Assessment of the predisposition to the risk of coastal erosion of the sandy coastline of Jacqueville in Assinie, Ivory Coast

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Contents

INTRODUCTION

BACKGROUND

70% of beaches worldwide are currently experiencing erosion, according to a global summary study conducted by Bird in 1985.

The Ivorian coastline is mainly sandy and exacerbated by the combined effects of natural hazards and human activities. It is highly exposed to coastal erosion.

Very steep slope break on Assoindé-Assinie beach (JUNE 2025)

PROBLEM

How can a geospatial approach be used to identify and locate the areas most prone to coastal erosion between Jacqueville and Assinie, which face significant anthropogenic pressure and a lack of protective structures?

OBJECTIVES

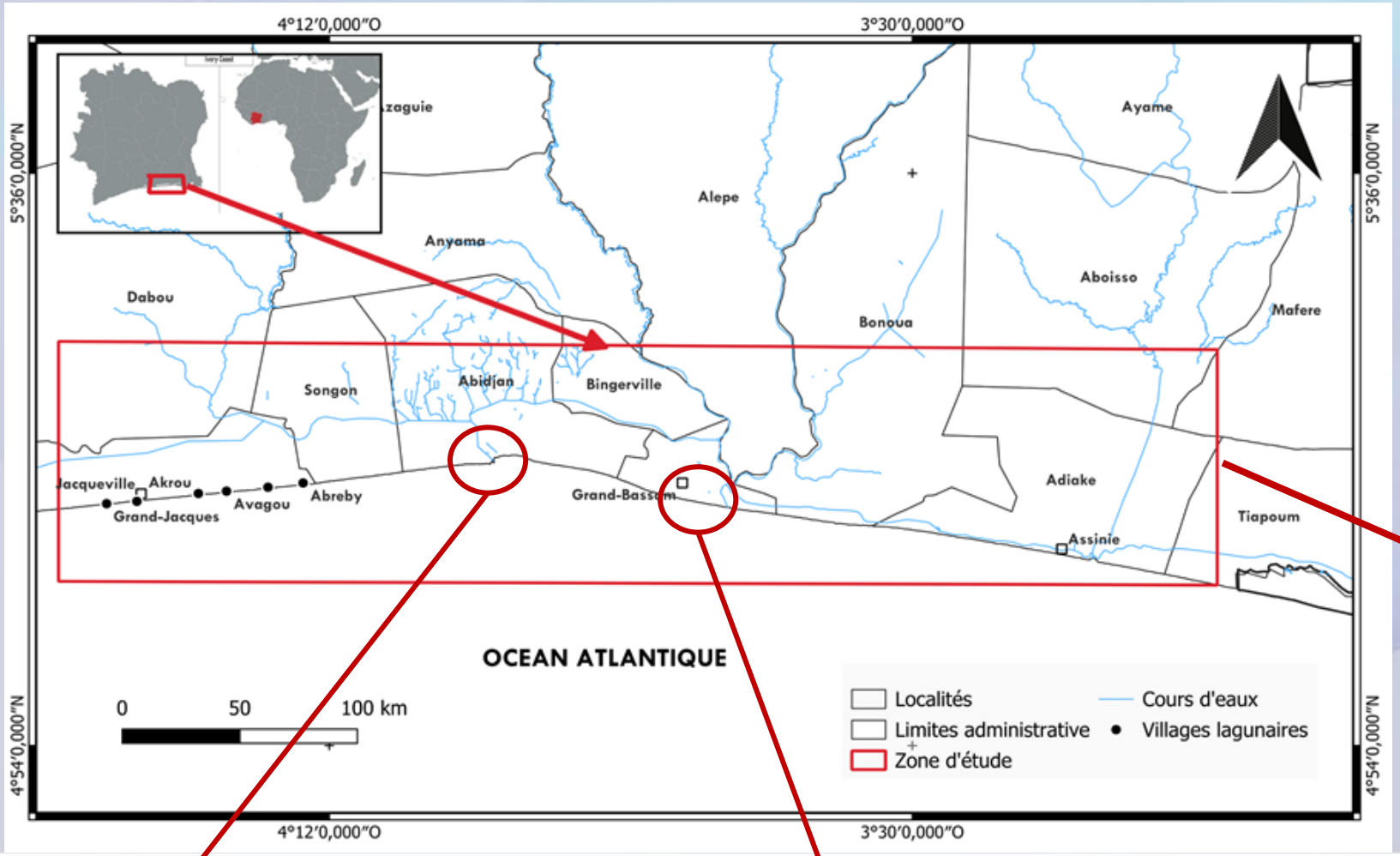
GENERAL OBJECTIVES

The overall objective of this study is to assess susceptibility to coastal erosion risk using satellite radar imagery.

