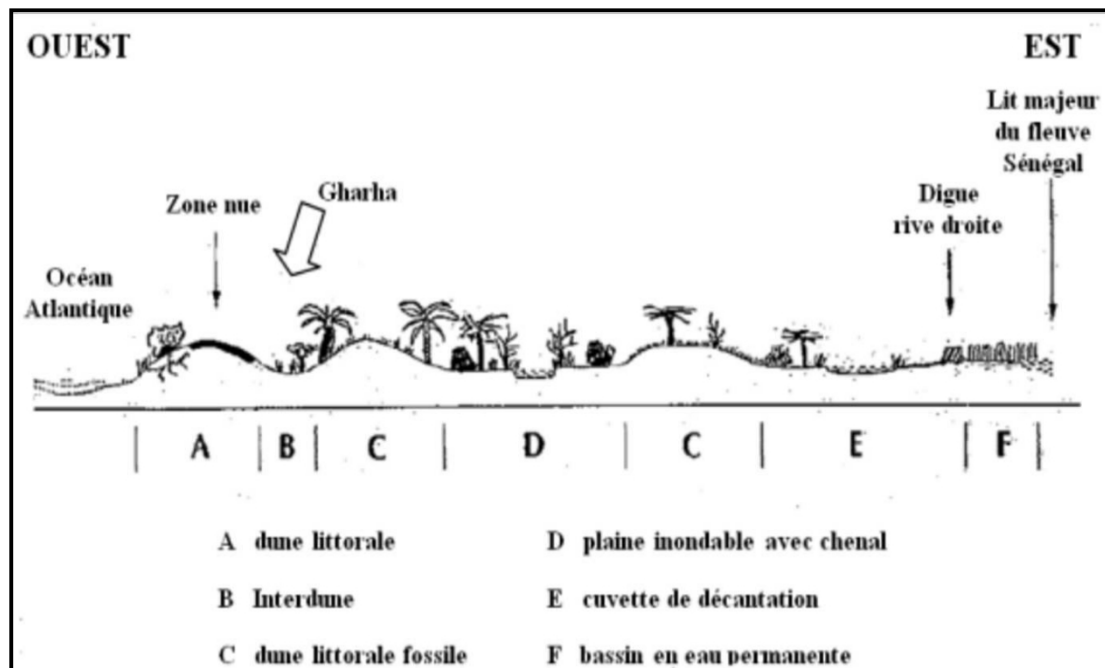


Figure 7: The different environments encountered in the Mauritanian lower

delta Hydrological framework :

The commune of Ndiago is part of the area around the mouth of the Senegal River. The Tchat Tbool, a former estuary, is a particular feature of this area. The water regime and the balance between the various basins that make up the area were greatly affected by the construction of the Diama dam. This has had a major impact on the ecological balance.

The creation of the PND was intended to correct this imbalance. After more than a decade, the situation has returned to normal following the commissioning of hydraulic works to regulate water transfers between the various basins of the lower delta. The Lower Delta of Mauritania is made up of several basins linked to each other by structures, which ensure the supply of water to the area. There are a total of eight hydrological units in the Mauritanian lower delta, three in the central zone of the NDP (Diawling-tichilitt, Bell and Gambar) and five in its peripheral zone (Aftout, Chat-Boul, N'Diader, N'Thiallakh and Geuyloubou). These basins are important sources of water flow from the river to the sub-region as far as Nouakchott, and ensure the irrigation of rice-growing areas in the Aftout zone.

