



GLOBAL  
CENTER ON  
ADAPTATION

**Deltares**

**Water Adaptation Community Webinar**

# **The climate emergency on Small Islands – challenges and opportunities**

5th July 2023, 14:00 CEST

**Webinar Knowledge Kit**

# Knowledge Kit Content

- Background
- **Presentation:** Climate Resilience in Curaçao
- **Presentation:** São Tomé and Príncipe - Climate Adaptation Feasibility & ROVs
- **Presentation:** Assessing Climate Risk in Antananarivo, Madagascar
- Related Links
- Stay Connected

# Background

## Chair:

Mr. Feisal Rahman, Senior Water and Climate Adaptation Specialist, Global Center on Adaptation

## Speakers:

- Honorable Mr. Ursell M. Arends, Government of Aruba, Minister of Transport, Integrity, Nature and Elderly Affairs
- Ms. Pédzi Girigori de Flores Martinez, Meteorological Department Curaçao
- Ms. Irene Seemann, Rebel Deutschland
- Mr. Scott Leckie, Displacement Solutions
- Ms. Anais De Keijser, SWECO

Watch the recording [here](#).

Marine transportation and ocean tourism are trillion-dollar industries. Without climate adaptation measures, damage to infrastructure, losses in crop production, and reduced fishing yields could cause average GDP losses of up to 19.5 percent in the world's deltas similarly, it is estimated that flooding due to climate change could affect 20% of global GDP. As the impacts of climate change continue to intensify, flooding risk will increase, putting infrastructure valued between US\$7.9 and US\$12.7 trillion at risk, as well as the lives of hundreds of millions of people. With 40% of the global population living within 100 km of the coast and 11% living in low-lying coastal areas, the impacts of sea level rise could be felt as soon as 2050. Accelerating adaptation efforts is essential to protect people, landscapes, economies, and even the very existence of some islands and deltaic coasts.

"Futureproofing Water and Climate Adaptation" is a webinar series focused on adaptation strategy, practices, and financing for deltas, urban deltas, small islands and coastal areas. The series is designed to support the ambition of the International Panel on Deltas and Coastal Areas - to build capacity for effective adaptation planning, governance and finance – through online knowledge sharing and creation. This series of webinars consists of sharing good practices, panel discussions and interactive community dialogues "The Climate Emergency on Small Islands – Challenges and Opportunities" webinar highlights the unique climate adaptation challenges that small islands face and will share some hands-on opportunities that have proven successful to deal with these challenges.



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## Building Resilience in Willemstad, Curaçao, a UNESCO World Heritage Site

*By: Pédzi Flores-Girigori MSc  
Curaçao Climate Change Platform*



MINISTERIO DI  
TRÁFIKO, TRANSPORTE I PLANIFIKASHON URBANO



MINISTERIE VAN  
ECONOMISCHE ONTWIKKELING



# Challenges in Urban Resilience



ferent groups of people with  
s and interests could share the  
hood without interacting.”



# Case study: Ser'i Otrobanda



Building Community  
Resilience through  
**Social  
Entrepreneurship**

- **Kaya Kaya  
Festival**
- **Hofi Ser'i  
Otrobanda**

# Social Preneurship: *Kaya Kaya Festival*



## Economical

To help existing businesses inside and outside the district flourish and empower the community to create new opportunities.

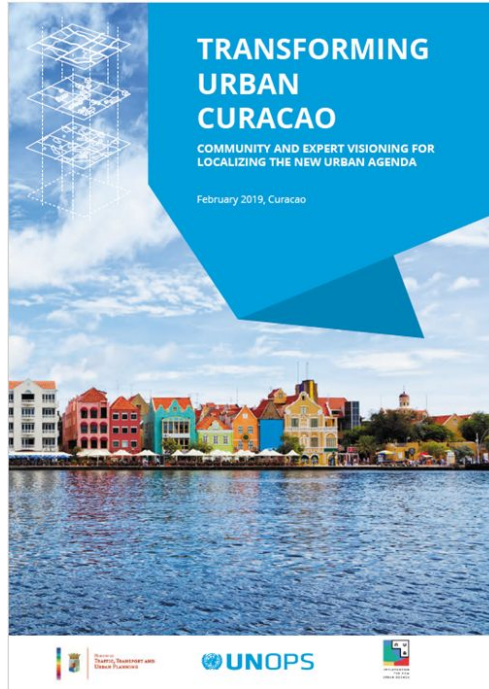
<https://www.kayakayafestival.com/>

# Climate & Food: *Hofi Ser'i Otrobanda*





# Strategy for Resilient Communities



# Key Take Away...

Curaçao will be  
resilient to the  
impacts of natural  
hazards and the loss  
of biodiversity

Increase Resilience

Resilient Communities

Resilient Economy

Resilient Biodiversity

“Limits to adaptation are not fixed, but are properties of dynamic socio-ecological systems. They are shaped not only by the magnitude of the climate hazards and the exposure to vulnerability to those hazards, but also by physical, infrastructural and **social tolerance**...”

~IPCC

**Extra information**

# Strategy for Willemstad



Transformational projects to kickstart the urban transformation of Curaçao

## Enhanced Culture

Build on diverse identities within the inner city

## Connectivity, Sustainability & Resilience

- Facilitate access to the Inner city and enhance the shades and scenery along its paths
- Improve public transport system
- Make coastline protective and accessible



## Stimulate local economy

Restore Punda as the beating heart of the Inner city

## Increase housing opportunities

- Improve living conditions in Scharloo
- Revitalize Otrobanda

## Strategy:

Attract more people in the Inner city and prevent urban sprawl

# Key Messages to Transform Urban Curaçao

## Urban Centres



## Innovative forms of housing



## Climate resilience & sustainability



## Strengthen communal spaces



## Urban Platform



## Improve accessibility



## Red and Green contours



## Greening the City

## Hierarchy of nodes



# Connection to Sustainable Development Goals



# Understanding the Bigger picture: *Proposed Integrated Strategic Development Plan*

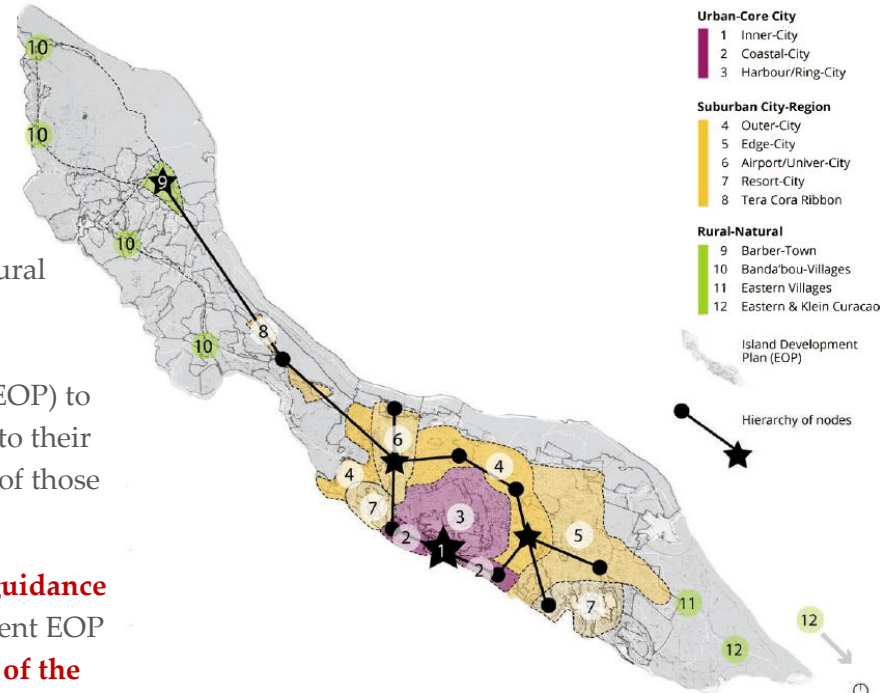
Strategic Development Plan (Structuurvisie) consists of:

- Urban Core (purple)
- Suburban City-Region (yellow)
- Rural towns (green)
- Hierarchy of nodes connecting the urban, suburban and rural

Next steps:

Develop a strategic overlay over the island development plan (EOP) to be able to guide developments in the different zones according to their own needs and plans but also according to the overall function of those zones in the total Curacao space.

The strategic overlay could function as a **longer term, flexible guidance** for refining and detailing the development projects in the different EOP land-use zones. At the same time, it will **reinforce the cohesion of the island's places**, spaces and flows.



# The climate emergency on Small Islands, July 5, 2023

A webinar hosted by the Water Adaptation Community, presented by IPDC, GCA, and Deltares



Coastal Protection in Sao Tomé & Príncipe  
*Irene Seemann, Rebel*



# Project Location



Screenshots retrieved July 5<sup>th</sup>, 2023 from [www.google.com/maps](http://www.google.com/maps)

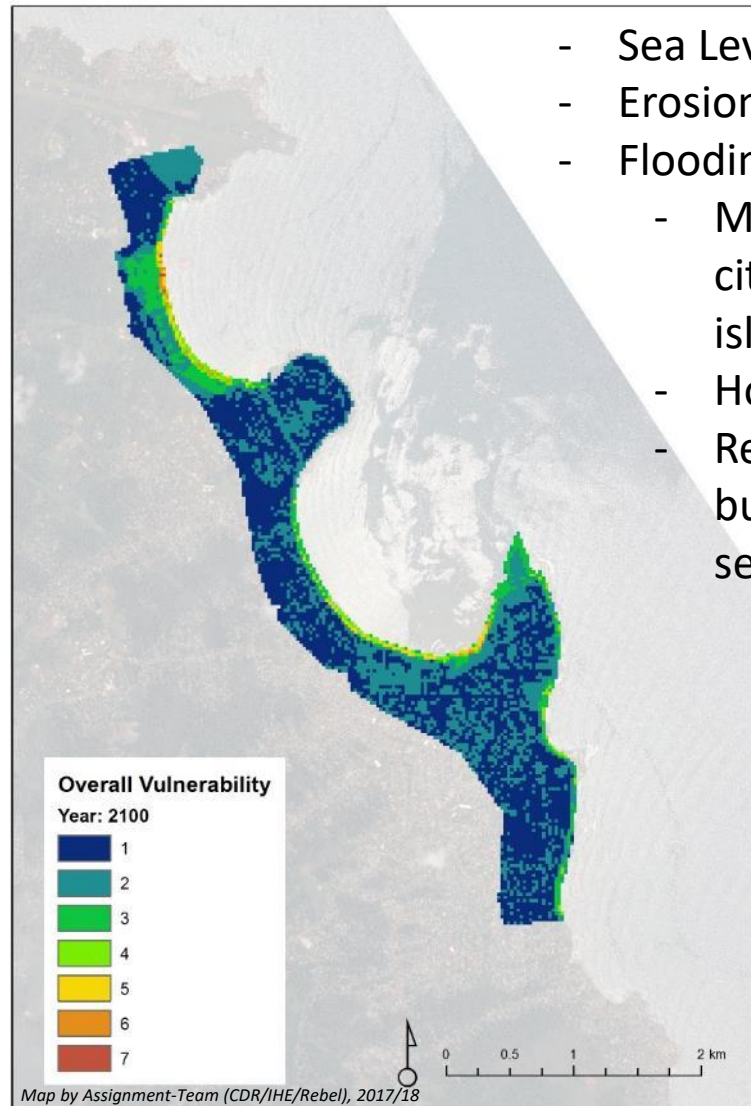
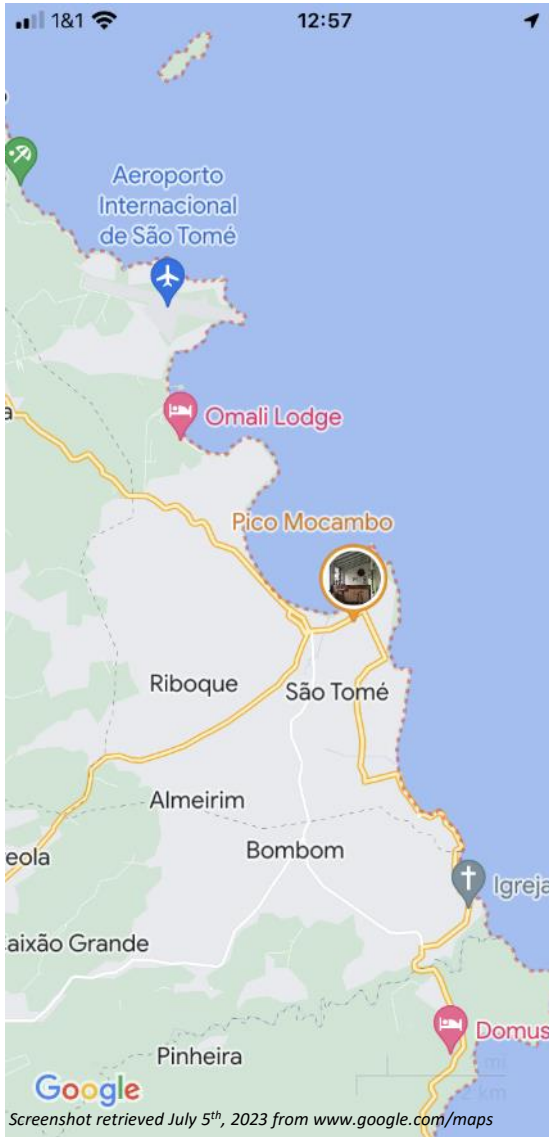
# Task & Team