SPECIFIC OBJECTIVES

- Identify indicators of susceptibility to coastal erosion risk
- Mapping areas prone to high erosion risk

PRESENTATION OF THE STUDY AREA



The coastline of Ivory Coast stretches for 566 km.

Jacqueville in Assinie stre over a length of 149 km.

Vridi Canal

Mouth of the Comoé River

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MATERIELS ET METHODES

EQUIPMENT

Data

Satellite imagery → **Sentinel 1-A**

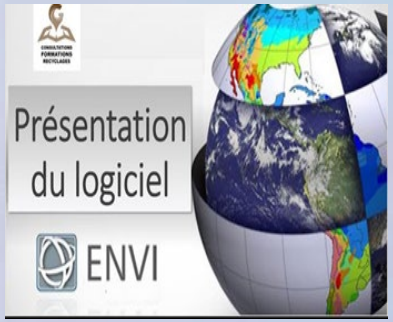
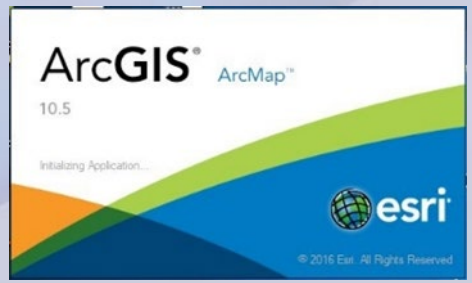
- Resolution 10m X 10m
- 2017, 2019, 2021, 2023 and 2024
- Study of coastline evolution

Indicators

- Issues,
- Protective structures,
- Coastal evolution.

EQUIPMENT

Software

QGIS — Digitisation, meshing and the creation of various maps.	SNAP — for the pre-processing and processing of radar images	 For converting GeoTIFF/BigTIFF images to shapefiles
Google Earth — To verify the visibility of protective structures and issues through field validation	(Digital Shoreline Analysis System) to calculate statistical changes in the coastline	 serves as a support for the DSAS 5.1 extension

METHODOLOGY

The methodological approach is as follows:

Inventory of selected predisposition indicators

Then segmentation of the coastal fringe into 'boxes' (observation units)

Calculation of coastline changes over different years

Then establish the code and weighting grid.

Producing coastal predisposition maps

METHODOLOGY

A *Inventories of indicators*

❖ **Issues**

- Economic infrastructure (village, factory, hotel complex)

❖ **Protective structures**

- Sea wall
- Groynes
- Sandbags, riprap, retaining wall

❖ **Evolution of the elevation line**

3-methodological approach

C *Processing of indicators*

Issues

Google satellite visualisation on QGIS

↓

Inventory by Google Earth

↓

Classification by type: major, significant, moderate, minor, absent → Assigning scores and colours → Map of issues

3-methodological approach

C *Processing of indicators*

Protective structures

Location via Google satellite on QGIS

⇩

Inventory by Google Earth

⇩

Digitisation on QGIS

⇩

Classification by type: major, minor, absence → Assigning scores and colours → Map of protective structures

3-methodological approach

C *Processing of indicators*

Coastline evolution

Sentinel 1-A images

↓

Pre-processing: Calibration, decibel conversion, file orbit, speckle filtering, mosaic and thresholding

↓

Digitalisation → Calculate EPR → Average EPR

3-methodological approach

C *Mesh segmentation*

❖ Segmentation: approach defined by Juigner (Juigner, 2021)

❖ Grid characteristics:

- A grid of 5 km squares

- Use of QGIS software

3-methodological approach

C *Indicator rating*

Assign a value to each indicator, taking into account its level of intensity and the impact it may have.

- The value of the codification of issues ranges from 1 for no issues (natural range) to 5 for major issues.
- The value of the codification of protective structures ranges from 1 for no structures to 5 for the presence of major structures.
- The value of the coastline evolution codification ranges from 1 for relative stability to 7 for critical erosion.