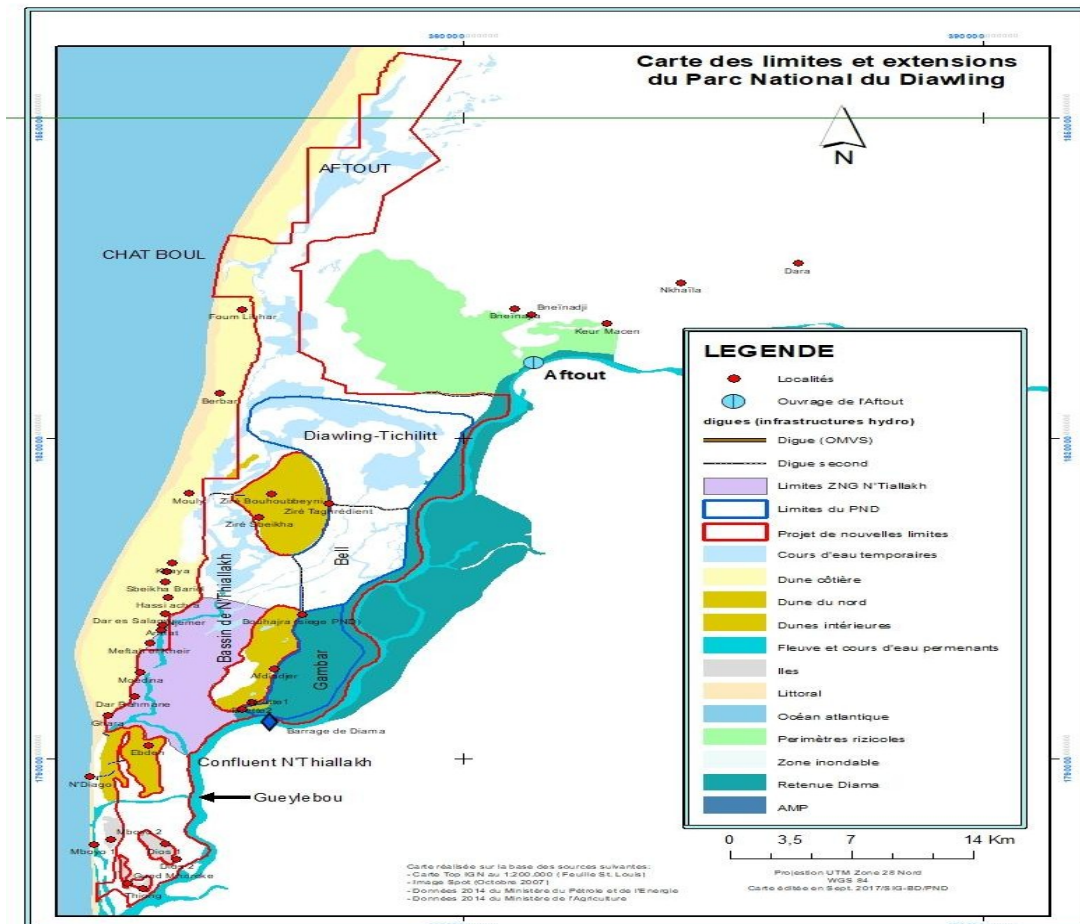


Figure 8: Main basins in the lower delta of the right bank Senegal river

The hydraulic principle of the lower delta of the Senegal River, right bank, depends mainly on that of the PND, given its geographical position, three basins of major importance for the supply of the area (Diawling-tichilitt, Bell and N'Tiallakh), which are mainly supplied by water from the river, using works installed on the latter.

The Diawling-tichilitt basin is the largest basin in the central zone of the 11,000 ha park, fed by the primary Cheyal structure with a water pressure of 20 m³ /s from the river. Within the basin are two secondary structures: Berbar North and Lekser North. The Bell basin, with a surface area of 4,500 ha, is located in the central zone of the NDP and is fed by the Lemer primary structure with a water pressure of 15 m³ /s. This basin is made up of 3 secondary structures: Bell West and N'Djorakh and Berbar South.

The third basin is the N'Tiallakh basin, with a surface area of 20,000 ha, located in the peripheral zone of the NDP. This basin is characterised by brackish water, which comes mainly from the mixture of water released from the Diama dam and the upwelling of water from the Atlantic Ocean, which feeds the basin.

The N'Tiallakh basin is made up of 3 secondary structures: Lekser Sud, Bell Ouest and N'Djorakh. This reservoir is the most sensitive compared with the other reservoirs. In fact, it is the only basin in the area that mixes water from the Atlantic Ocean with that from the Senegal River, thus supplying the other basins with brackish water.

Water from N'Thiallakh reaches the various basins of the lower delta via the following secondary structures:

- The Lekser Sud structure: This ensures the passage of water and fish from N'Tiallakh to the Diawling-Tichilitt basin and then northwards to the Hassi Baba marigot and the Aftout Essahli depression, located to the north of Chatt Boul.
- The Bell Ouest and N'Djorakh structure: This feeds the Bell basin, which in turn feeds the Diawling-Tichilitt basin via the Berbar Sud structure.
- Water from the Senegal River flows into the N'Diader basin from the Aftout Essaheli structure, supplying the city of Nouakchott with drinking water and irrigating the rice-growing areas to the east of Keur Macène.