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Task:  
Vulnerability Analysis, Feasibility Study  
and Preliminary ESIA  
Água Grande Coastal Protection project



# Challenges



- Sea Level Rise & storm surges
- Erosion of coast + coastal road
- Flooding of:
  - Main connection airport-city and airport-rest of island
  - Hotels
  - Residential buildings, businesses, public services

# Challenges – some impressions

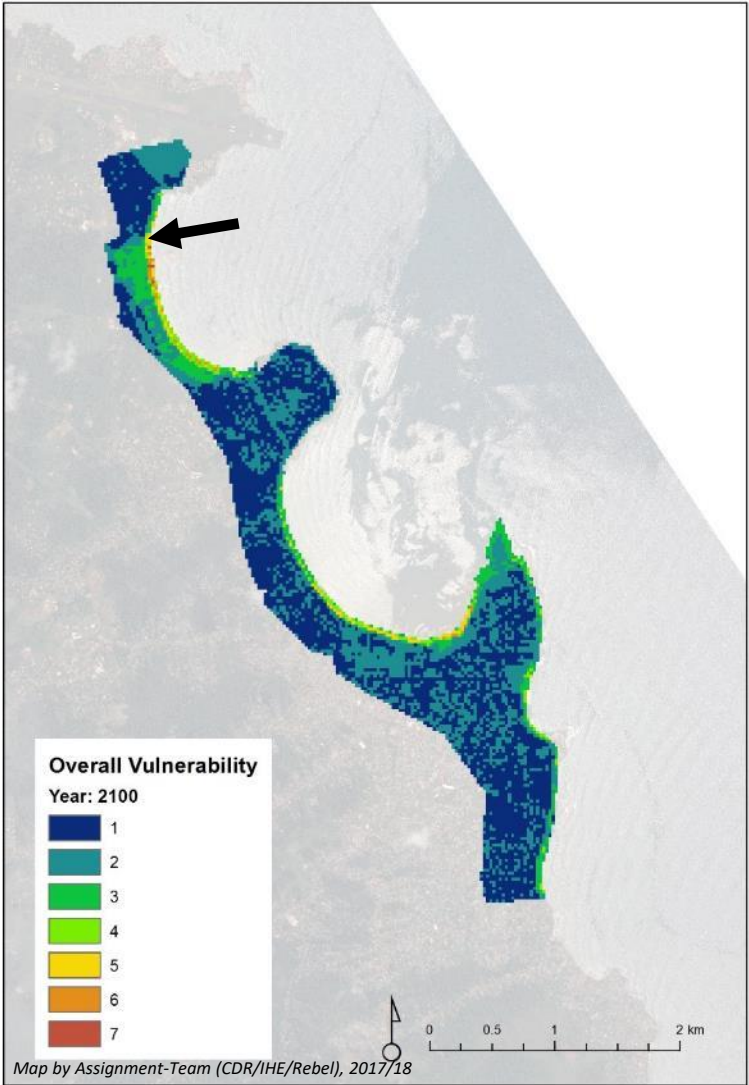


Photo by Assignment-Team (CDR/IHE/Rebel) 2018

# Challenges – some impressions

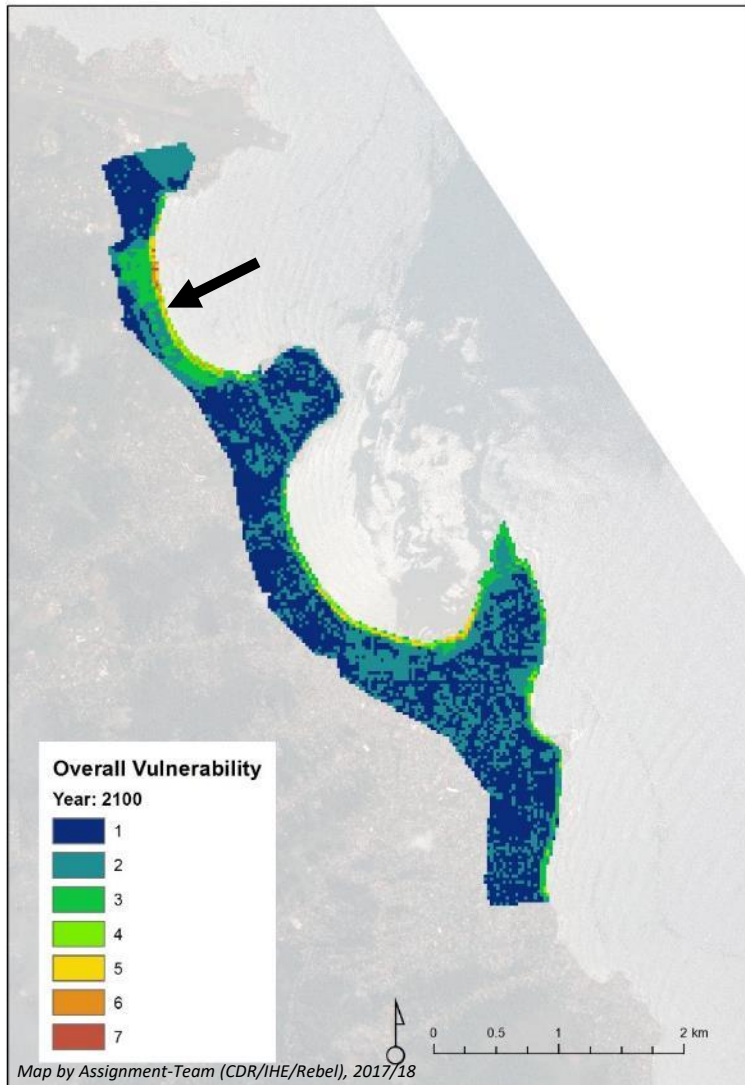


Photo by Assignment-Team (CDR/IHE/Rebel) 2018

11:00 AM

# Challenges – some impressions

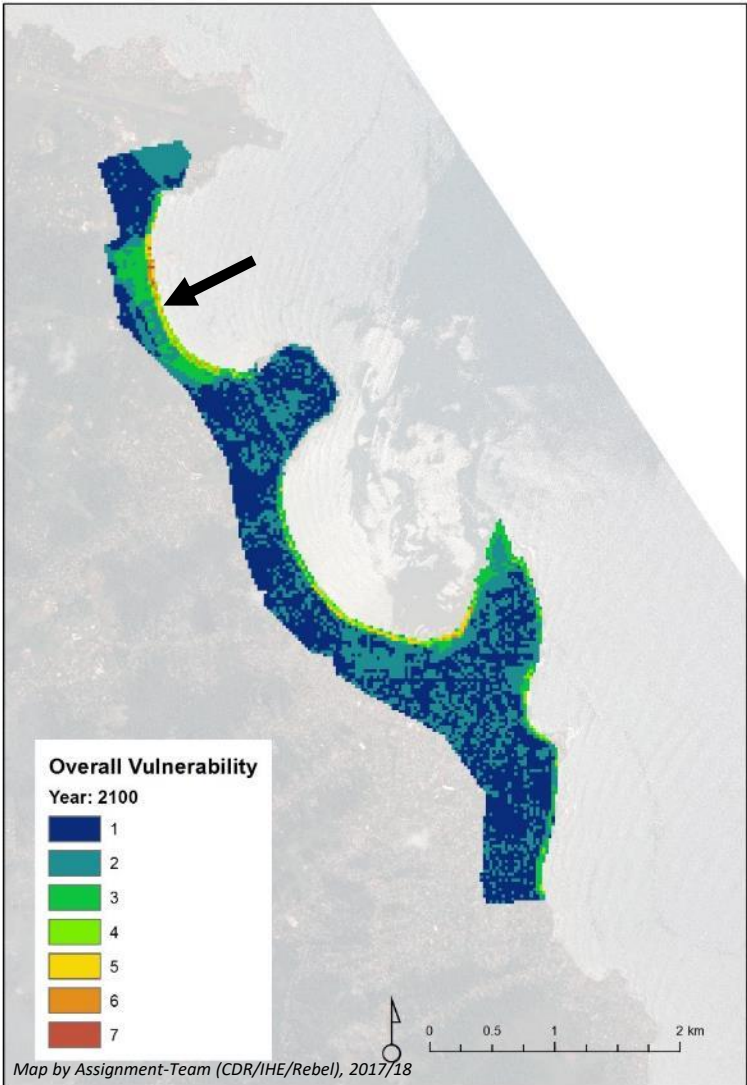


Photo by Assignment-Team (CDR/IHE/Rebel) 2018

