



GLOBAL
CENTER ON
ADAPTATION

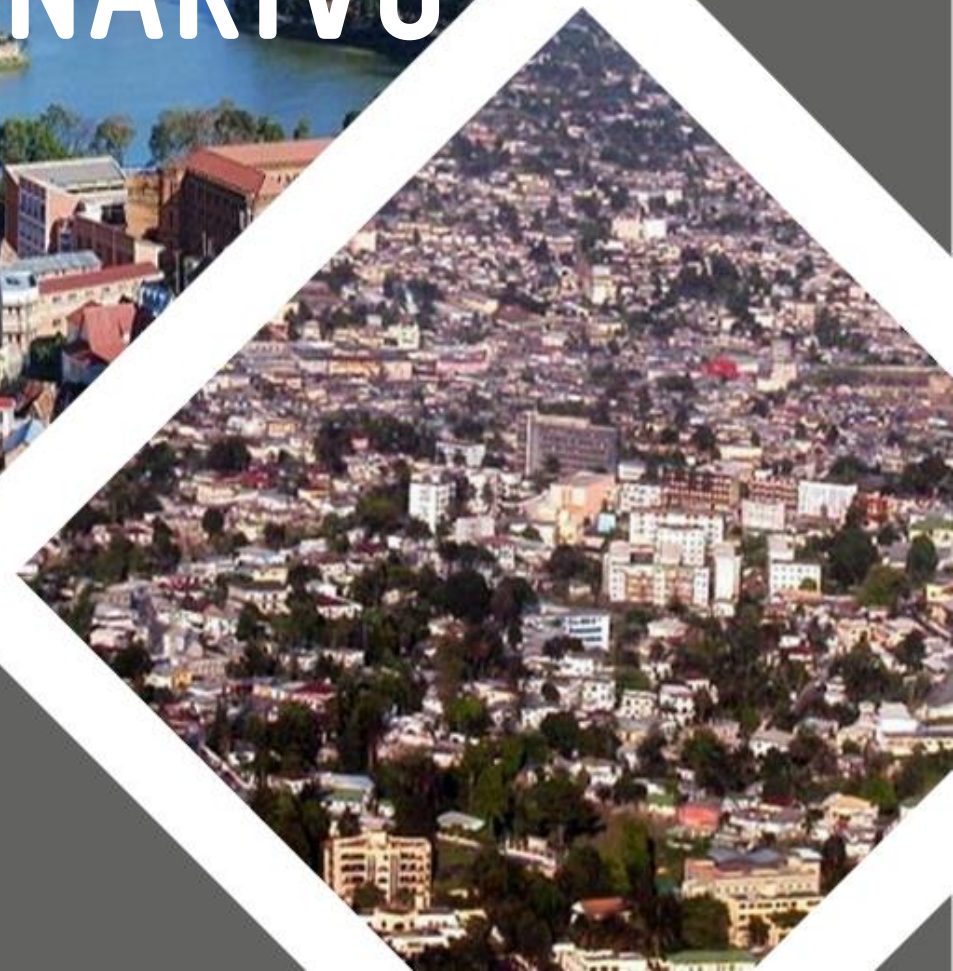
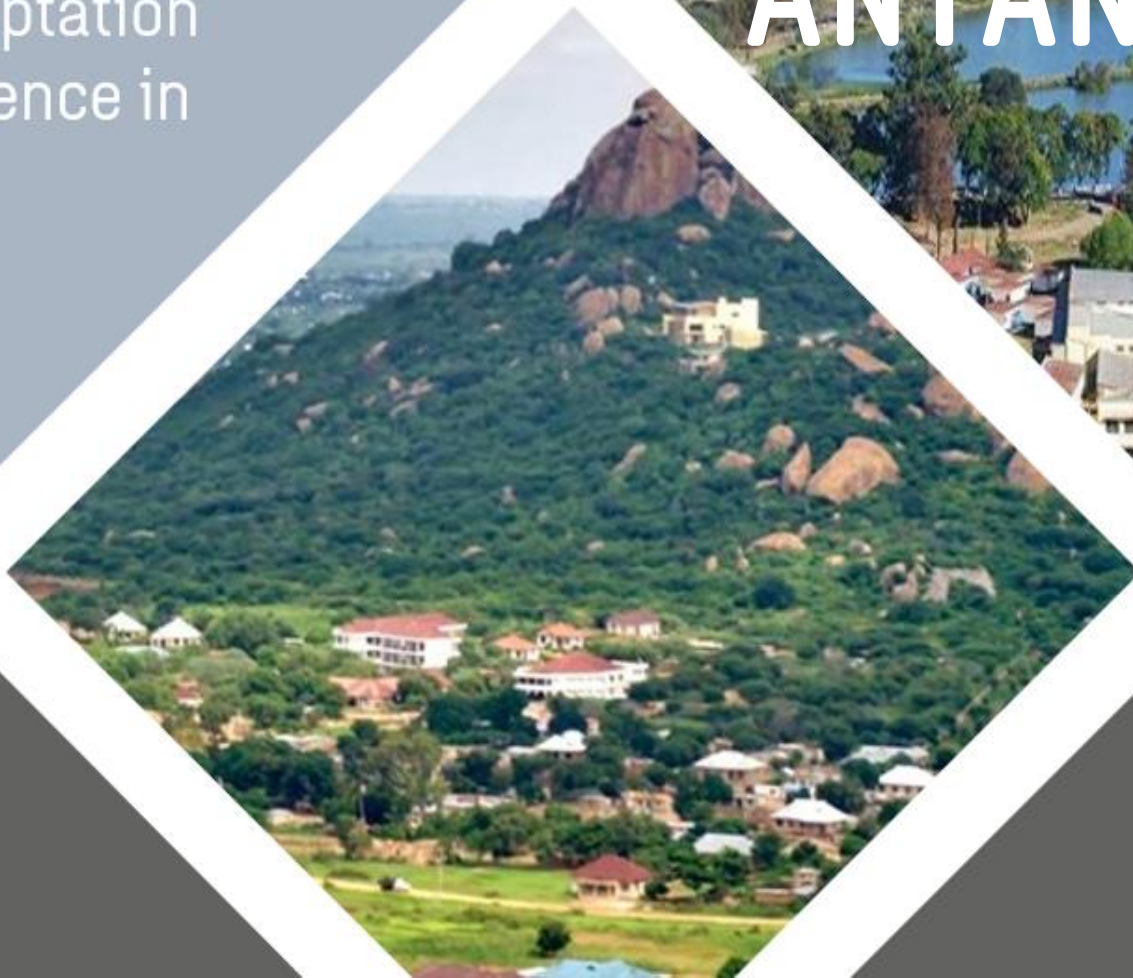


Final Report

Climate Risk Assessment

Urban Adaptation and Resilience in Africa

ANTANANARIVO



Accountability

Titel	Climate Risk Assessment: Urban Adaptation and resilience in Africa
Project Number	51008339
Client	Global Center on Adaptation
Project Management	Enrico Moens
Version	Final
Date final delivery	19th of April 2022
Author	Anaïs De Keijser, Lynn van Wissen van Veen, Jens Aerts, Guy Janssen
Mail adress:	Anais-marie.dekeijser@swecobelgium.be
Approved by	Enrico Moens

Table of contents



Introduction

- a) Madagascar
- b) Antananarivo



Governance structures



Hazard & impact assessment

- a) Relevant climate hazards
- b) Per hazard theme:
 - Relevant non-climatic data
 - Relevant climate hazards over time
 - Impacts per hazard theme and sector
 - Prioritized Impacts
- c) Climate Hazard Maps: Spatial Diagnostics



Risk Assessment

- a) Priority impacts
- b) Risk Matrix



No regret measures

- a) Adaptive capacity
- b) No regret measures



Past & planned investments

- a) Past investments
- b) Planned investments



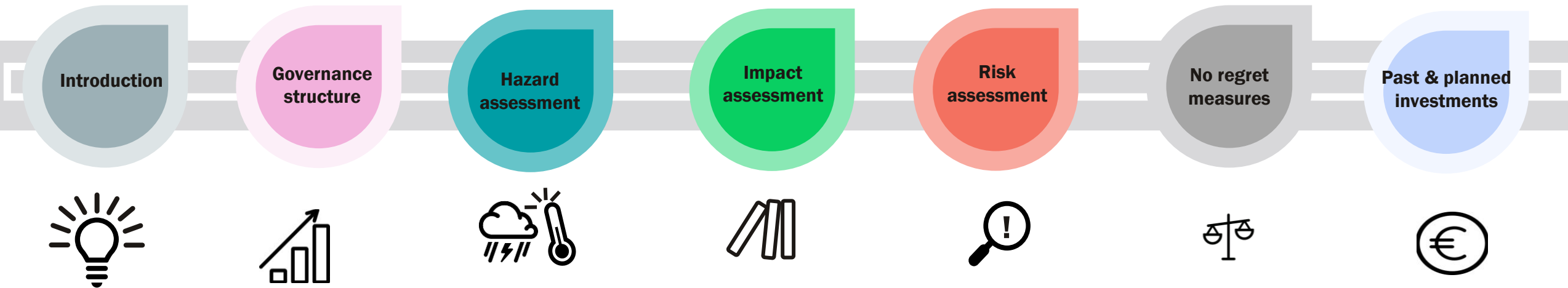
Acknowledgement



Annexes

Steps Climate Risk Assessment

The Climate Risk Assessment consists of the steps showed below. This report presents the results per step. Results are based on an **extensive literature study** and **city stakeholder interviews**.



City Stakeholder Participation

An important aspect of this Climate Risk Assessment is the **co-creation** and **validation** of results with stakeholders from the city of Antananarivo. Their input is crucial for obtaining good results. City stakeholder participation took place on three levels:



Our local Partner. Our local partner was our person on the ground. She identified key stakeholders, made initial contact with them presenting the project and its objectives. She collected local data and reports and kept a record of the hazards being presented in the local media. She took pictures of these events and informed us on the situation with the different storms and cyclones happening during the project.