3-methodological approach

C *Indicator rating*

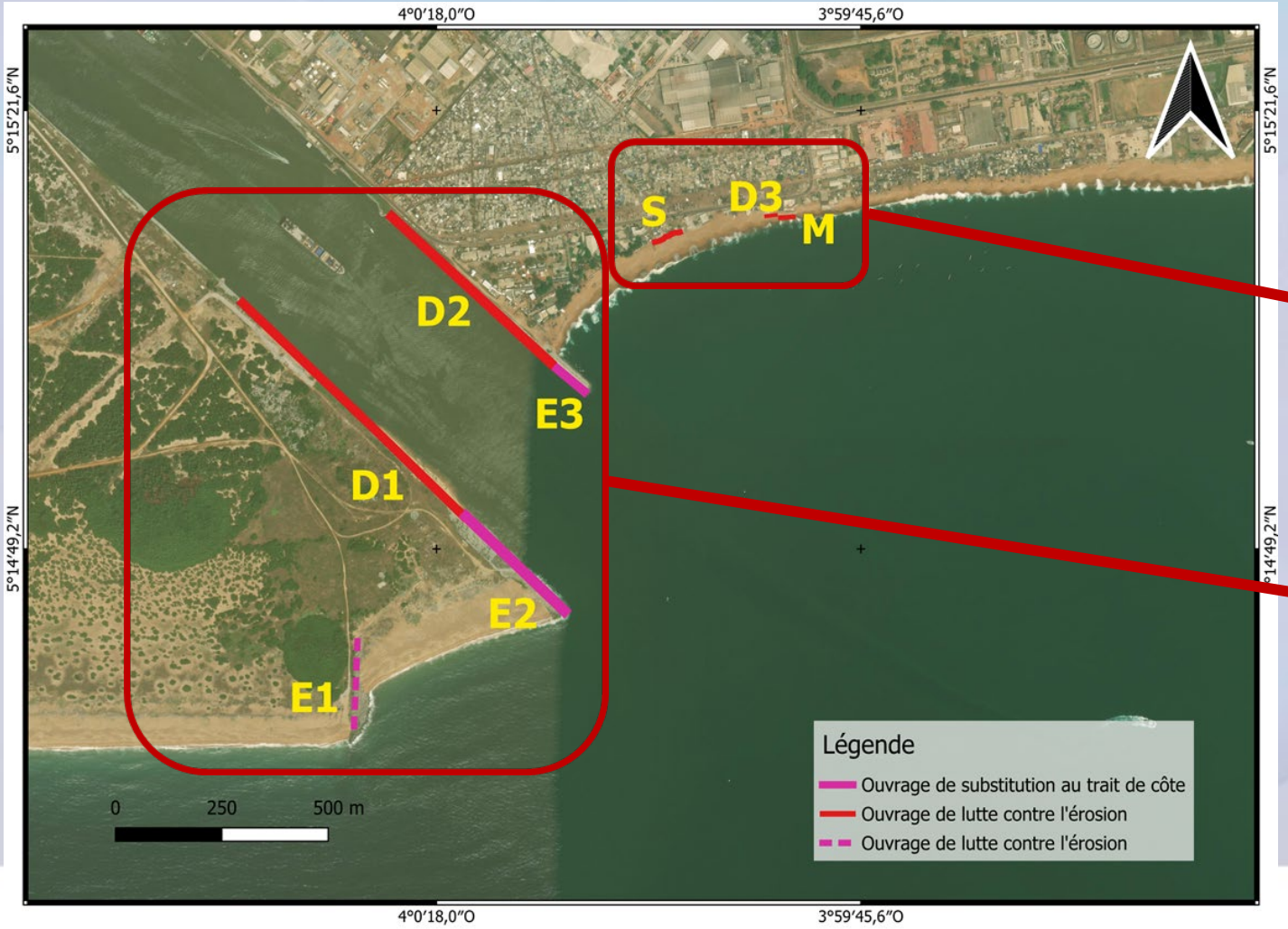
Indicator	Score 1 (Low)	Score 2	Score 3	Score 4	Score 5 à 7 (Strong)
Issues	No-go zone: beaches, dunes	Sparse habitats, etc.	Hotel complex, church, etc.	Laguna villages, dense areas, etc.	City, ports, factories, etc.
Protective structure	No protective structures		Minor protective structures, medium maintenance (sandbags, riprap)		Major protective structure (dyke, groyne)
Coastline evolution	Accretion (> +1 m/year) Stable coastline (±1 m/year)				Erosion (> –2 m/year) (red)