03:00 PM

# Challenges – some impressions

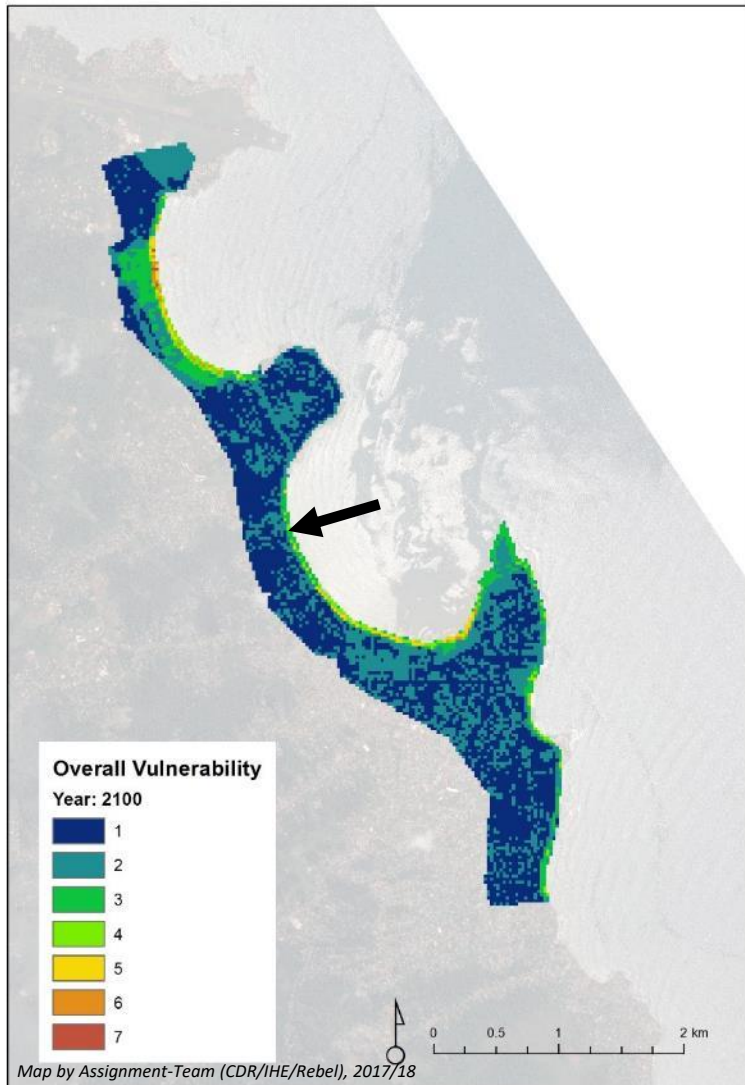


Photo by Assignment-Team (CDR/IHE/Rebel) 2018

# Challenges – some impressions

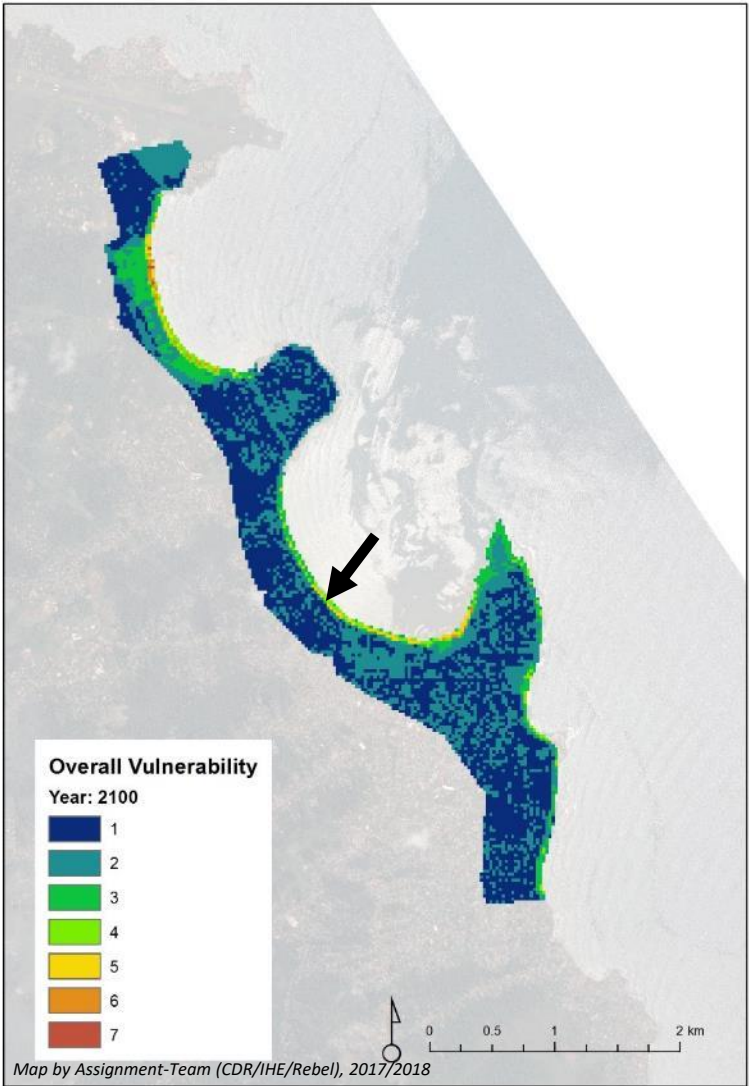


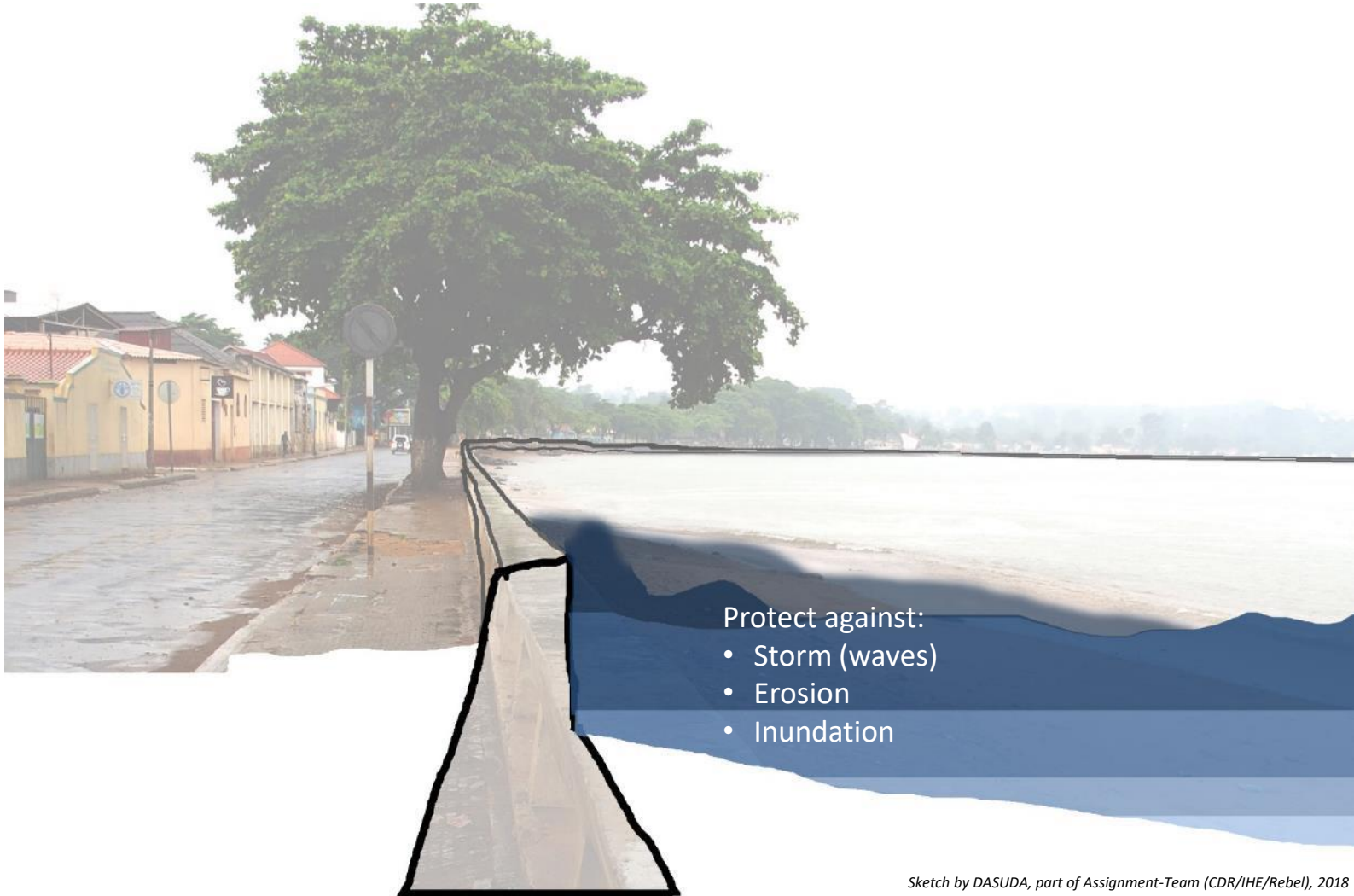
Photo by Assignment-Team (CDR/IHE/Rebel) 2018



# Coastal Protection measures assessed

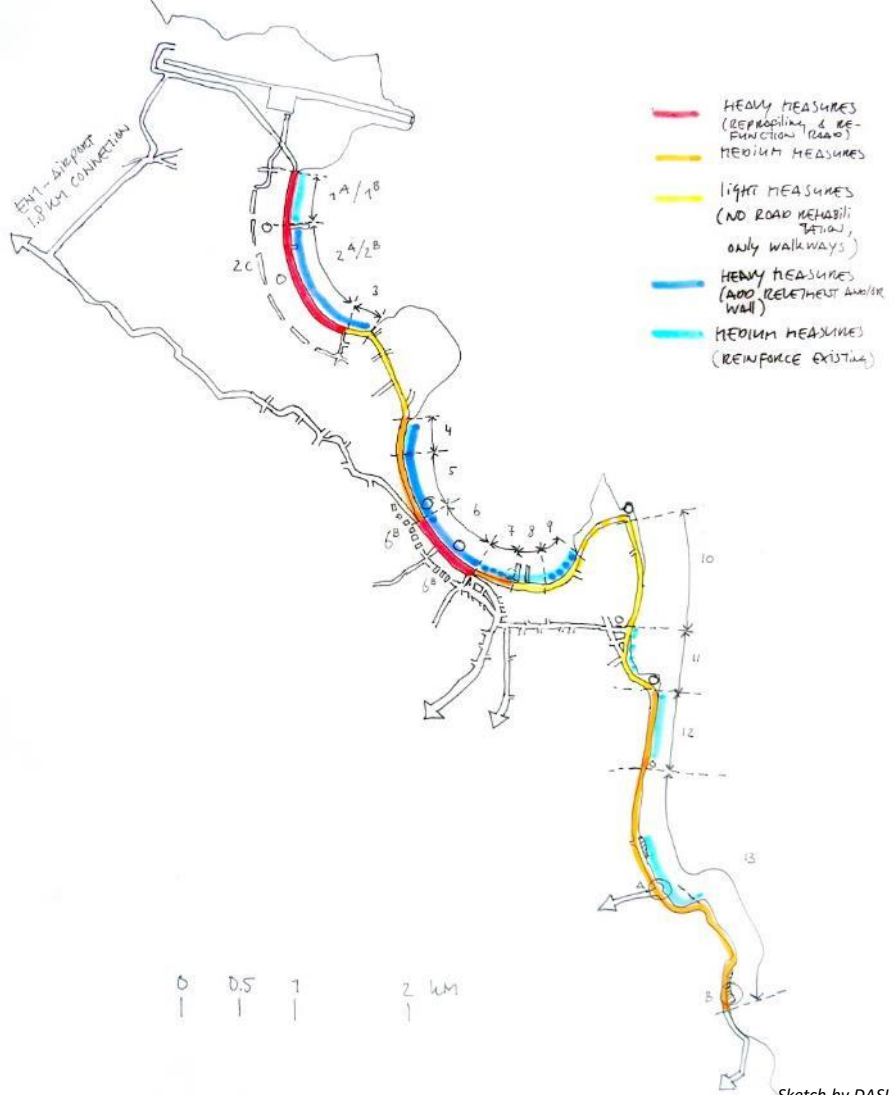
	Panthufo	Ana Chaves	Lagartho
Detached Breakwaters	-- (except "landing site")	--	--
Groynes with beach	--	- (maybe small groynes)	--
Beach Nourishment	--	- / + (wall is needed)	-/+ (in combination)
<b>Rock Revetment</b>	+ (parts)	-- (urban / existing wall)	+ +
Concrete steps	--	--	+
Gabions	--	--	+
<b>Seawall</b>	+ (parts)	++ (rehab)	-
Seawall / rock revetment	+ option	-	+