Our city advisor and key stakeholders: Our city advisor was the Chief of Staff of the Mayors Office. He was our first interviewee, and also validated the preliminary findings. In addition, he informed us about relevant stakeholders,, investments and climate hazards in Antananarivo.

Next to this, we had seven interviews with key stakeholders (see next page 7). In these interviews the goals of the project, data availability, planned, current and past investments, and no regret measures were discussed.



Interview with GLZ. While we originally planned to have a survey filled in by residents in the vulnerable parts of the city, the floods and cyclones that hit Antananarivo in the early months of 2022 made that a large part of the population was displaced. Thus, as most people were facing urgent issues it was decided to not held the survey.

As we believe that it is important to get insights into experiences from the people living in Antananarivo, we decided to have an interview with the GLZ, who has experience working with local stakeholders.

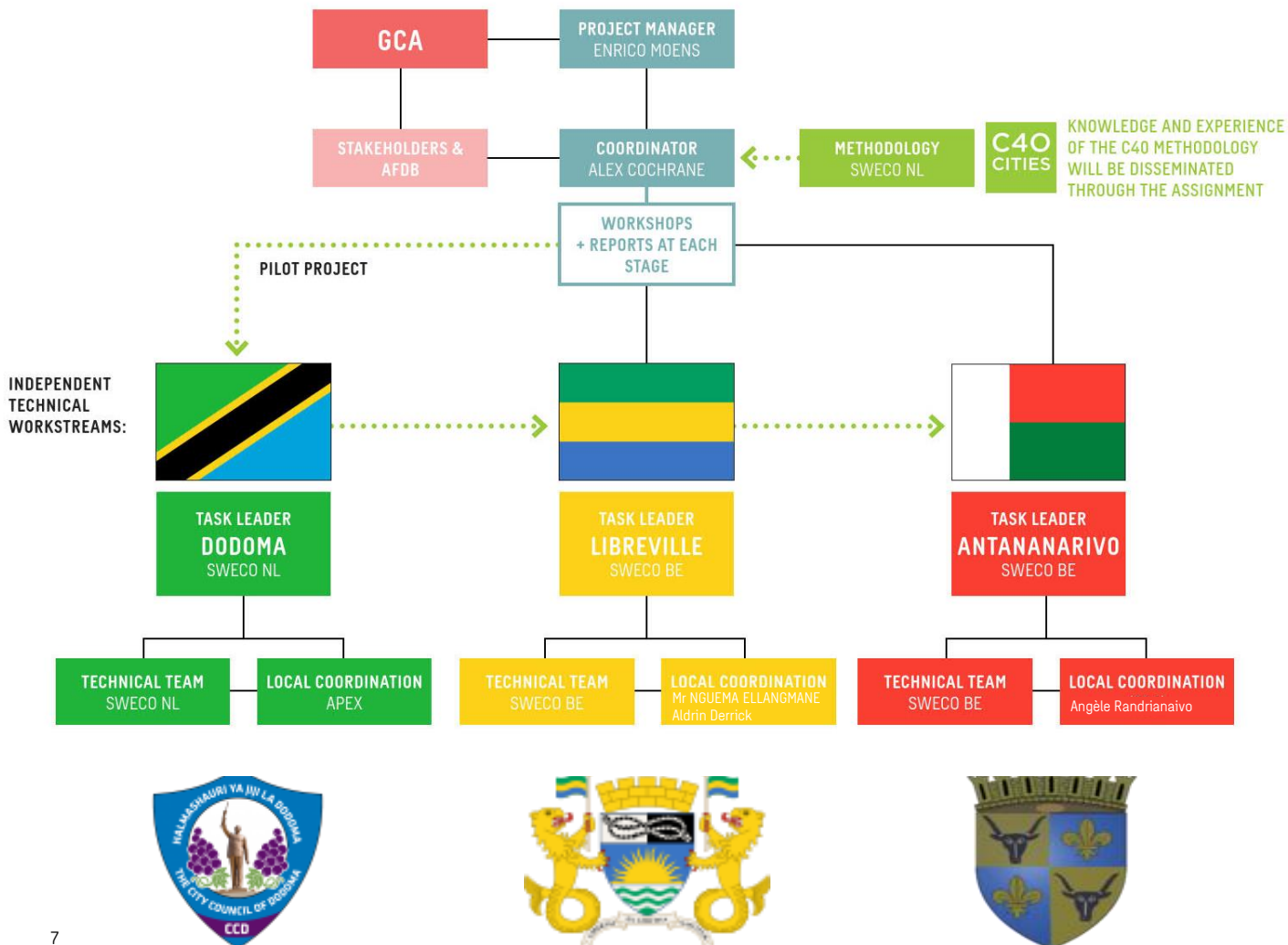
City Stakeholder Participation

In the schedule below interviewed stakeholders are displayed. Stakeholders were interviewed related to their knowledge on climate hazards in the city of Antananarivo, climate governance, past – current- planned investments and no regret measures.

Name	Function	Organisation
City advisor		
Guy Razafindralambo	Chief of Staff of the Mayor's Office	City of Antananarivo
Key stakeholders		
Marcellin Lalason	Head of department for climate adaptation	Ministry of Environment and Sustainable Development (MEDD)
Heritoky Lalaina	Head of department for follow-up and evaluation	
Rakotomanana Gérard Olivier	Project coordinator	Ministry of Land Use Planning and Land Services (MATSF)
Rabenirina Danielle	Head of the Rural Development/Environment Unit Project Manager - Environment Sector	AFD
Tantely Andriambololona	Technical Advisor	GIZ
Rakotofingina Sabrina	Technical Advisor	

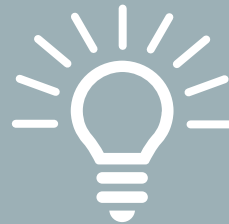
Name	Project	Organisation
Key Stakeholders		
Esther Bergstra	PRODUIR	Bosch Slabbers
Olivier Caux	City Diagnostic & City's Vision 2040	MADEXPERTISE

Approach and Team



Organisation	Name	Role
General Coordination	Enrico Moens	Project Manager
	Anna Älgevik	Contract Manager
	Alexander Cochrane	General Coordinator and liaison to the AfDB city diagnostic teams
	Jens Aerts	Quality Assurance
Dodoma	Jeroen van Eekelen	Country Project Leader and Climate Adaptation Expert
	Richard Mushi	Local Consultant
	Severine Alfred	Local Consultant
	Floor Mossink	Climate Adaptation Expert
	Don Ottenheim	Intern
Libreville	Séverine Hermand	Country Project Leader and Climate Adaptation Expert
	Aldrin Derrick Nguema Ellangmane	Local Consultant
	Ghulam Sakhi Saba	Intern
Antananarivo	Anaïs De Keijser	Country Project Leader and Climate Adaptation Expert
	Angèle Randrianaivo	Local Consultant
	Lynn van Wissen van Veen	Intern
Supporting Pool of Experts	Lazare Nzeyimana	Climate Resilience and Drought Expert
	Jart Ligterink	Expert data and GIS
	Jelmer van de Ridder	Senior Climate Adaptation Expert
	Kevin Penalva Halpin	Senior Expert Strategic Urban and Regional Planning

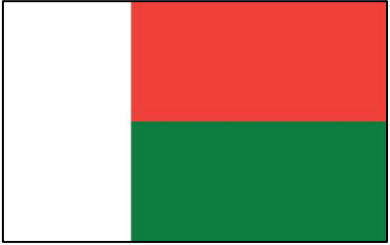
Introduction



Madagascar



Madagascar in 2020



Population: 28 million

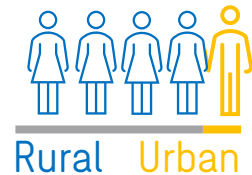
Provinces: 6
Regions: 22
Districts: 116
Communes: 1 548
Fokontany: 16 969

Capital: Antananarivo

Urban Population

3.7 million people live in Antananarivo, which is about **13% of the Malagasy population** (City Diagnostic, 2021)

Urban proportion of total population:



Antananarivo



Madagascar

Population

Population



2020

28

(million people)

2050 projection

54

GDP



2020

13,0

(billion USD)

2023 projection

15,3

© Macrotrends

© PROUIR

Madagascar

Main Challenges

1. **4th** poorest country in the world
(World Population Review, 2020)
2. **48%** of the country's population is considered vulnerable to food insecurity and malnutrition
(UNICEF, 2020)
3. **75%** of the population lives below the poverty line of **1,9\$/day**
(World Bank, 2019 – as cited in PNA, 2021)