Class boundaries	Low	moderate	criticism
	Level of predisposition		

RESULTS

1-TREATMENT RESULTS

Protective structure



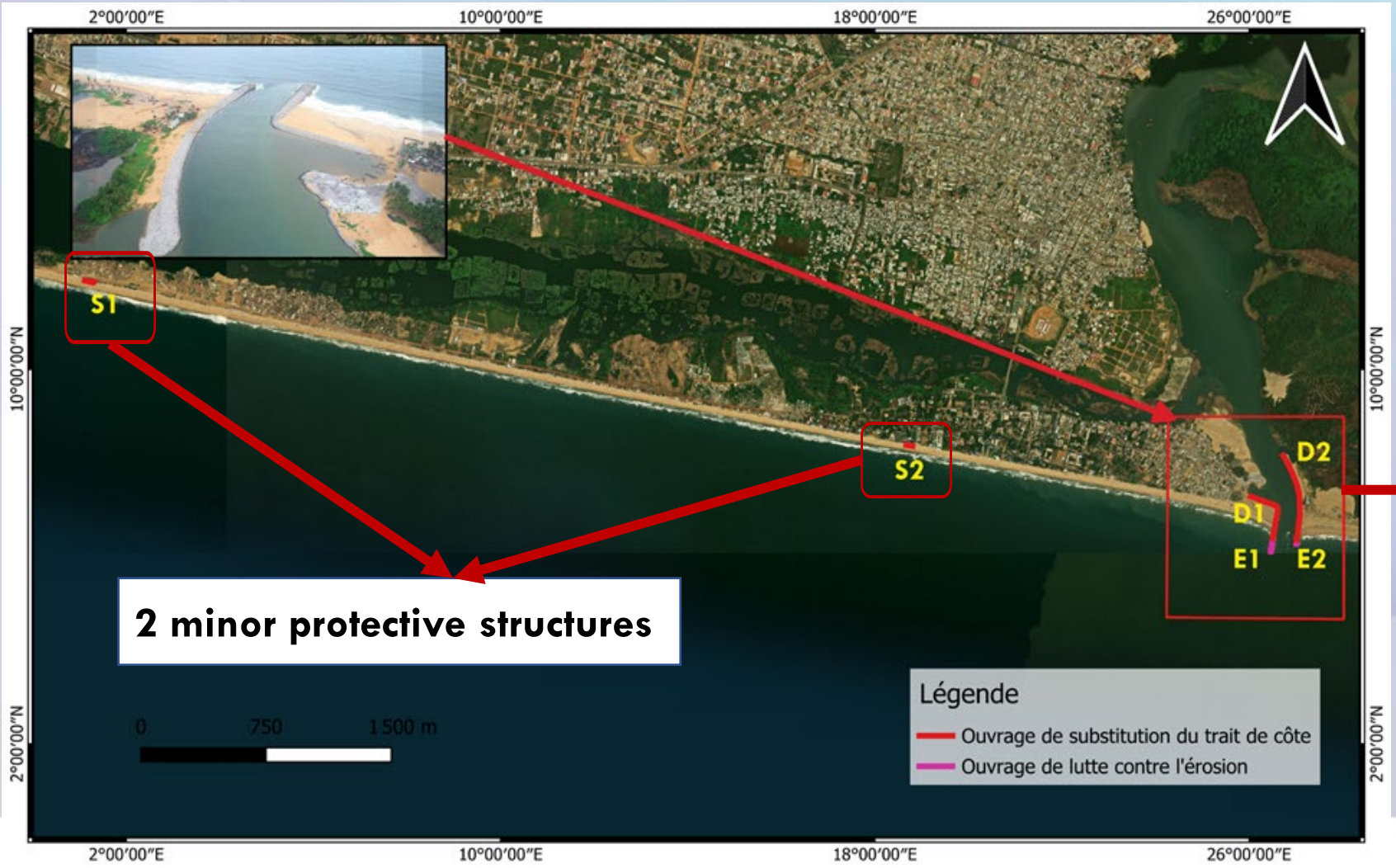
The Vridi Canal area in Abidjan has eight protective structures.