# Coastal Protection measures proposed



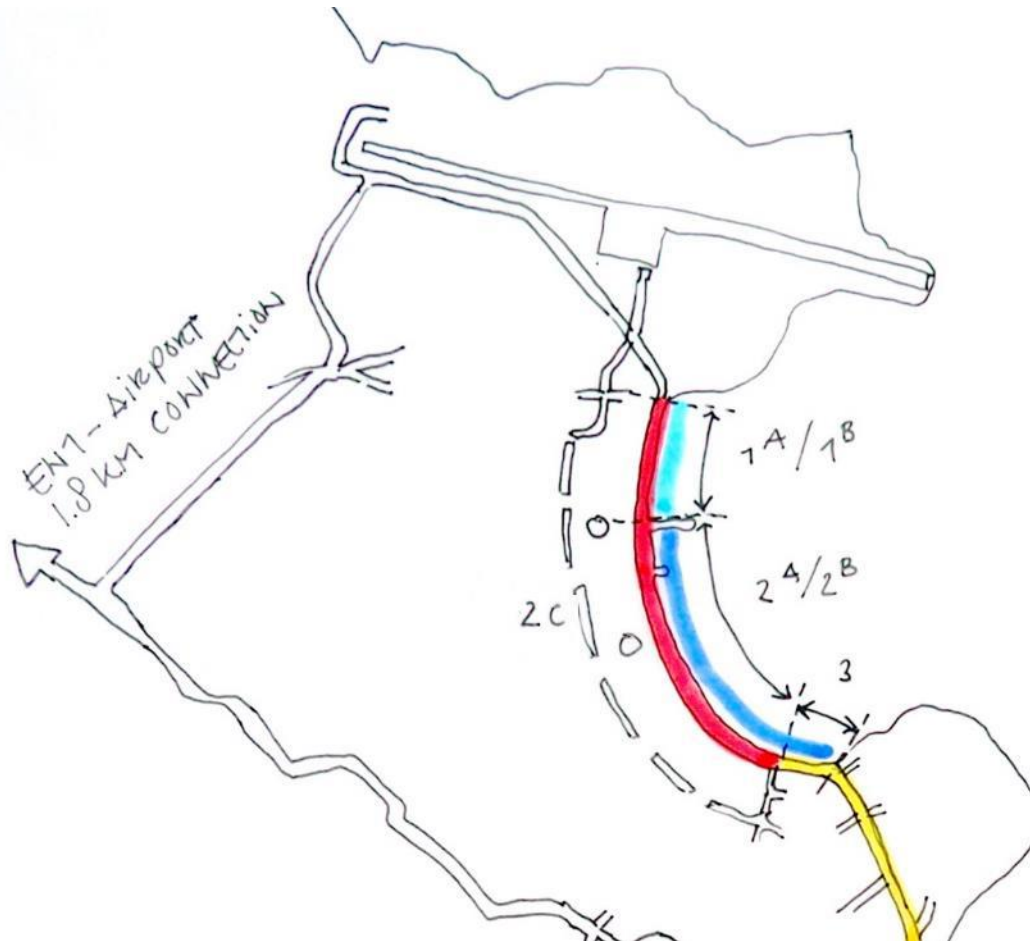
*Sketch by DASUDA, part of Assignment-Team (CDR/IHE/Rebel), 2018*

# Coastal Integrated Approach



Sketch by DASUDA, part of Assignment-Team (CDR/IHE/Rebel), 2018

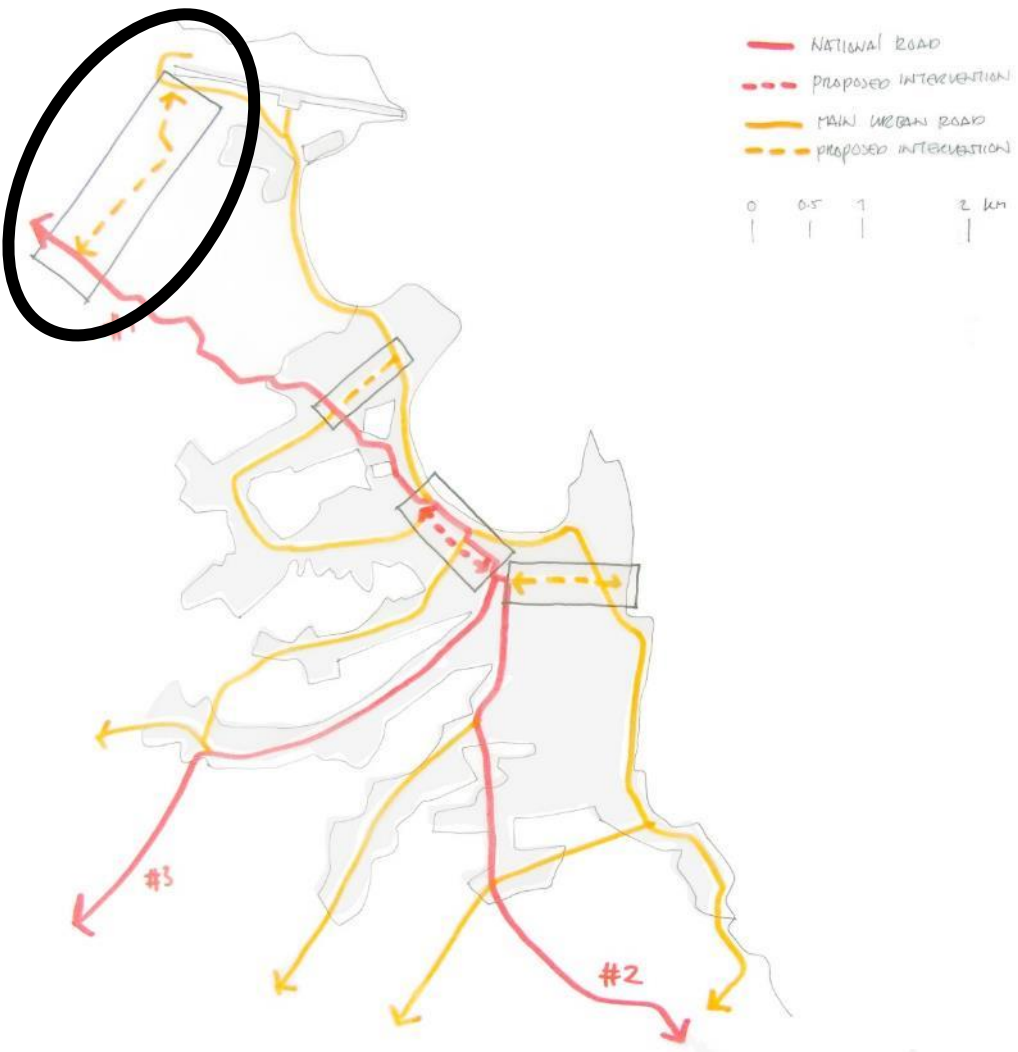
# Coastal Integrated Approach



Lagarto Bay

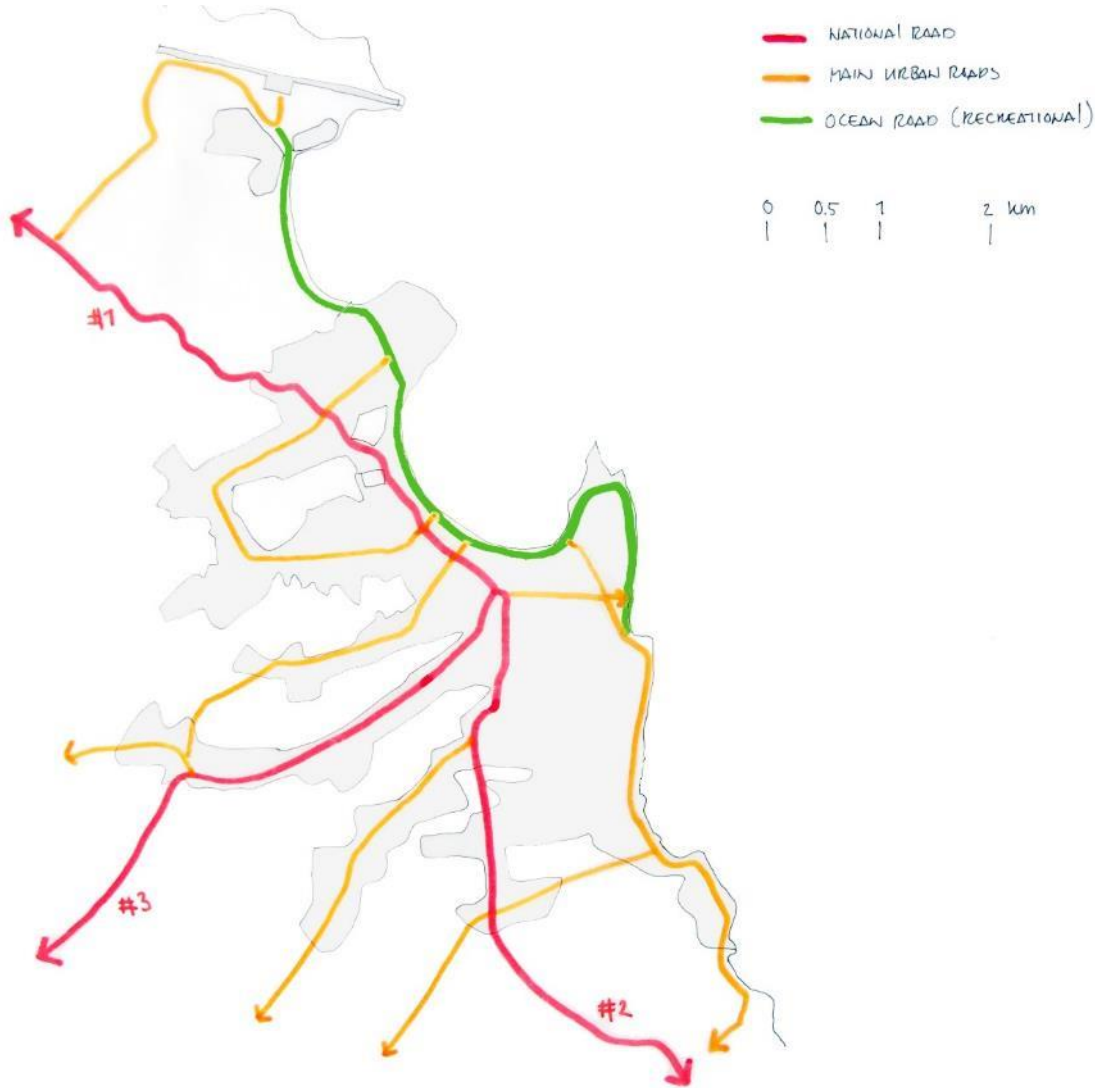
Sketch by DASUDA, part of Assignment-Team (CDR/IHE/Rebel), 2018