Antananarivo

Antananarivo

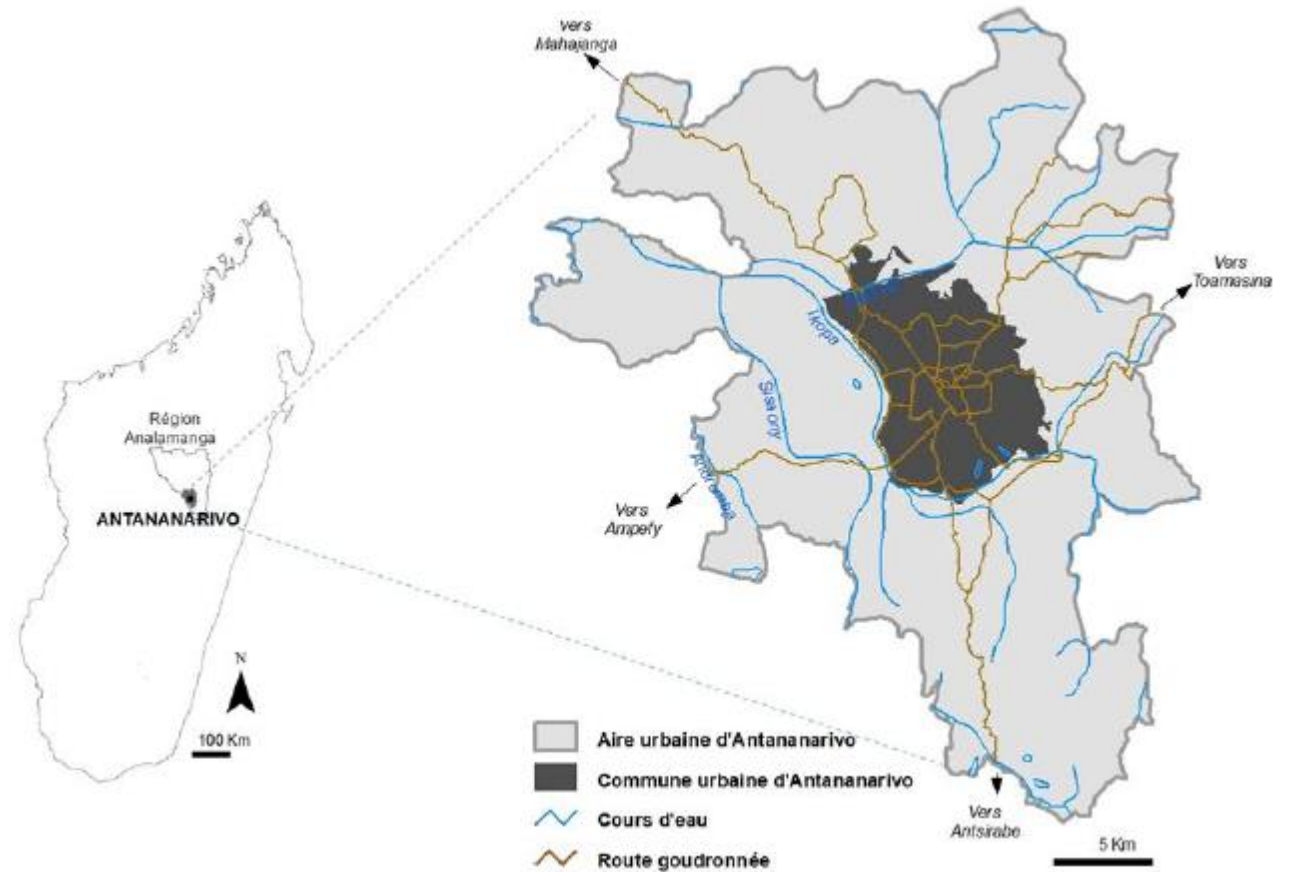


Administrative Area of the city “Grand Tana”

- Known as Antananarivo-Renivohitra
- Located in the regions of Analamanga and Itasy
- Subdivided into 571 Fokontany
- Consists of the Urban Municipality of Antananarivo & 38 associated municipalities
- Population: 3 700 000

Urban Municipality of Antananarivo (CUA)

- Area: 770 km²
- Population: 1 300 000
- Consisting of 6 Municipal Boroughs
- Altitude: 1280 m
- Founded in 1610



Antananarivo

GDP 01/2020 12/2020
 **\$14.1 \$13.01**
billion -7.4% billion



© Tradingeconomics
POP 2020 2030
 **3.0 4.0**
million million



 **2020**
70,7%
Living in poverty



Antananarivo

Local context

a “water city”

a “city of hope”

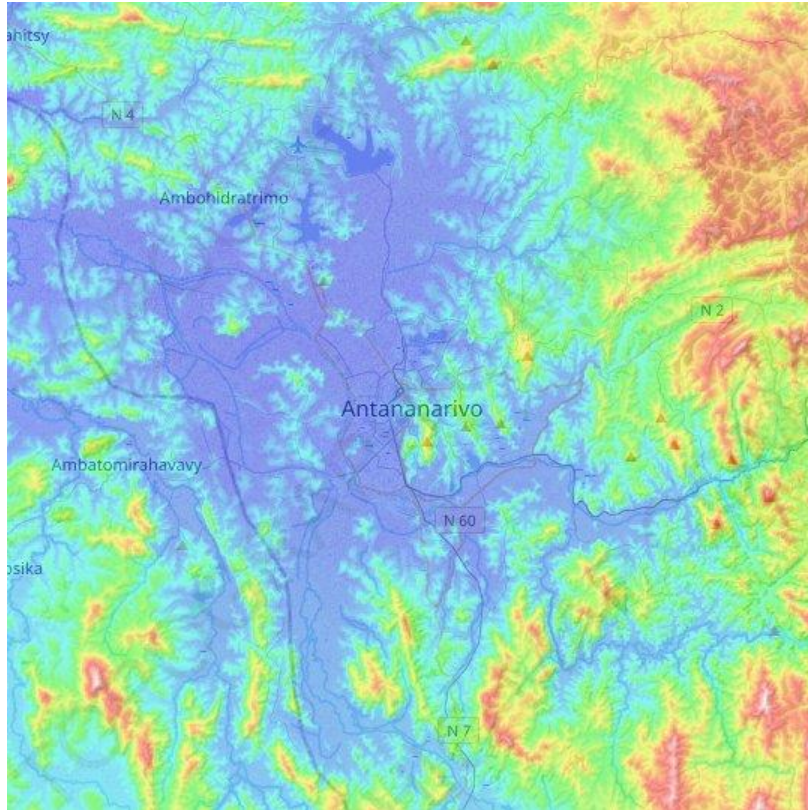
an “informal city”

an “old city”

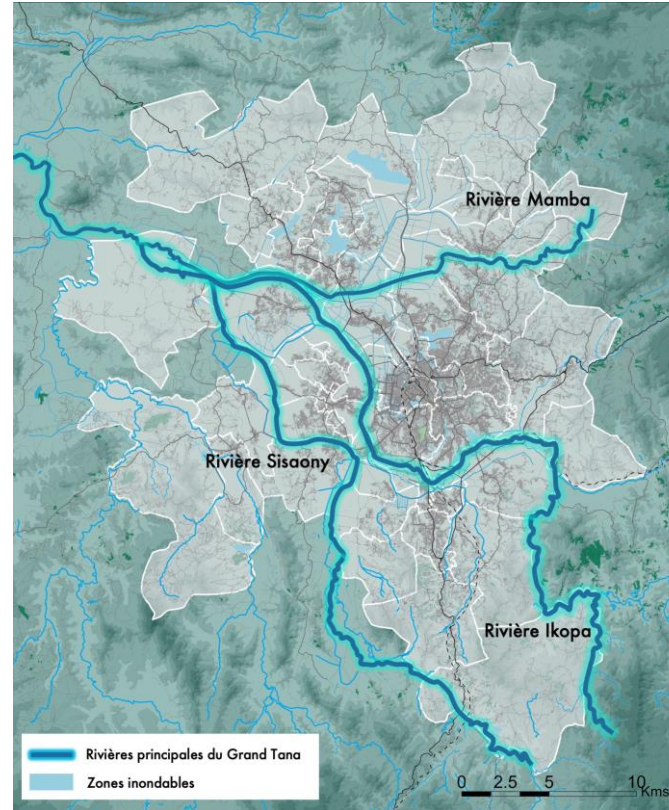


Antananarivo

Geography



Elevation map of Antananarivo ([Topographic map](#))



Map of rivers in Antananarivo
© Urban Diagnostic Report, 2021

- The city is located in **a swampy large plain**: the Betsimitatatra.
- It is crossed by the **three main rivers**: the Mamba, the Sisaony and the Andromba.
- It is bordered with **hills from the south and east** (three ridges that intersect).

Antananarivo

Historical Context

- Since pre-colonial times the higher casts have lived at higher elevations and the **lower classes**, including those descended from the slave class (andevo) and rural migrants, **have occupied the flood-prone lower lying districts.**
- During the XVII century, **a series of dikes, canals and reservoirs were built.**
- This was done to:
 - Protect the low-lying lands from the water
 - Have reservoirs that keep water for irrigation of the rice fields during the dry season
 - Ensure the supply of water and to transport the harvest.
- Local laws stated that **water was a common good**, that should circulate freely and not be diverted from its natural course.