3 Minor protective structures

5 Major protective structures

Protective structures

1-TREATMENT RESULTS

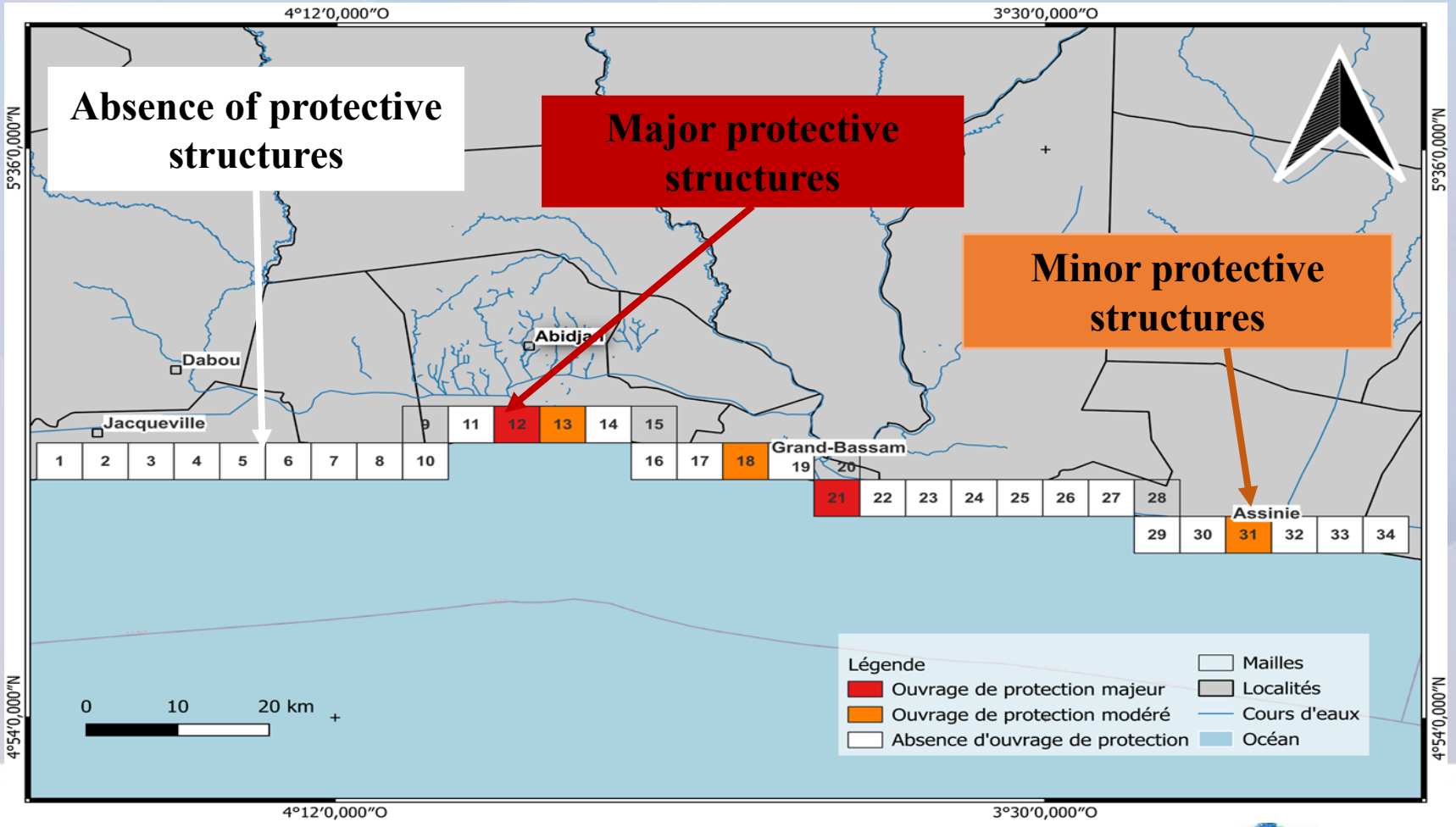


The GAND-BASSAM area has six protective structures, divided into major and minor structures.

4 major protective structures at the mouth of the Comoé River

1-TREATMENT RESULTS

Spatialisation of protective structures



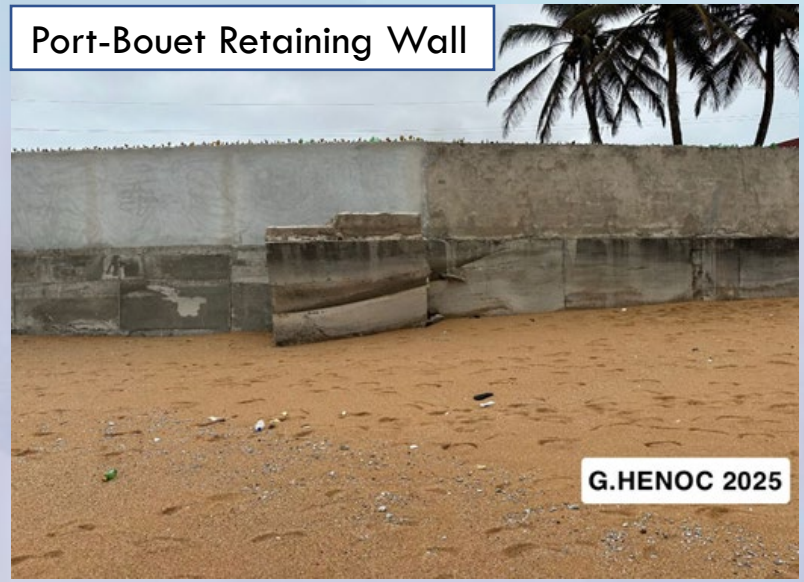
This figure shows the spatial distribution of coastal protection structures from Jacqueville to Assinie.

1-TREATMENT RESULTS

Protective structures

Grand-Bassam Block

Port-Bouet Retaining Wall



Some images from a field trip confirming the presence of protective structures on the coastline