# Coastal Integrated Approach



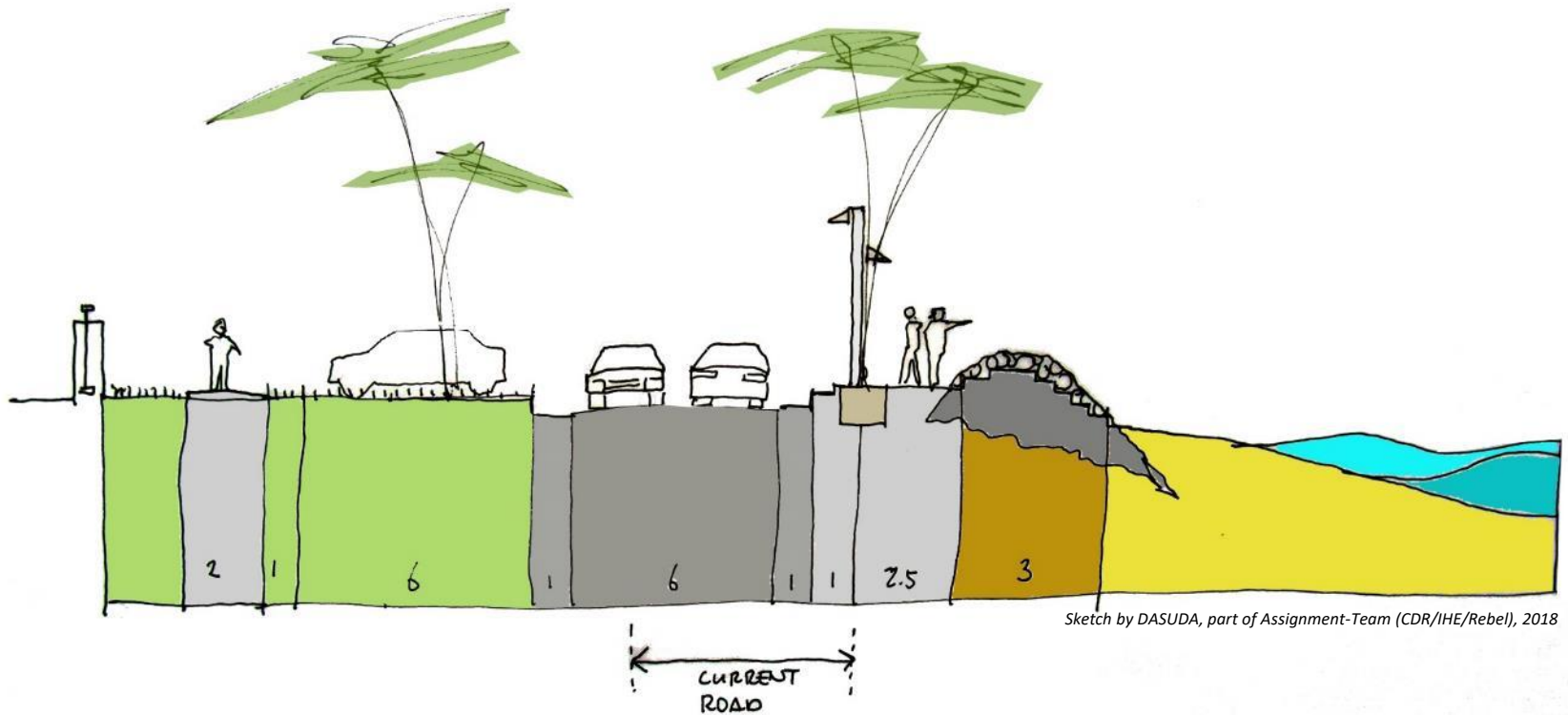
Sketch by DASUDA, part of Assignment-Team (CDR/IHE/Rebel), 2018

# Coastal Integrated Approach

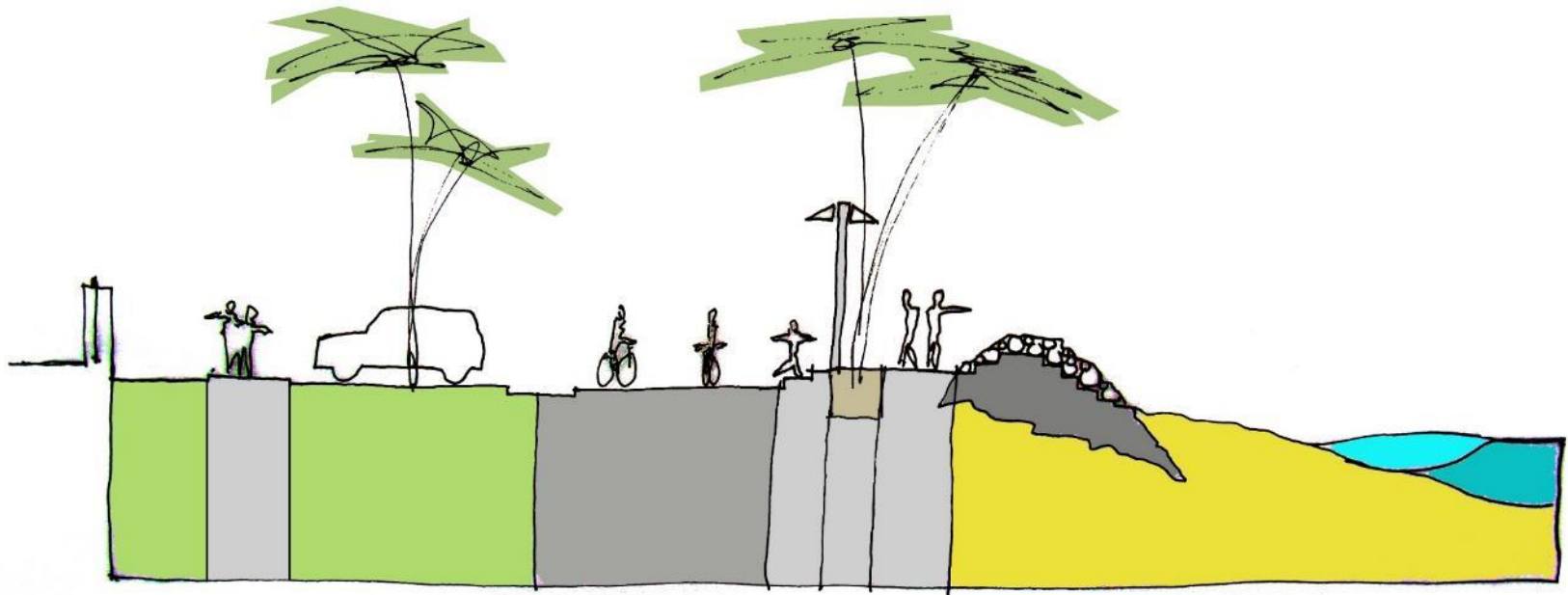


Sketch by DASUDA, part of Assignment-Team (CDR/IHE/Rebel), 2018

# Coastal Integrated Approach



# Coastal Integrated Approach



Sketch by DASUDA, part of Assignment-Team (CDR/IHE/Rebel), 2018



# Coastal Integrated Approach



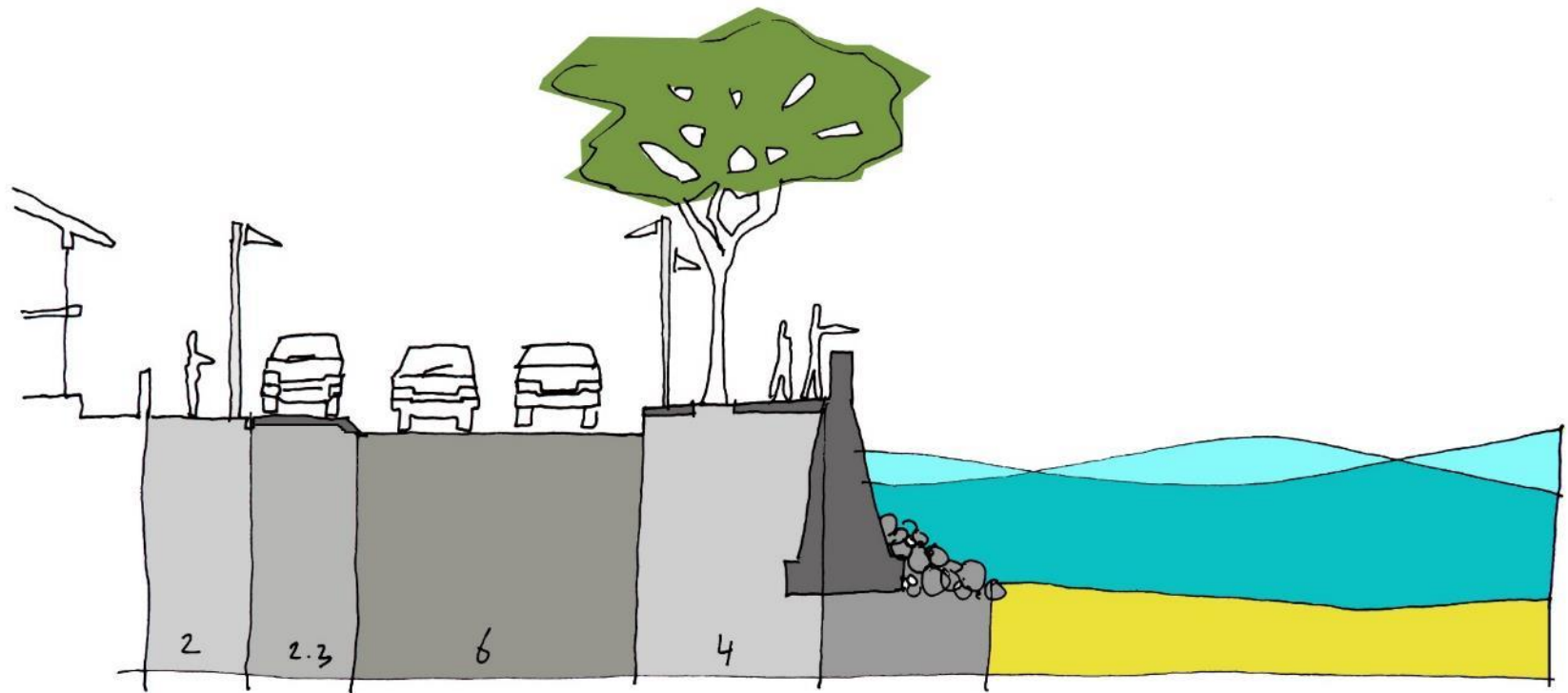
Photo by Assignment-Team (CDR/IHE/Rebel) 2018