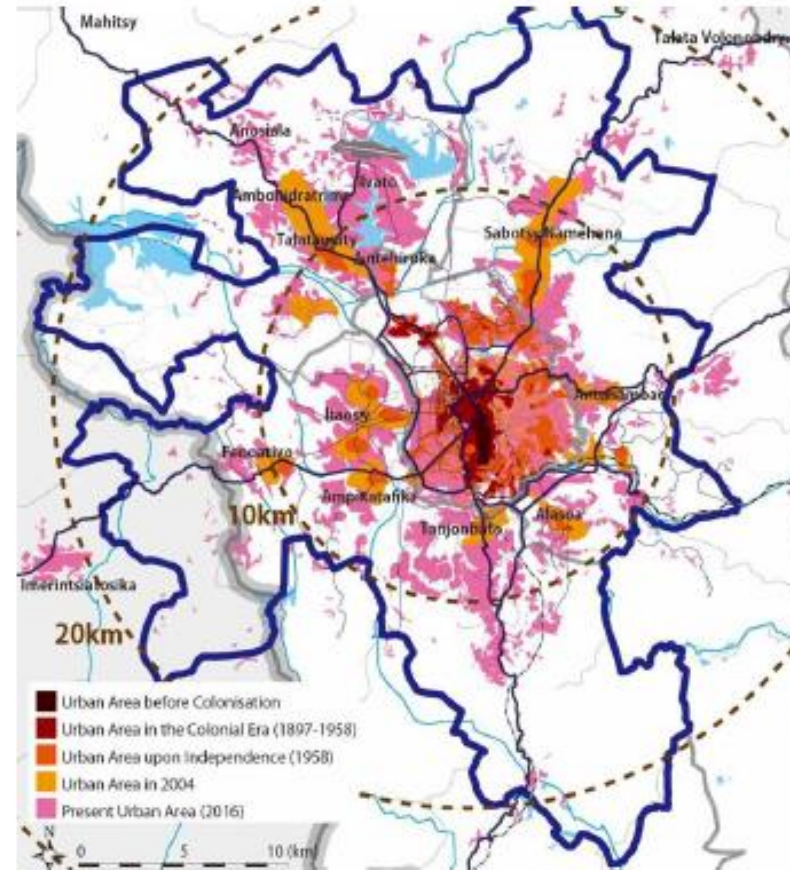
© PRODUIR

Images of Antananarivo now and in the past
© Bosch Slabbers for PRODUIR, 2021

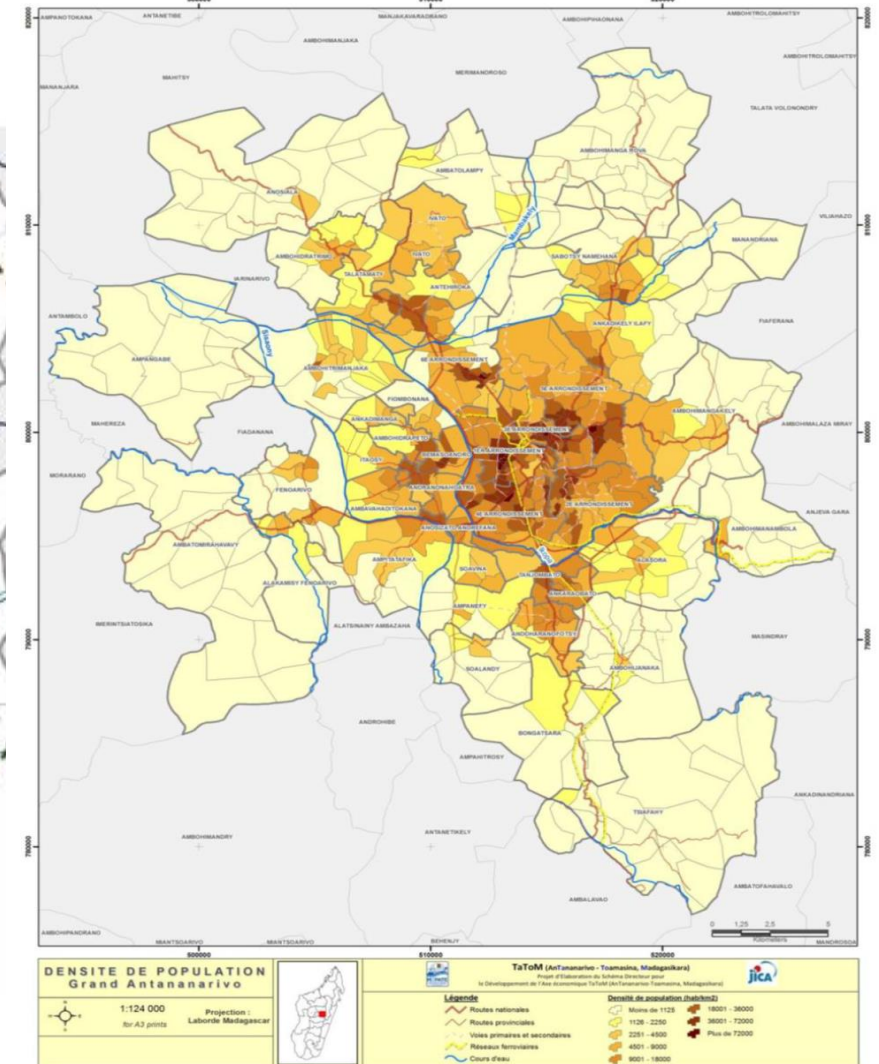
Antananarivo

Urban Expansion and population density

- Before colonisation, the urban expansion extended from the royal palace at **the top of the hill downwards**.
- The **city then expanded to nearby hilltops** – so called island cities “Anosipatrana” from their tops down.
- Once the hills were saturated **the city expanded to the plains as well as into satellite towns outside the CUA**.



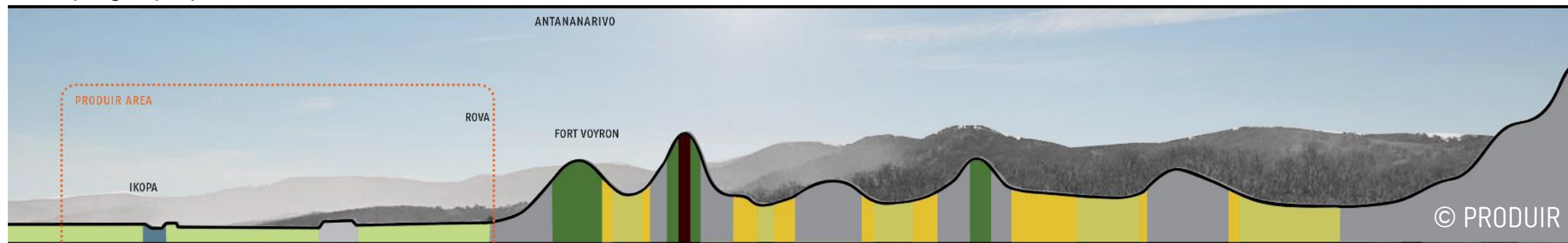
Historical expansion phases of Antananarivo (Tatom, 2018)



Map of population density per Fokontany in the Great Tana (Tatom, 2018)

Antananarivo

Topography of Antananarivo

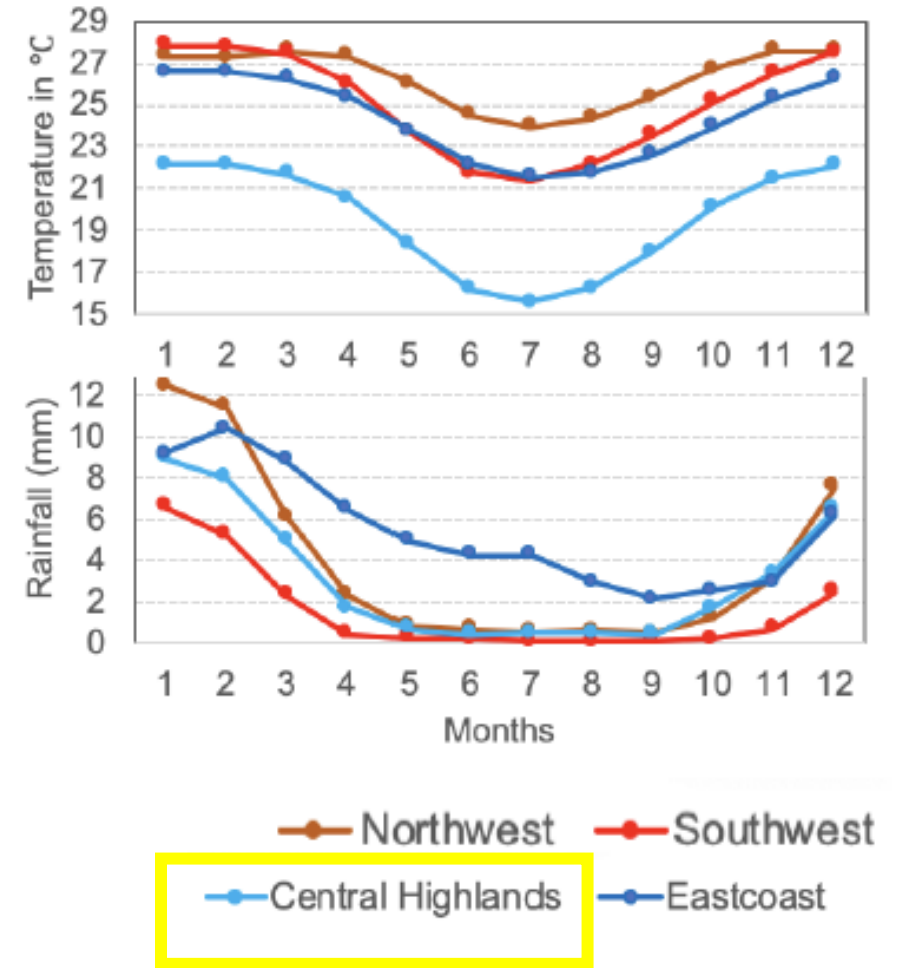


Plain and river	The island cities (Anosipatrana)	Informal city	The forest hills	The urbanized valleys	The valleys	Colonial city	The Urbanised hills
<ul style="list-style-type: none"> Rice fields Informal settlement Elevated occupied island River is hardly visible Waterbodies are used for retention No clear boundary between city and nature 	<ul style="list-style-type: none"> Old elevations in the city All urbanised 	<ul style="list-style-type: none"> City grows organically, mainly along main roads Focusses on road not the landscape 	<ul style="list-style-type: none"> Wood is used for lodging Only exists in protected areas 	<ul style="list-style-type: none"> No panoramic views In the shadow of the city In the proximity of green 	<ul style="list-style-type: none"> Small areas between the hills Lungs of the city Rice fields 	<ul style="list-style-type: none"> High old buildings Lanes with trees Lot of traffic Easy to find your way due to squared road system Heigh cliffs, stairs 	<ul style="list-style-type: none"> Used to be planted Very densely build Green only in isolated mostly private spaces

Antananarivo

Climate

- Antananarivo is part of the **central highlands**
- It has a **sub-tropical climate** with mild, dry winters and warm, rainy summers.
- The **annual average of rainfall** was **about 1500 mm** (1985-2017) and most precipitation falls in between November and April (PNA,2021_).