Grand-Bassam Breakwaters

Assoindé-Assinie Sandbag

2025

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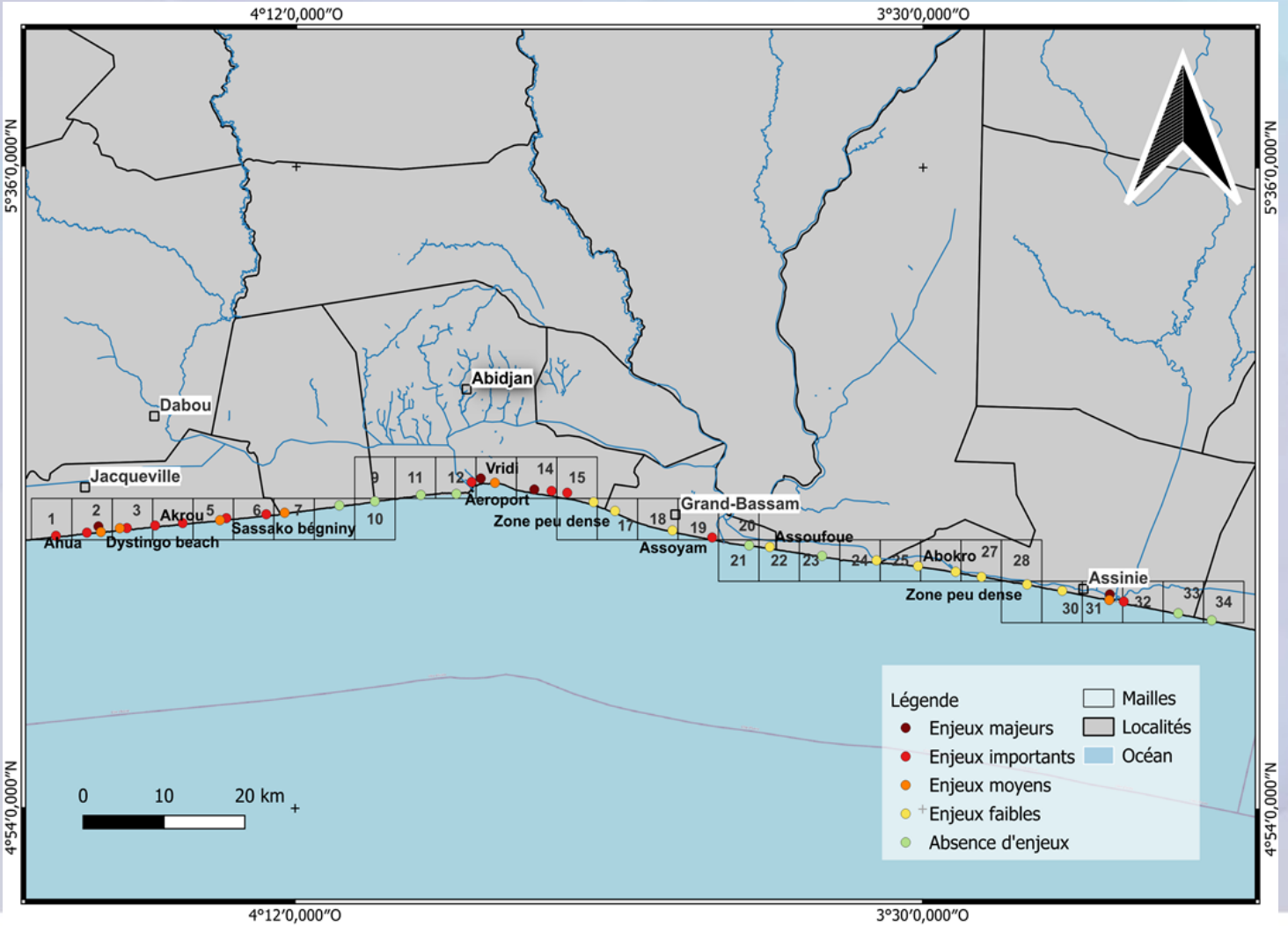
RESULTS