# Coastal Integrated Approach



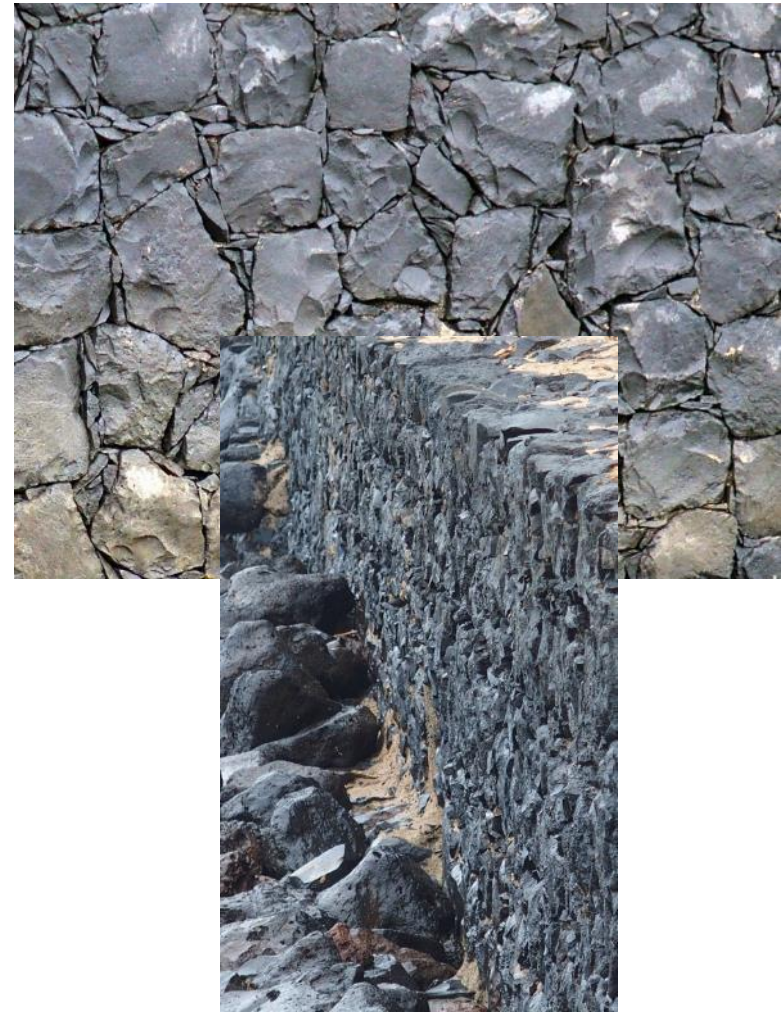
*Photo by Assignment-Team (CDR/IHE/Rebel) 2018*

# Coastal Integrated Approach



Sketch by DASUDA, part of Assignment-Team (CDR/IHE/Rebel), 2018

# Coastal Integrated Approach



*Photos by Assignment-Team (CDR/IHE/Rebel) 2018*

# Coastal Integrated Approach



*Photo by Assignment-Team (CDR/IHE/Rebel) 2018*

# Coastal Integrated Approach



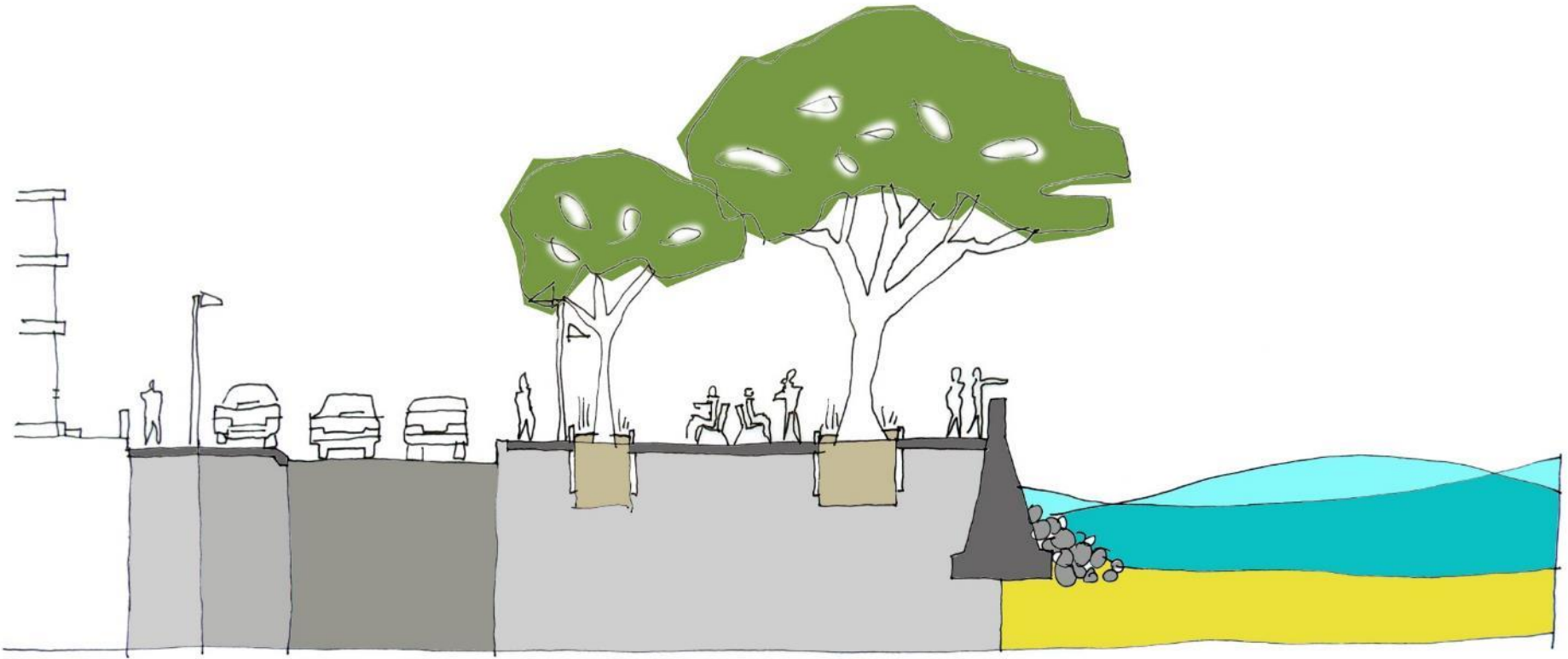
*Photo by Assignment-Team (CDR/IHE/Rebel) 2018*

# Coastal Integrated Approach



*Photo by Assignment-Team (CDR/IHE/Rebel) 2018*

# Coastal Integrated Approach



Sketch by DASUDA, part of Assignment-Team (CDR/IHE/Rebel), 2018



# Costs and Benefits

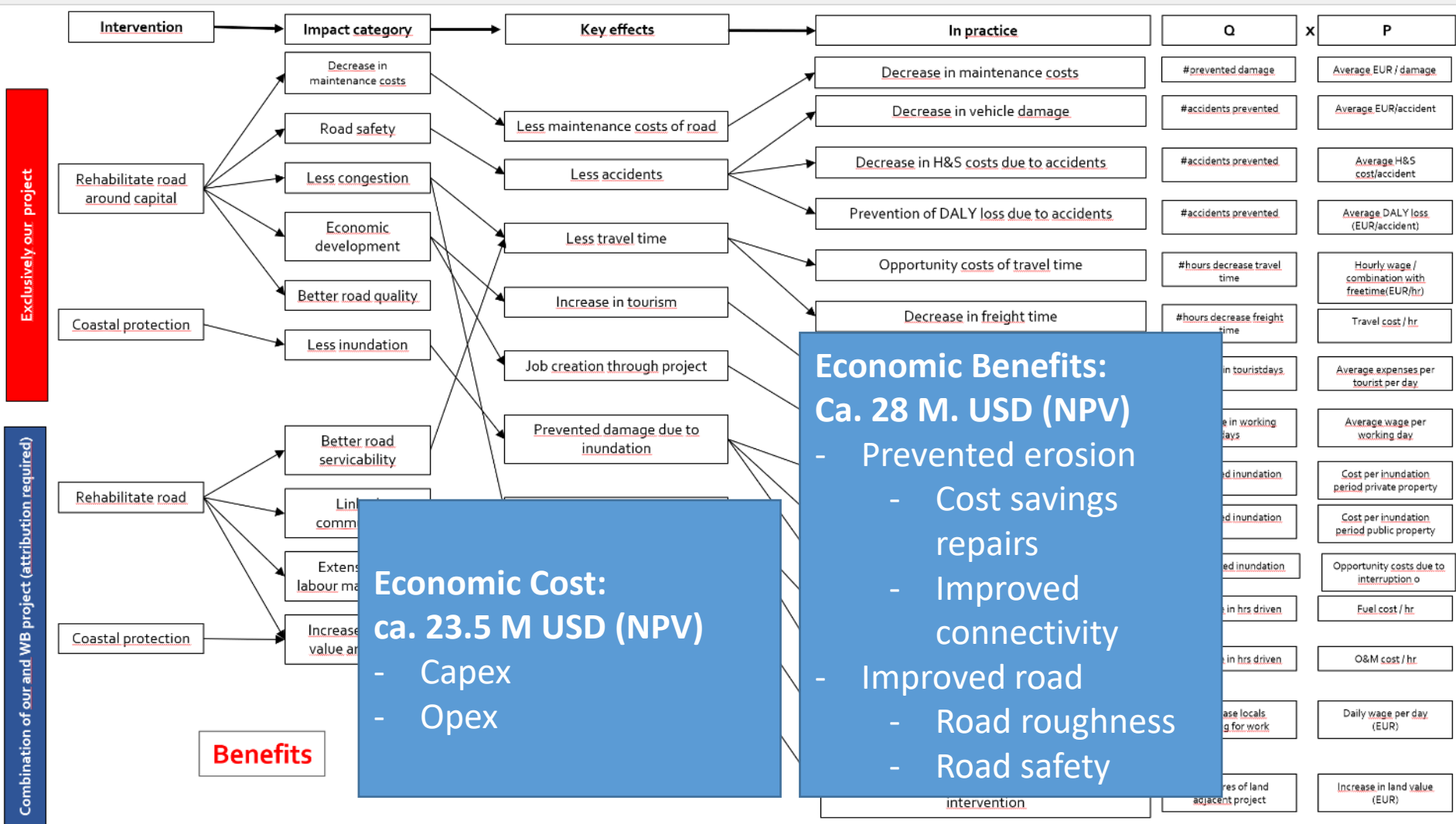


Figure by Rebel, part of Assignment Team CDR/IHE/Rebel, 2018

# Financial structure

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- Combination with an ongoing World Bank project (rehabilitation of national road): 60 Million USD
- Non-revenue project
- Financing/ funding from three sources:
  - *Dutch bilateral Grant*
  - *World Bank Grant*
  - *European Investment Bank Loan*

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Contact:

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Rebel Deutschland GmbH, part of RebelGroup

+49 176 21 42 24 06

Irene.Seemann@RebelGroup.com

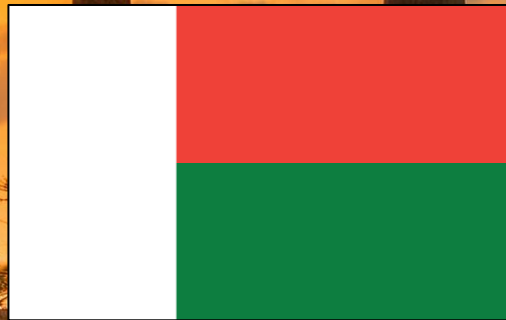
# Climate Resilience on Islands

The case of Antananarivo,  
Madagascar

PhD Anais De Keijser, Climate Adaptation Expert, Sweco  
[anais-marie.dekeijser@swecobelgium.be](mailto:anais-marie.dekeijser@swecobelgium.be)