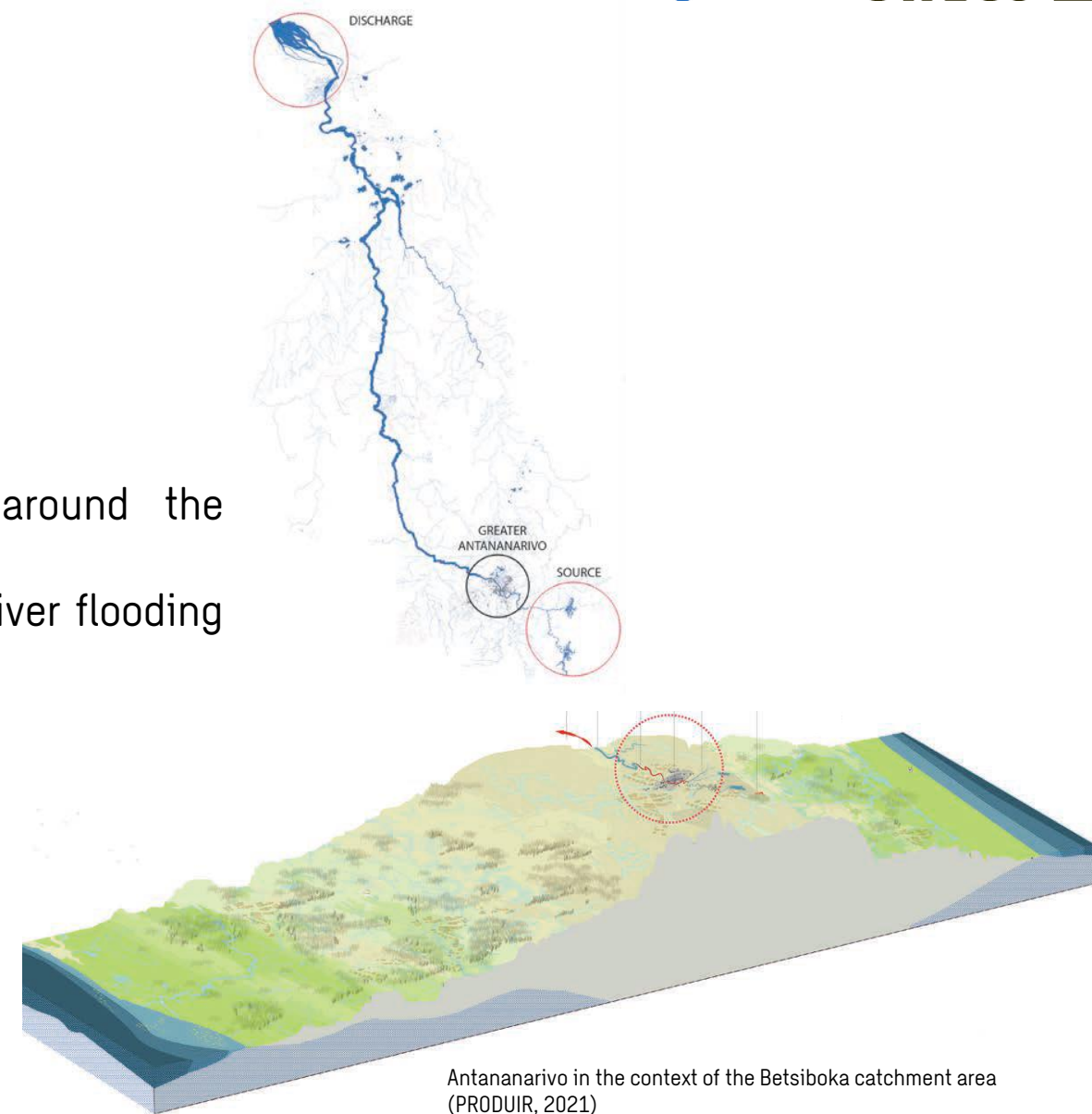
Average rainfall and temperature in Madagascar's different climate zones (PNA, 2021_)

Antananarivo

Water-related information

The context upstream

- Antananarivo is located in a very large plain .
- It is crossed by several streams and rivers.
- These rivers are fed by different catchment areas around the Antananarivo basin (Interview Directeur du cabinet, 2022).
- More frequent heavy rainfall events upstream can lead to river flooding in the city (Interview MATSF, 2022).
- Deforestation upstream increases water runoff (PRODUIR).



Antananarivo in the context of the Betsiboka catchment area (PRODUIR, 2021)

Antananarivo

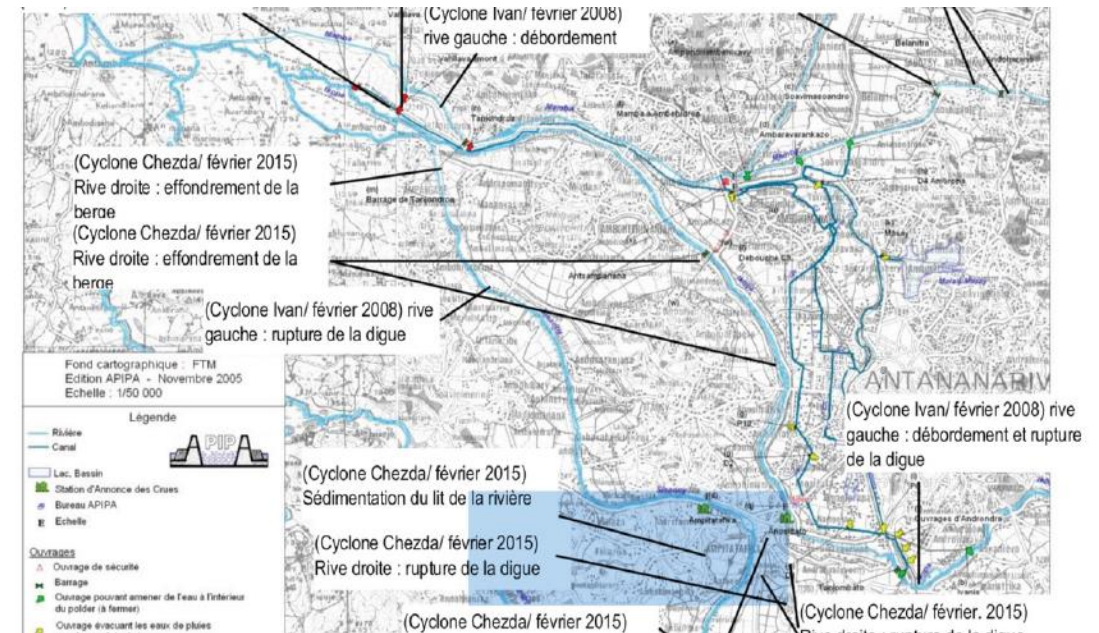
Water-related information

Existing Infrastructure

- The water supply infrastructure in Madagascar mostly dates from the colonial period (1952) and has been **outpaced** by urban expansion and population growth.
- Existing sanitation infrastructure & drains do not have the necessary capacity to deal with regular **flooding events** (Directeur du cabinet, 2022).
- They are also often filled with **solid waste** (City Diagnostic).
- There are problems with waste management – only one landfill needs to be moved due to the lack of space – as it is difficult to convince neighbouring areas to host a landfill (Directeur du cabinet, 2022).
- Water quality is also an issue. **Waste water** is not treated. Eighty percent of the people drinks water contaminated with faecal matter.
- In 2015 the damage due to floods were equal to 1% of the national GDP ([World Bank, 2016](#)). 100 000 people were displaced and 20 people died due to landslides.



Images of waste in rain water drainage infrastructure & polluted drinking water (Urban Diagnostic, 2021)



Map of historical damages to existing infrastructure that are in need of repair (PRODUIR, 2021)

Antananarivo

Key economic information

Income generation



- Agriculture
- Industry: soap production, brick works, food and tobacco processing, brewing, textiles and leather manufacturing
- Commercial sector
- Mining (growing)
- Tourism (growing)

Informal sector



Various forms of production and employment typically exist in very small enterprises. In addition, the informal sector is the lowest paying segment of the urban labour market and less exposed to international competition (Vaillant et al., 2014).



Touristic picture of Antananarivo ([Alybabuy](#))



Food vendors in Antananarivo ([The new humanitarian](#))