This specific hydraulic system, which was put in place to correct a malfunction caused by the Diama dam, ensures connectivity between the different parts (basins) of the NDP.

IV.2.5. The biological environment

The area is characterised by the richness of its ecosystems and exceptional biological diversity.

Wildlife :

More than 97 species of freshwater and estuarine fish have been recorded in the area. Reptiles and mammals number more than fifteen species. Birdlife plays an important role, with over 174 species and numbers in excess of hundreds of thousands of individuals. This large number of birds has led to the site being included on the RAMSAR list of wetlands of international importance since 1994.

Flora :

The Mauritanian delta was characterised by its great floristic diversity (lowland and estuarine species). The hydrology of the Mauritanian low delta has always favoured

development of a mangrove with *Avicennia germinans* and *Rhizophora racemosa* with a characteristic flora, large areas of *Sporobolus robustus* and other species of pastoral importance such as *Echinochloa colona*, *Oryza barthii*, etc.

On the plain, the plant cover is dominated by the following species, among others: *Euphorbia balsamifera*, *Acacia tortilis*, *Commifora africana*, *Aristida longifolia*, *Cenchrus biflorus*, *Heliotropium bacciferum*, *Dactyloctenium aegyptium*, *Maetenus senegalensis*, *Ipomoea asarifolia*, *Ipomoea kotchyan*.

There are also deeper-rooted tree plants such as *Acacia tortilis* and other shrubs such as *Maetenus senegalensis*.



Figure 9 : Some local species: *Euphorbia balsamifera*, *Adonsonia digitata* and *Acacia albida*

IV.2.6. The socio-economic environment

The main livelihood activities in the area, based on natural resources, are fishing, livestock farming (goats and camels) and market gardening. The entire area is used as grazing land for herds, especially during the dry and hot seasons.

Fishing sector: The locality is home to the most experienced artisanal fishing community in Mauritania. The fishermen of Ndiago are reputed to be experts in the best practices of small-scale pelagic fishing. They supply the Mauritanian market and operate beyond their geographical area. Together with Senegalese fishermen, they supplied part of the fish processing industry. In recent years, Ndiago fishermen have experienced a number of problems with this activity, which they attribute to the activities of oil operators and the establishment of the port of Ndiago.

Livestock sector: There are an estimated 18,000 head of livestock in the Diawling National Park and surrounding area. This includes cattle, sheep and goats. Livestock farming is the main activity for many of the inhabitants of the Diawling National Park. Income from this type of activity is 99% from the sale of livestock and 1% from the sale of milk. Sales are broken down as follows: oxen, 44%, ruminants (sheep and goats), 30% and camels, 26%.

Market gardening: On the coast, the Ziré dune and the Birette dune, the inhabitants practise market gardening. According to a survey carried out by the Diawling National Park (2011), 28% of households in the commune of Ndiago work in agriculture, with a high proportion of women. The main products grown are vegetables, watermelons, cowpeas and groundnuts. These products are harvested mainly between August and November. The produce is marketed in Nouakchott. The tools used are traditional: long picks for sowing and pickaxes for clearing. Buckets and watering cans are used for watering. In addition to these basic activities, the women also engage in secondary activities, notably the gathering of various non-wood forest products.

IV.2.7. Protected sites in the project area

The area is home to several protected sites of high ecological importance:

➤ Diawling National Park:

The Diawling National Park (PND) was created by Decree no. 91-005 (14 January 1991), at the instigation of IUCN, as a Public Administrative Establishment (EPA) under the supervision of the Ministry of the Environment and Sustainable Development, to compensate for the negative effects of hydro-agricultural developments in the lower delta of the Senegal River and the after-effects of the drought of the 1970s that plagued the sub-region, as well as the ever-increasing human pressure on natural resources.

Located at the south-western tip of the country, at the mouth of the Senegal River, the main mission of the PND is to restore the environment, which has been damaged by the two large dams at Diama and Manantali on the Senegal River. An area rich in biological diversity, the PND is known for the vital role it plays as a breeding and nursery ground for many species of fish and migratory birds.

In terms of flora, the DNP contains more than 128 species. A mangrove with *Avicennia germinans* and *Rhizophora racemosa* can be found on the floodplain mudflat. As for the fauna, more than 97 species of freshwater and estuarine fish have been recorded in the area, along with around fifteen species of reptiles and mammals and around 174 species of bird, with

numbers can exceed hundreds of thousands of individuals. The site's importance as a bird sanctuary has led to it being included on the RAMSAR list of wetlands of international importance since 1994.