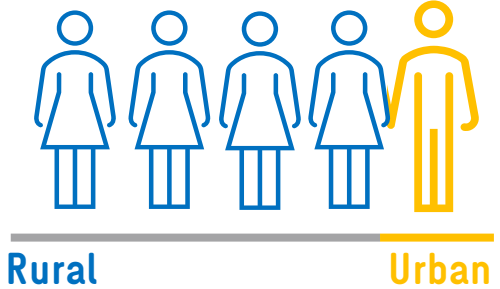
05/07/2023

# Madagascar

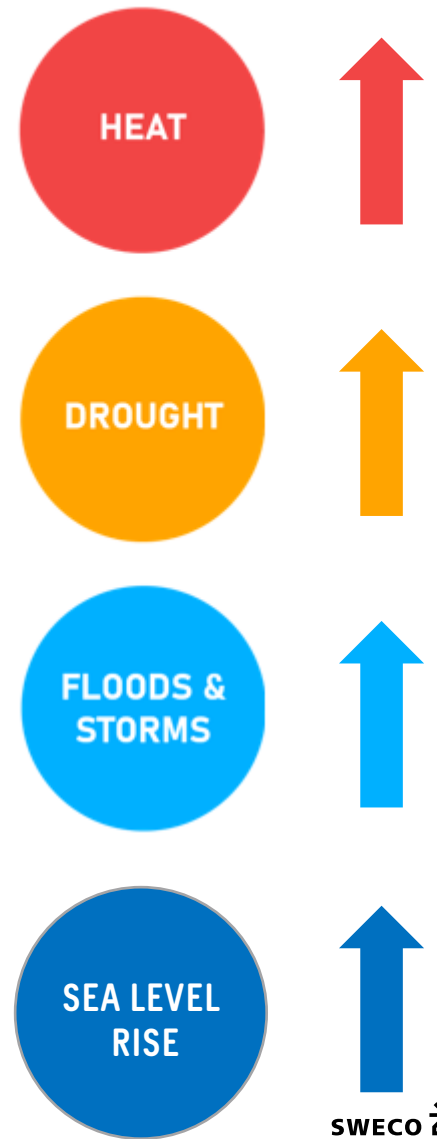




Antananarivo



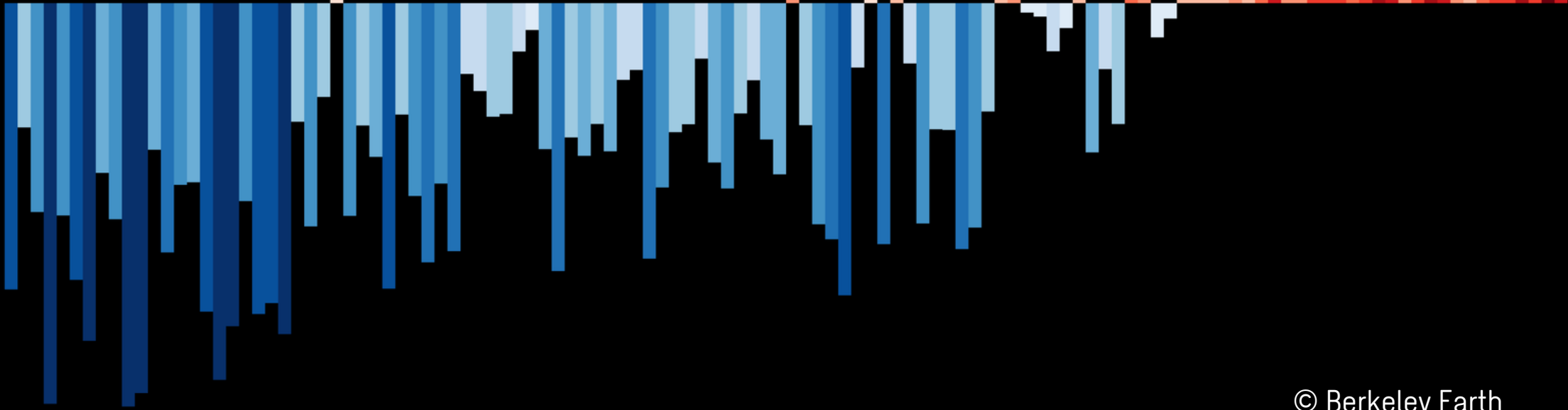
CLIMATE CHANGE



# Temperature change in Madagascar



1901 2020





2050

2100

# Average yearly precipitation

(National Adaptation Plan, 2021)



-13%

-16%



FLOODS &  
STORMS

MADAGASCAR



© Nasa Earth



and regional sea level rise, relative to a 1995-2014 baseline.

[About the data](#)

Data

Scenario (i)

Warming Level

Process

Total Sea Level ⬆️⬇️⬆️

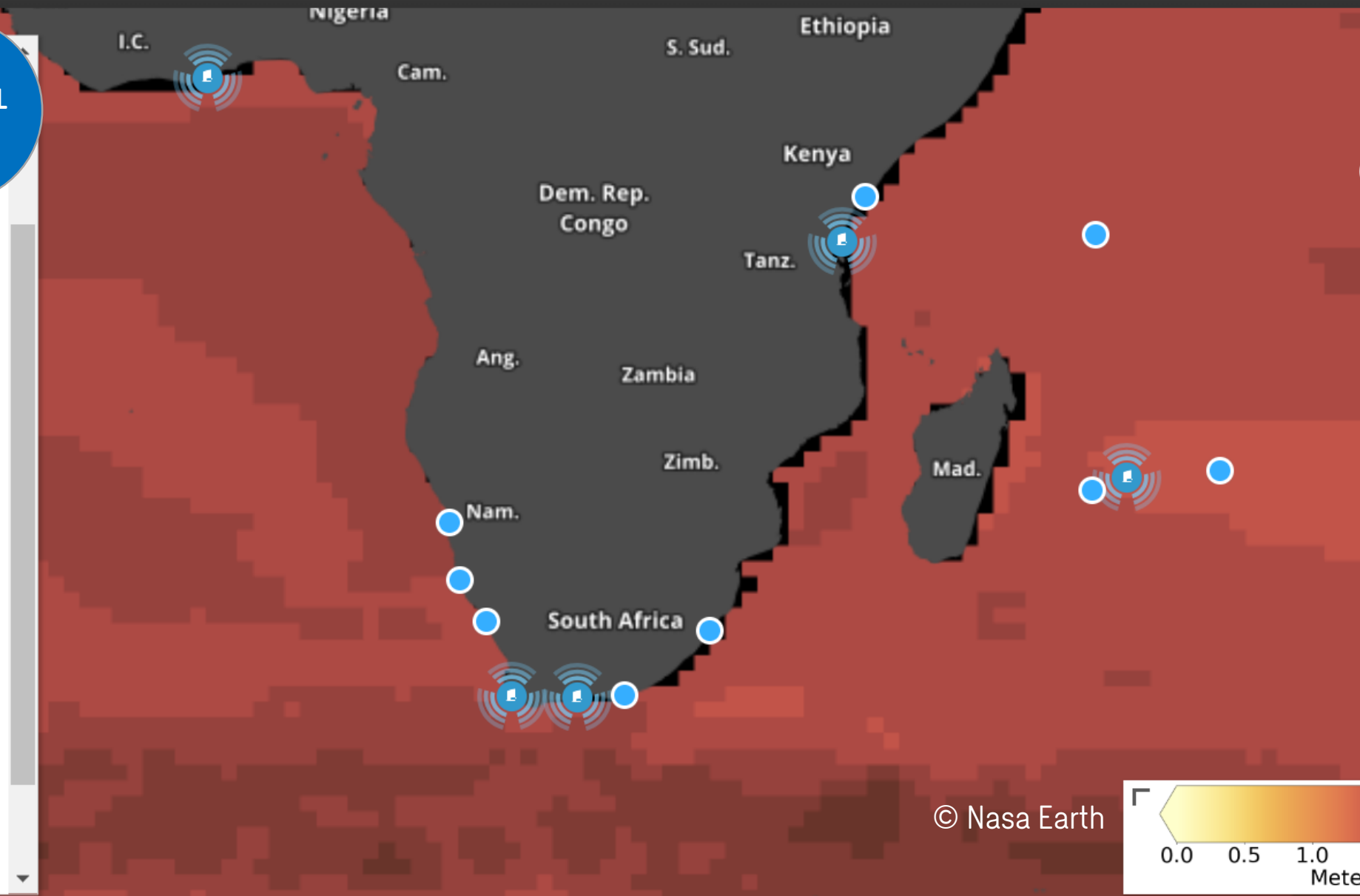
Decades

2100 ⬆️⬇️⬆️

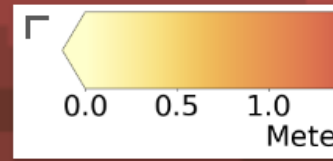
Scenario

SSP5-8.5 (i)