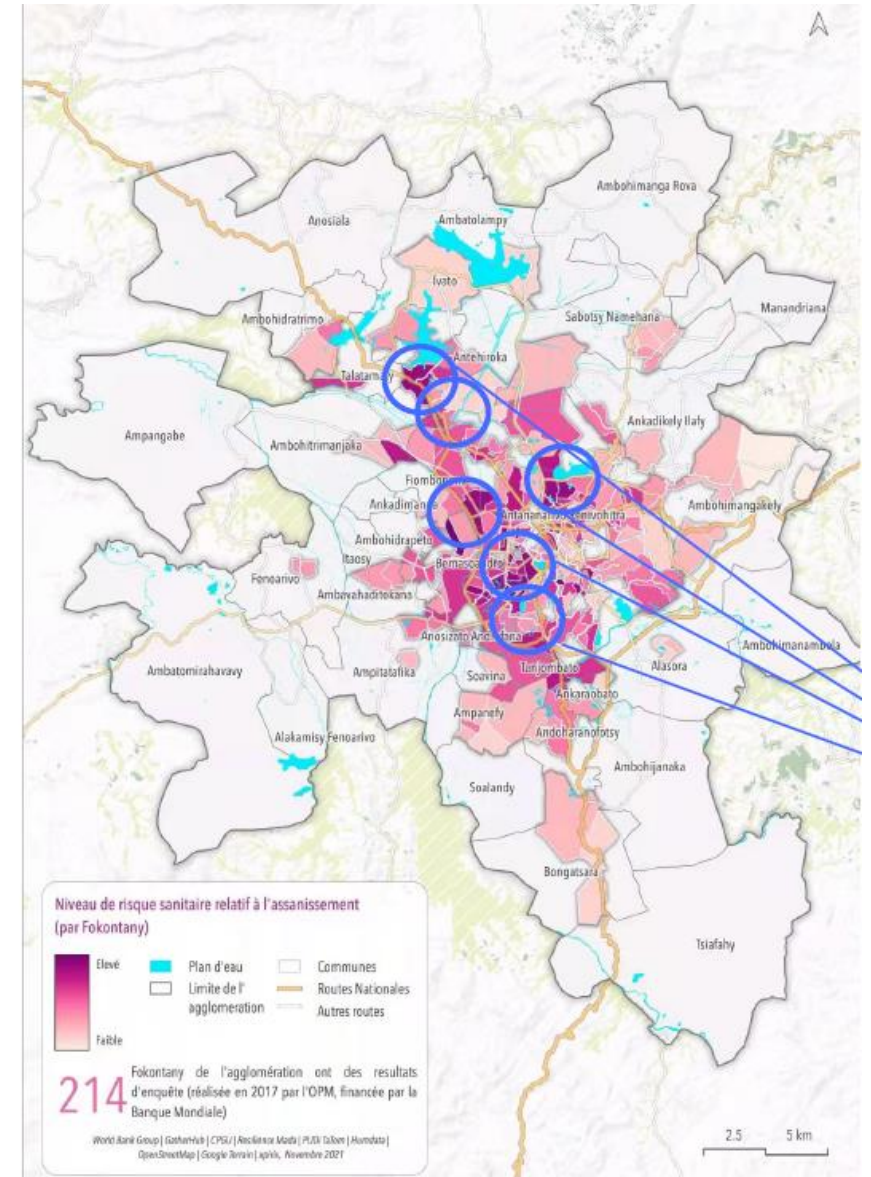
Antananarivo

Informal sector

- During water cuts, teenagers in the neighbourhoods offer to collect water for households from the public kiosks.
- There is a **lack of affordable housing options** (Limi, 2019).
- Rural-urban migration has led to urban growth and the **urbanisation of the floodplains with informal settlements** (United Nations, 2012).
- The so-called “**bas quartiers**” suffer from **a lack of infrastructure and basic services** (United Nations, 2012).
- People **discard their waste in the drainage** infrastructure and rivers and they **do not follow building norms and standards**.

“ No space can even be found for a latrine. 40m² to 50m² is just required, but often even that can not be found. ”

» Chief of Staff, CUA



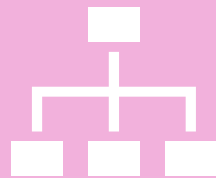
Overview of Fokontany's risk to sanitation incidents in Antananarivo (City Diagnostic, 2021)

Antananarivo

Main Challenges

1. **Climate migration:** due to drought and cyclones people leave rural areas and move to Antananarivo (Interview Nzeyimana, 2022).
2. **Informal settlement:** most growth takes place in low lying and flood prone areas due to a lack of space in the city .
3. **Old** and insufficiently maintained **infrastructure:** most (sewage and drinking water) infrastructure does not meet the (quality) demand (Interview City Advisor, 2022).
4. **Socio-economic inequalities** are expressed spatially as the higher casts live in the highlands and the lower casts in the low flood prone areas.
5. The result is that the **poorest people** are living in the areas that are **the worst affected by climate impacts**, having **no access to public services** and are affected the most by **cyclones and flooding**.

Governance structure



Governance Structure

Introduction

Presentation of governance structures

The presented information is based on an analysis of relevant policy documents and stakeholder interviews.

It specifically focuses on the official responsibilities related to the aspect of “climate adaptation and resilience”. Thus, it does not include an overview of governance structures for relevant sectors such as water provision, infrastructure, agriculture etc.



© RAZORLEARNING

Madagascar National Climate Governance

National Climate Adaptation Strategy

National Level

The **Ministry of Environment and Sustainable Development (MEDD)** is responsible for Climate Change Adaptation



Policy – A National Climate Adaptation plan has been elaborated in 2021 (the PNA)

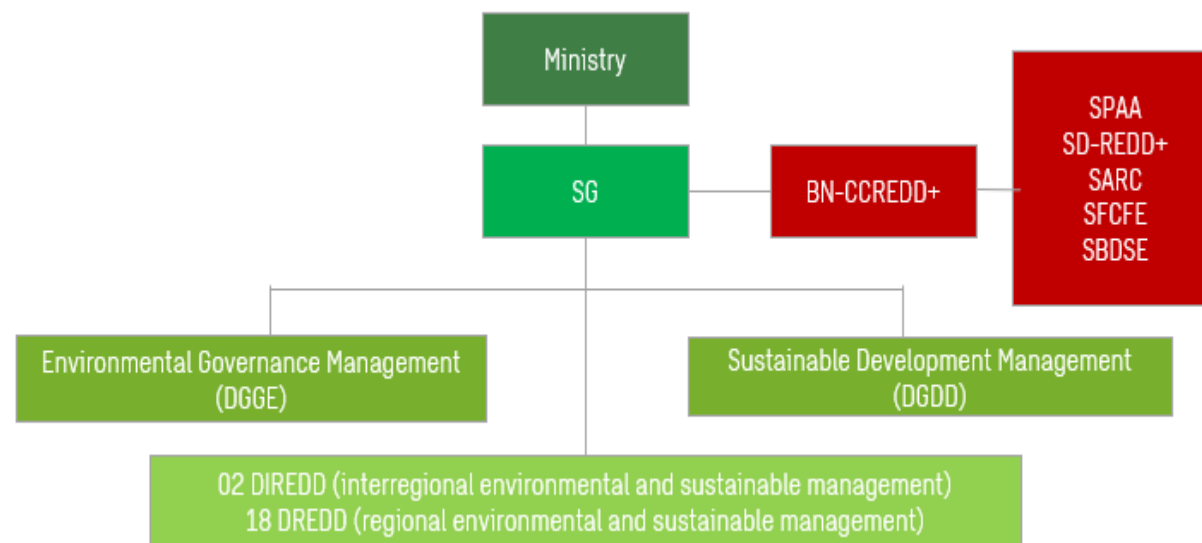


Monitoring



Evaluation

The **National Office for Climate Change and the Reduction of Emissions due to Deforestation and Degradation of Forests (the BN-CCREDD+)** is responsible for the coordination of all climate change and climate adaptation initiatives in the country.



Madagascar National Climate Governance

National Climate Change Strategy

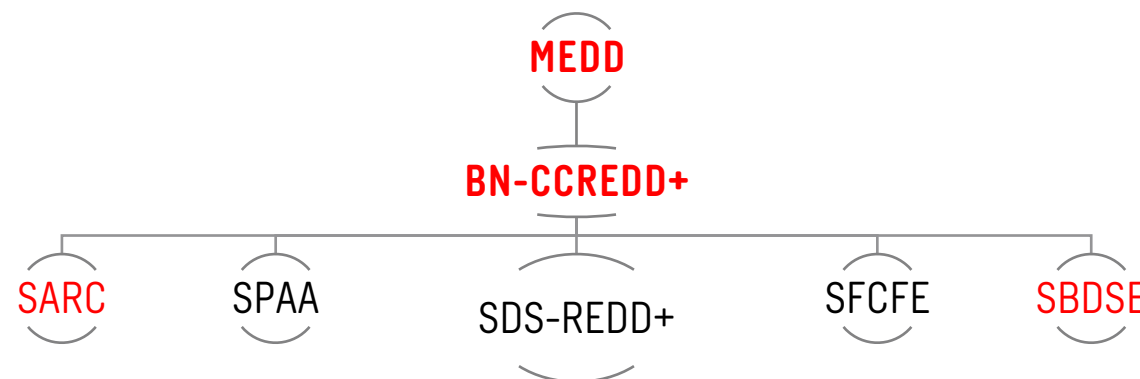
BN-CCREDD+ consists of the following services:

- Climate adaptation and resilience (SARC)
- Promotion of mitigation actions (SPAA)
- Development of the REDD+ strategy (SDS-REDD+)
- Carbon fund and external investments (SFCFE)
- Data and evaluation (SBDSE)

Platforms have been set up. These ensure the involvement of stakeholders:

- The national scale PFN REDD+
- The regional scale PFR REDD+

These platforms are the **bridge between government and non-governmental stakeholders** such as: the public sector, administrations, universities, the private sector, funding agencies, civil society etc.



Madagascar National Climate Governance

National Climate Change Strategy

Climate change and climate change adaptation are seen as transversal themes:

- The National Comity for Climate Change (CNCC)

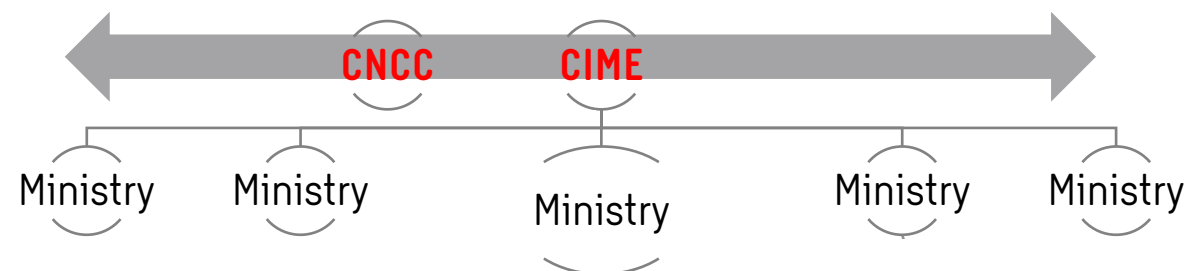
Is responsible for the technical elaboration as well as the validation by the secretariat of the convention framework for climate change of the United Nations.