Issues

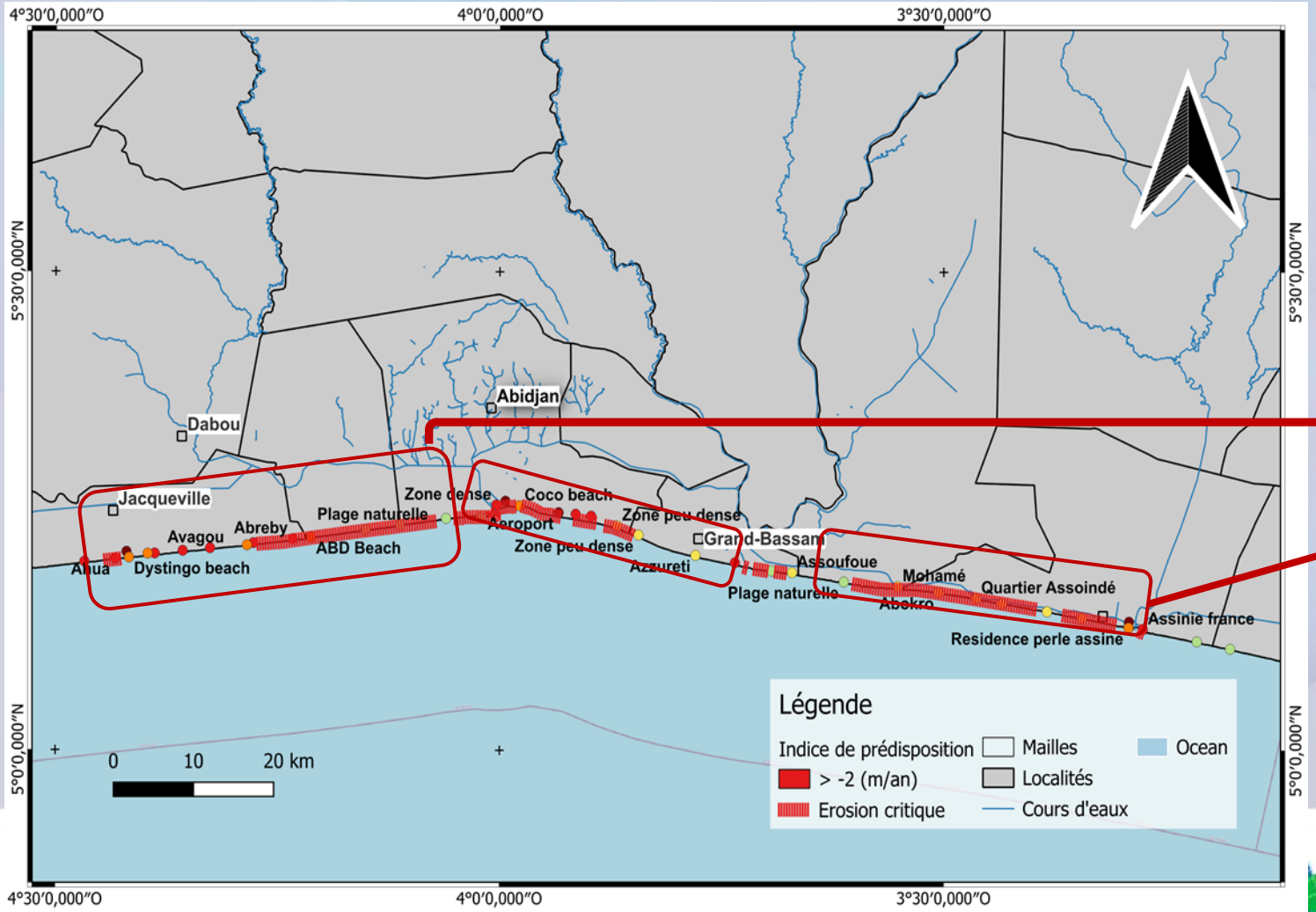
1-TREATMENT RESULTS



Locality	Presence of Issues
Jacqueville	Major, Significant, Moderate, Absent
Abidjan	Major, Important
Grand-Bassam	
Assinie	High, Medium, Low, Absent

1-TREATMENT RESULTS

Areas prone to high erosion risk



Several coastal areas, including Jacqueville, Abidjan, Grand-Bassam and Assinie, are critically exposed to coastal erosion.

Area at high risk of erosion

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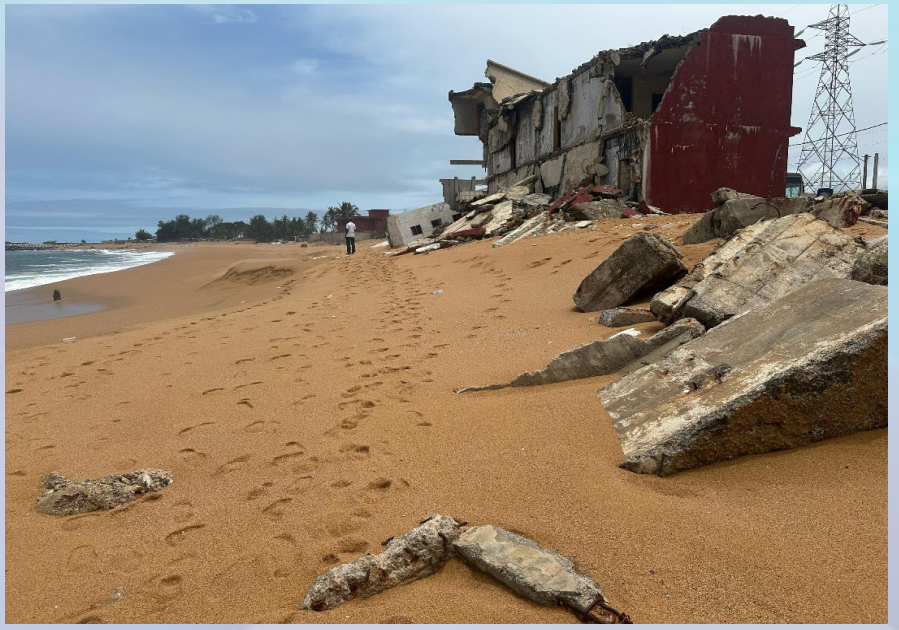
RESULTS