During the summer, temperatures are high, leading to strong evaporation and therefore increased salinity. To reduce the salinity level, water is released from the Diama dam into the Diawling basin in winter. In addition, oxygen levels are tending to fall, which could be due to eutrophication in the Diawling basin. The DNP and its peripheral zone are made up of dune massifs (Ziré dune, Birette dune, coastal dune ridge) and natural basins (Diawling-Tichilit basin, Bell basin, N'Thiallakh basin, Gambar basin).

The NDP is a sensitive area and is subject to a number of natural and anthropogenic pressures, including agro-pastoral activities, poaching, overfishing, the installation of port infrastructures (N'diogo port), urbanisation, etc.

➤ **The Tboul chat :**

The former mouth of the Senegal River, the Chat Tboul Reserve is a lagoon located at the level of the sebkhas upstream of a 1.2 km wide breach. The Chat Tboul is a paralic environment, consisting of a body of transitional water between the marine and continental environments, with lakes, temporary and permanent pools and brackish to hyper-salty water.

To the south of this mouth, there are flood plains with marshes and ponds, bordered to the west by living dunes and vegetated dunes. A biodiversity hotspot, Chat Tboul is a unique breeding site for certain species, notably the lesser flamingo. The site has been classified as a RAMSAR site since 2000. It is subject to a number of pressures, the most significant of which are those linked to climate change, the construction of port infrastructures (Port of Ndiago) and future tarmac roads to serve the Port.

➤ **Essahli Aftout:**

This area of coastline, located between Nouakchott and Ndiago, is a low-lying area in the continental part and a transition zone for water masses, covered during the cold season by the cold and relatively salty waters of the Canary Islands in its maritime part. It is the first to be influenced by the penetration of the warmer, less salty waters of the thermal front in May and June. Together with the waters of the Canary Islands, these waters form a buffer zone known as the thermal front, the characteristics of which are favourable to certain pelagic species, forming a dynamic habitat for these migratory species.

V. Method for identifying and assessing the impacts of the Project

The CDD production plant will help to minimise the negative effects of solid waste generated by the country's municipalities and industries. It will recover these products and transform them into CDD to be used again in industry, thus preventing them from being discharged into the environment. However, the project may involve environmental risks.

V.1. Method for assessing the significance of potential impacts

The assessment of the environmental and social impacts of the Project consists of a cross analysis between the activities of the Project and the environmental and social sensitivity and vulnerability of the eco-geographical environment receiving the Project. This analysis must be carried out in compliance with national legislation on environmental and social impact assessment.

The approach used to review the environmental and social impacts potentially associated with the implementation of the Project makes the link between the main project activities and the sensitive environmental components. This cross-referencing matrix is used to identify the potential impacts (positive and negative) of the Project.

Impact analysis consists of identifying, describing and assessing the potential impacts of the project on the components of the natural and human environment on the basis of the information available. The method used to assess the significance of the impacts is based on identifying the sources of impact and on three fundamental criteria: the duration, extent and intensity of the impact.

Duration: An impact can be described as temporary or permanent. A temporary impact may last a few days, weeks or months, but must be associated with the notion of reversibility. On the other hand, a permanent impact is often irreversible and is observed permanently or over the very long term.

Extent: The extent of the impact corresponds to the spatial scale of the modification of the element affected. There are three levels of extent: regional, local and specific.

Intensity: The intensity of the impact is a function of the extent of the modifications to the component of the environment affected by a Project activity or of the disturbances that will ensue. There are three levels of intensity: high, medium and low.

The correlation between the descriptors of duration, extent and intensity makes it possible to establish an overall assessment of the various impacts, the significance of an impact. However, it is up to the assessor to make an overall judgement of the impact based on the specific characteristics of the environment.

The overall assessment is divided into the following three categories:

- **major importance:** the impact on the environment is very strong and difficult to mitigate;
- **medium importance:** the impact on the environment is significant but can be mitigated by specific measures;
- **Minor significance:** the impact on the environment is insignificant but reduced and may or may not require the application of mitigation measures.

V.2. Sources of potential impact of the Project

The project comprises three phases: a construction phase for the various plant components at the start of the project, followed by an operating phase during which CDDs will be produced, and a plant closure and dismantling phase. All these phases have potential negative impacts on the receiving environment, which will be assessed, and those deemed significant will benefit from mitigation measures. The positive impacts will be enhanced and amplified.