- The cross-ministry comity for environment (CIME)

Is responsible for the integration of climate adaptation in all major policies and strategies



Integration of Climate adaptation in major policies



National Plan for Climate Change Adaptation (PNA, 2021)



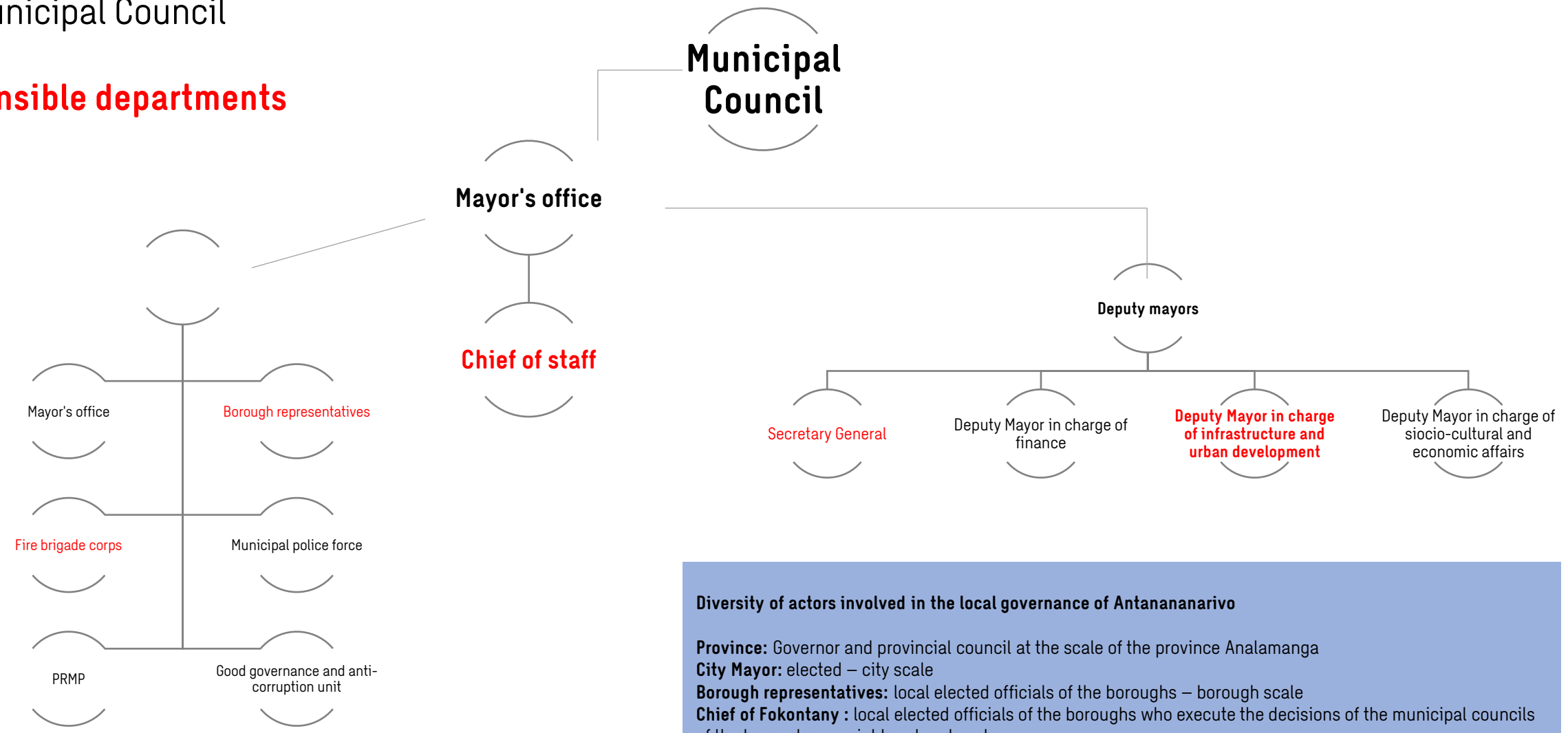
Three main strategic area's

1. **Strengthening governance and integration** of adaptation
2. Implementing priority **sectoral action programmes**
3. **Financing adaptation** to climate change.

Antananarivo- Governance

The Municipal Council

Responsible departments



Diversity of actors involved in the local governance of Antanananarivo

Province: Governor and provincial council at the scale of the province Analamanga

City Mayor: elected – city scale

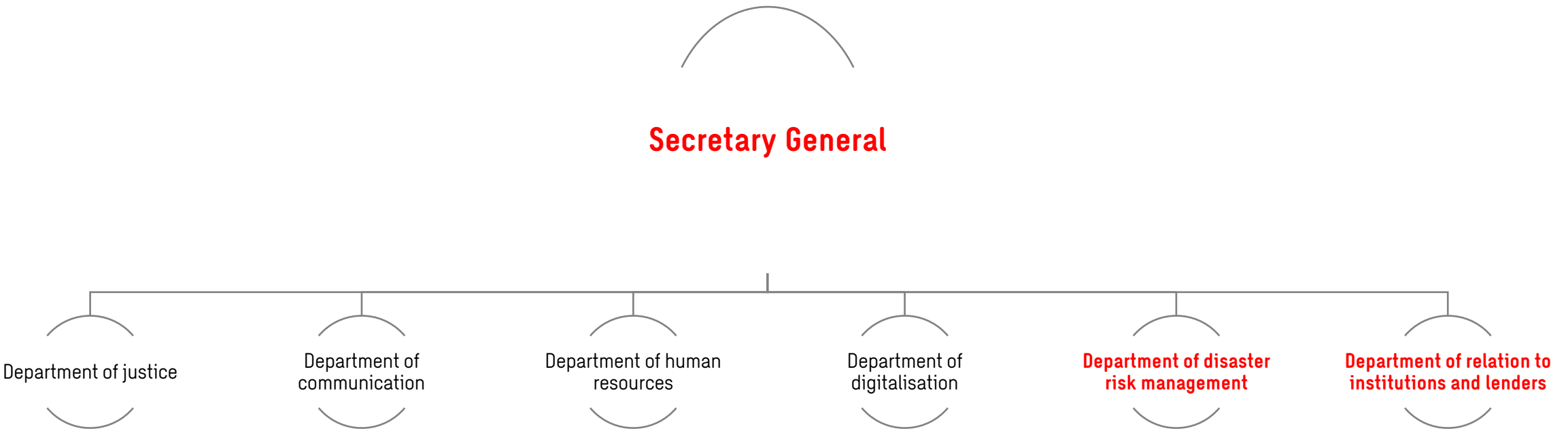
Borough representatives: local elected officials of the boroughs – borough scale

Chief of Fokontany : local elected officials of the boroughs who execute the decisions of the municipal councils of the boroughs. – neighbourhood scale