Areas prone to high erosion risk

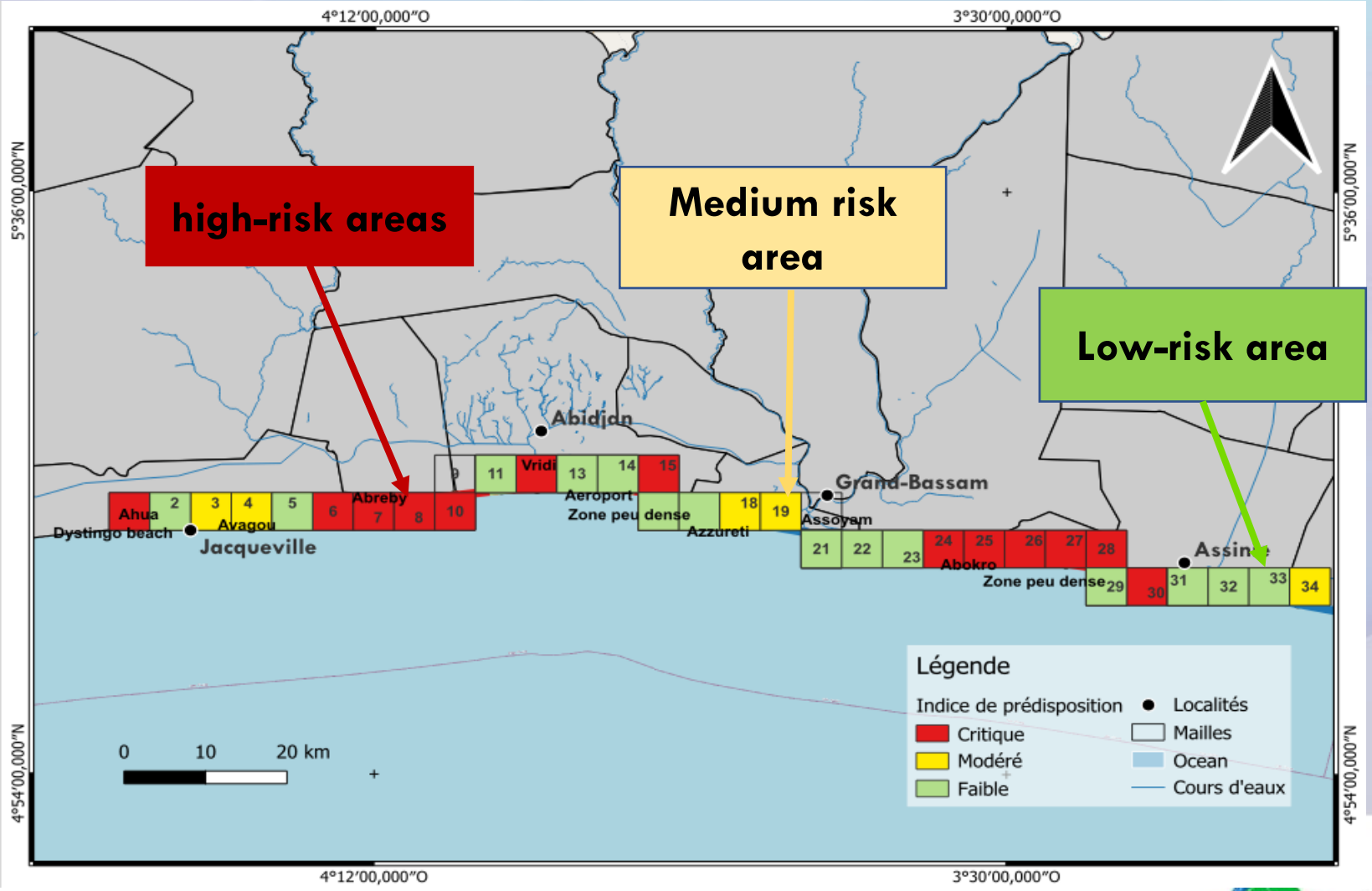
1-TREATMENT RESULTS



Some images of coastal erosion

1- RESULTATS DES TRAITEMENTS

Indicateur de prédisposition



The indicator is calculated as follows= **Alea (coastline change) × (Issues)**

PERSPECTIVE

- Take into account population density and community vulnerability for a more comprehensive assessment of coastal erosion risk, beyond physical factors alone.

- Extend the study to the entire Ivorian coastline, particularly Grand-Lahou and San Pedro, with a view to producing a national risk map.

- Using drones for land surveys and promoting participatory approaches with local communities for sustainable and inclusive coastal management.

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