Potential impacts can be identified by cross-referencing project activities and components of the receiving environment (see table below).

Table 3: Cross-reference between project activities and environmental components likely to be affected by the project

Activities	Environmental receptors
• Bringing in building materials and fitting out the site of the CDD production plant • Atmospheric emissions and unpleasant odours from the plant • The production of liquid and solid waste from the CDD production process • Job creation	Biophysics : • Atmosphere (dust and greenhouse gases, etc.) • Soil (Land use) • Water (surface water and groundwater) • Flora/fauna and vegetation human : • Public health • Employee safety • Jobs • Infrastructure

V.3. Indicative list of potential impacts of the Project

The industrial unit helps to minimise the negative effects of solid waste generated by the country's municipalities and industries. It recovers these products and transforms them into CDD for re-use in industry, thus preventing them from being discharged into the environment. However, the project may involve environmental risks.

The Project may give rise to impacts resulting from the collection, transport, storage and treatment of waste. These impacts include, among others

- Contamination of surface and ground water as a result of spills or fires involving waste or CDD;
- Contamination of the surrounding population by staff in contact with these products.

Table 4: Indicative list of potential impacts and mitigation measures

Potential impacts	Possible mitigation measures
Bringing in building materials and fitting out the site of the CDD production plant	Minimise noise and vibration disturbance and ground deformation
Atmospheric emissions and unpleasant odours from the production plant fixed-term contracts	Use machinery that is in good condition and emits as few greenhouse gases as possible, and avoid the release of pollutants. bad smells
The production of liquid and solid waste from the plant's production process Fixed-term contracts	Treating and disposing of wastewater and solid waste in an environmentally sound manner
Job creation	Recruit and train project staff and ensure their safety

VI. Public consultation plan

Article 17 of Decree N°2007-105 stipulates that "public information and participation shall be ensured during the execution of the Environmental Impact Assessment, in collaboration with the competent bodies of the administrative district and municipality concerned".

Public consultation includes meetings with the administrative authorities and local elected representatives. It also includes a one-day public hearing at which the promoter will explain the various project activities in the presence of

representative of the relevant sector ministry and the Ministry of the Environment, as well as civil society and ordinary citizens.

A register will be opened and accessible to the public, allowing them to record their views on the project. The date of the public hearing day will be decided in close collaboration with the ministries concerned and the local authorities and elected representatives. Civil society will be informed in time to take an active part in the day. The results of this public consultation will be taken into account in the EIA report, which will be sent to the Ministry of the Environment.

Documents consulted :

1. **Recycling Experts Mauritania (2023) :** Business plan (2023-2026) Project to set up a waste-to-energy plant in Mauritania
2. **African Development Bank (2021):** Profile of Mauritania, 2021. World Bank.
3. **European Commission (1999):** Forest resources in Mauritania. Direction Générale VIII Développement, programme de partenariat Européenne-Organisation des Nations Unies pour l'Alimentation et l'Agriculture (CE-FAO) (1998-2002).
4. **Commune of N'Diogo (2017):** Development plan for the commune of N'Diogo. Ministry of the Environment and Sustainable Development (Mauritania).
5. **Dia A.T., Colas F. and Wispelarere G., 1995:** Contribution à l'étude des milieux naturels du littoral mauritanien In Colas F., 1997: Environnement et littoral mauritanien. Proceedings of the symposium, 12-13 June 1995, Nouakchott, Mauritania. Montpellier, France and CIRAD, pp39-45.
6. **Duvail, Stéphanie 2001:** Hydrological scenarios and development models downstream of a large dam. Water uses and resource sharing in the Mauritanian delta of the Senegal River.
7. **Ebou Moussa, S. (2022):** Impacts des infrastructures sur les aires protégées étude de cas analyse des impacts environnementaux et sociaux du projet port de N'Diogo sur le Parc National de Diawling et zone périphérique (Mauritanie). Université Cheikh Anta Diop de Dakar (master's thesis).
8. **El Habib Barry, M., &Nuscia Taibi, A. (2015):** From the Diawling National Park to the Transboundary Biosphere Reserve: scale games testing sustainable development in the lower Senegal River delta.
9. **Ould Mohamed Baba Elemine, 2010:** Géographie de la Mauritanie, Editions Universitaires Européennes.
10. **Diawling National Park, (2022):** Diawling National Park Development and Management Plan 2018-2022.