UPDATE MAP



© Nasa Earth



# Antananarivo, Madagascar, sea level rise -135 - 65 m

Press Esc to exit full screen

SEA LEVEL RISE



# Key Climate Risks



Social



Environment



Economic

Displacement and loss of lives

Food insecurity

Damage to buildings and infrastructures

Negative health impact

Climate migration

Floods & Storms

Drought

Floods & Storms

Heat

Floods & Storms

Heat

Floods & Storms

Drought

Floods & Storms



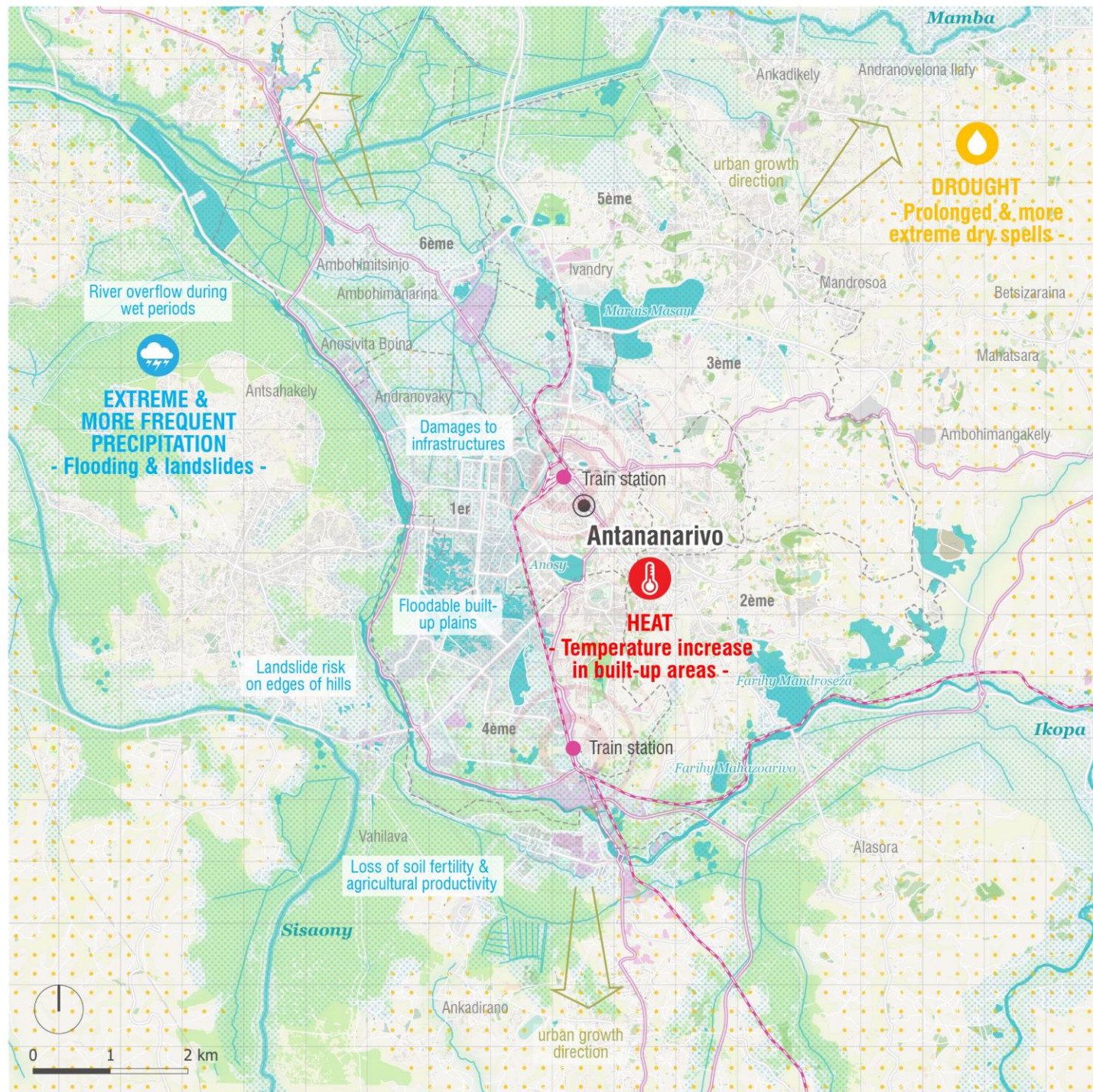
**Antananarivo**

# Antananarivo

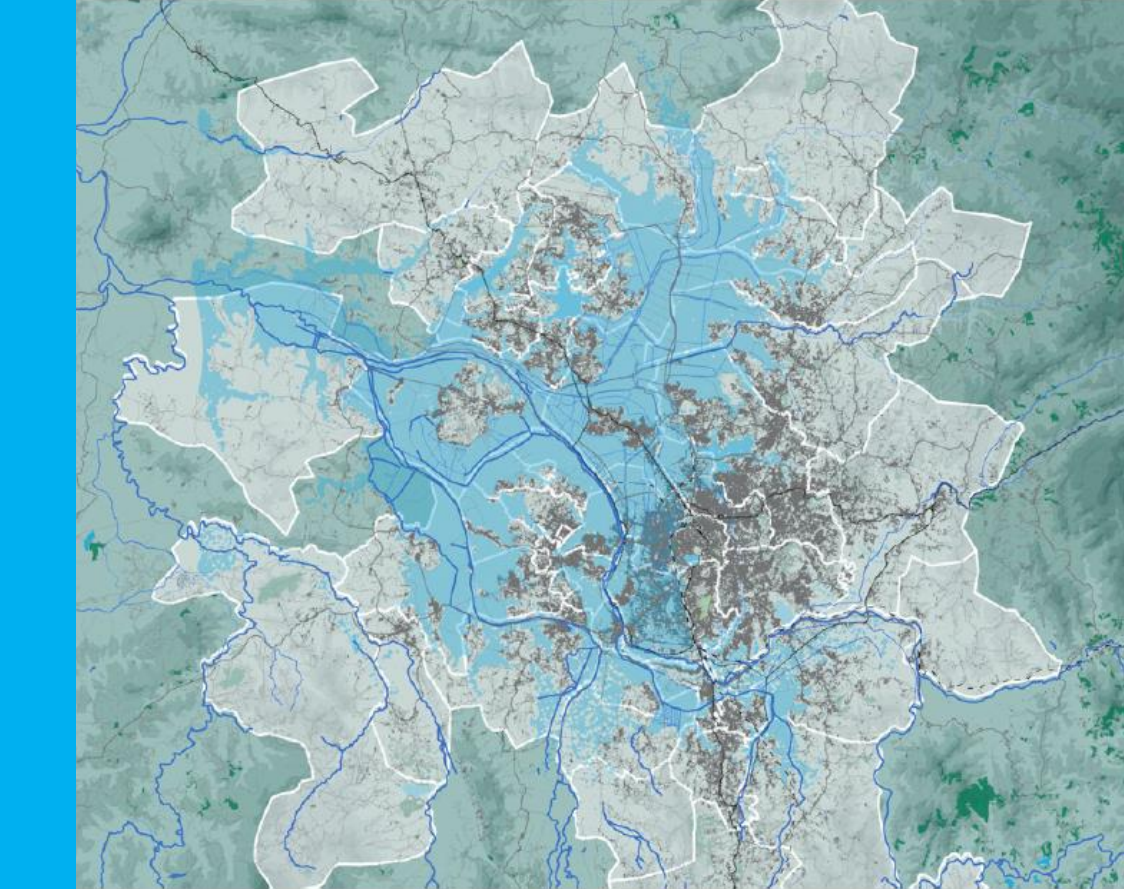
## Spatial Diagnostic

This map shows the climate hazards in the CUA. (Sweco, 2022)

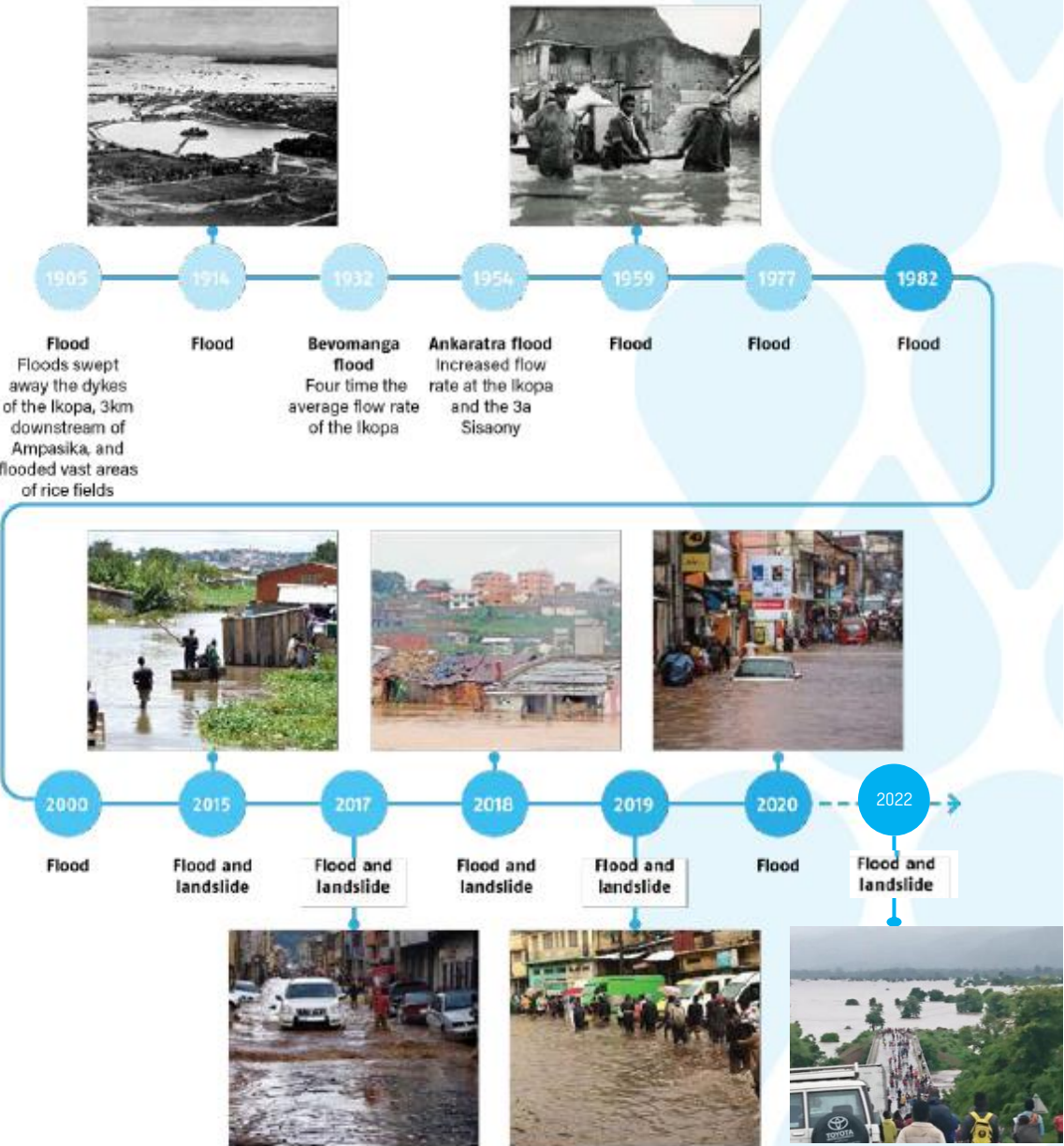
-  Train station
-  Rail line
-  Main road
-  Secondary road
-  Airport
-  City centre
-  Administrative boundary
-  Floodable area
-  Green areas
-  Lake
-  River
-  Informal settlements
-  Built up areas
-  Economic zone
-  Drought
-  Deforestation
-  Urban growth direction



# More frequent and extreme rainfall events



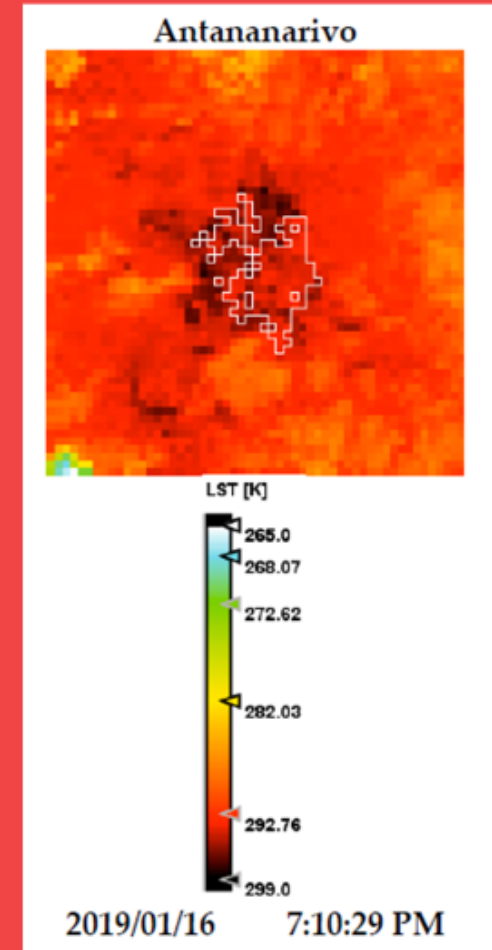
Map of flood risk zones in Antananarivo(City Diagnostic,2021)



Overview of floods over the last century (based on Urban Diagnostic, 2021)

# Urban Heat Island

(Sobrino & Irakolis, 2020 – Surface temperature)





# Antananarivo

Topography as a basis for socio-economic segregation



2022

2040

A polycentric,  
inclusive and  
resilient city



*City's Action Plan 2025-2040  
(Citylinks & MADexpertise)*

# Related Links

- [Curaçao Climate Change Policy Assessment Road Map](#)
- [Transforming Urban Curaçao Community Agenda](#)
- [More on the Antananarivo Rapid Climate Risk Assessment](#)
- [Displacement Solution's Publications Portal](#)
- [Webinar Recording](#)

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<p><a href="https://communities.adaptationportal.gca.org/">https://communities.adaptationportal.gca.org/</a></p>	<p><a href="https://gca.org/gca-events/">https://gca.org/gca-events/</a></p>	<p><a href="https://www.linkedin.com/groups/14262070/">https://www.linkedin.com/groups/14262070/</a></p>	<p><a href="https://gca.us7.list-manage.com/subscribe?u=6dfa0ea942c9f12e85f30d962&amp;id=70f1cb250c">https://gca.us7.list-manage.com/subscribe?u=6dfa0ea942c9f12e85f30d962&amp;id=70f1cb250c</a></p>



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