Antananarivo- Governance

The Municipal Council

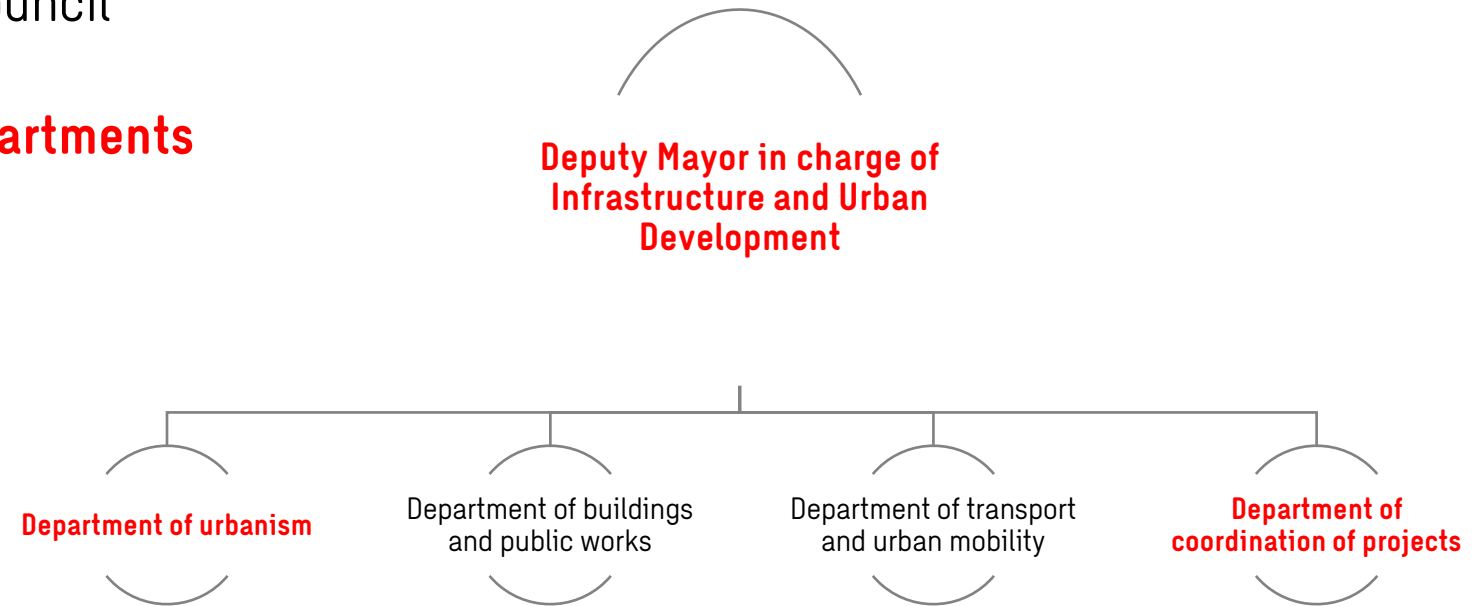
Responsible departments



Antananarivo- Governance

The Municipal Council

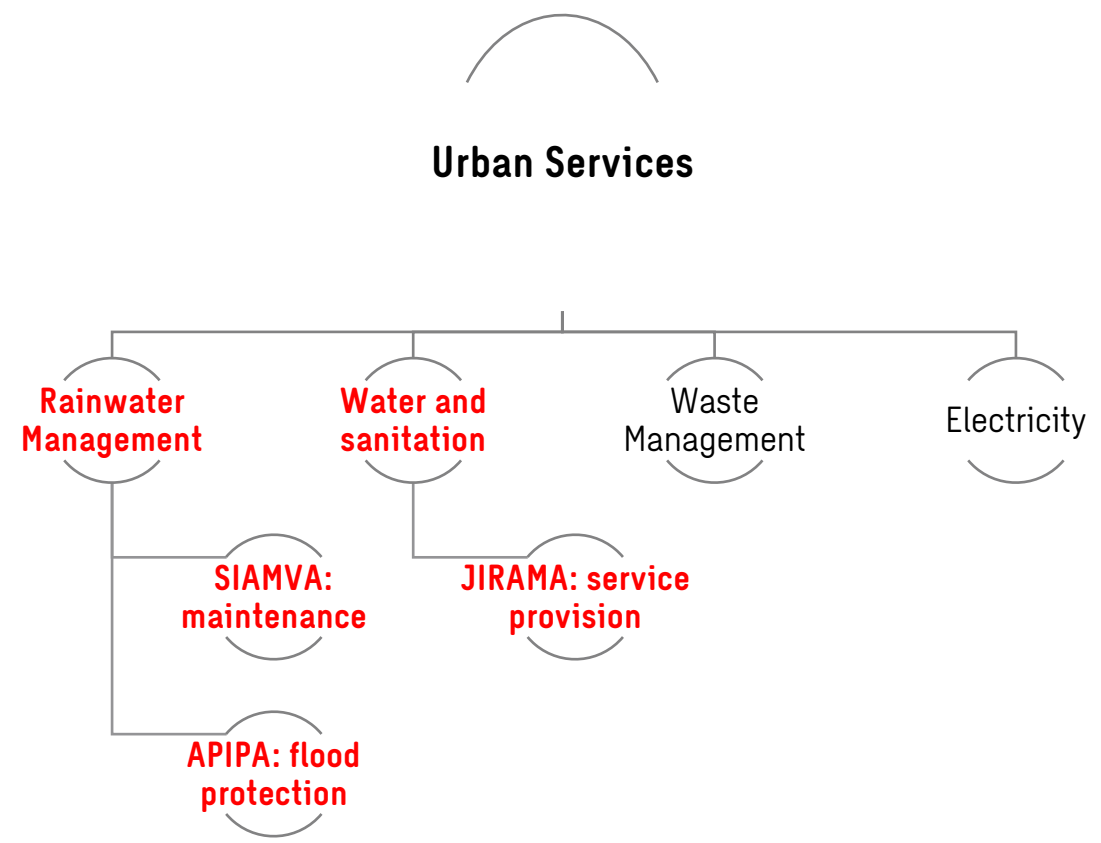
Responsible departments



Antananarivo- Governance

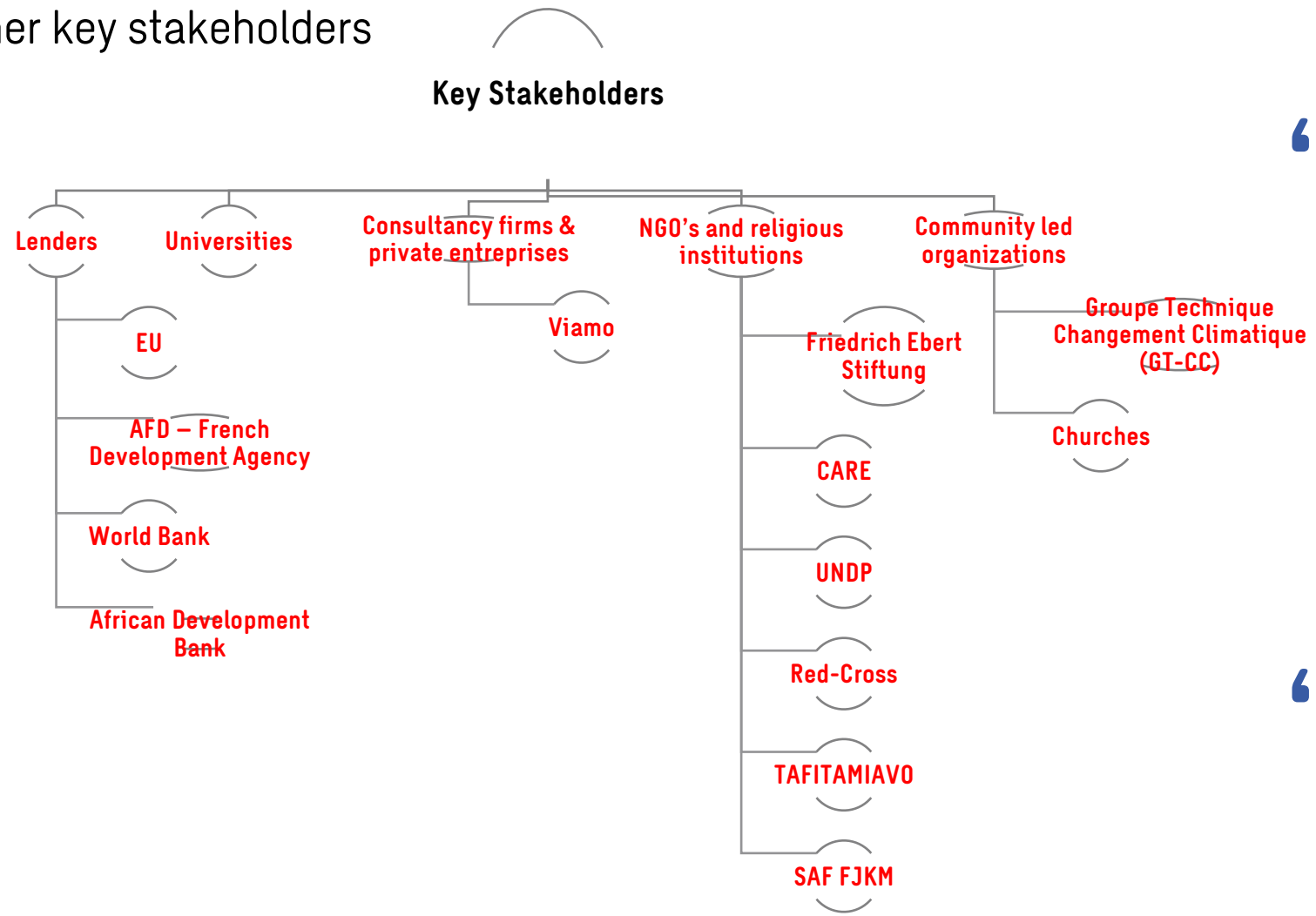
Urban Services

Responsible departments



Antananarivo- Governance

Other key stakeholders



“ The MEDD encourages citizen engagement by often organising sensibilisation campaigns. (Interview with BNCCRED+, 2022) ”

“ There is a need to encourage and accompany the creation of community organisations that are representative of the CUA. (Interview with AFD, 2022) ”

Madagascar

Budget Flow

Increasing international budget for climate adaptation:

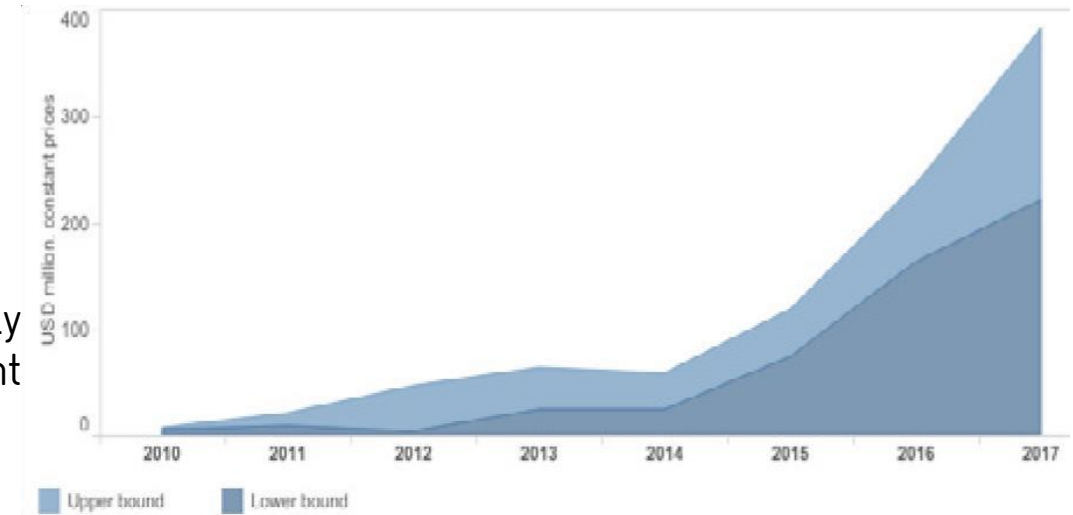
- Mainly in the form of aid (60%) (PNA, 2021).
- Climate adaptation is the main priority in the country.
- Every donor needs a letter of non-objection from the MEDD.

Limited availability of national budget for climate adaptation

- National financing for climate adaptation is quite limited and it is currently not possible to monitor it (as it can be a subject within many different types of expenditures).

Lack of required financial instruments

- The **Ministry of Economics and Finances** (MEF) is responsible for the national budget planning. However, there is no specific entity responsible for the organisation and coordination of the international budget that is available.
- As the ministry is responsible for the coordination of climate adaptation the MEDD is responsible for the coordination of those budgets; identifying which ones are a priority of the state and in which regions they would be needed (Interview BNCCRED+, 2022).



Evolution of climate financing between 2010-2017 in USD ([OECD-DAC](#))

“ There is a need for the development of national climate adaptation financing instruments (PNA, 2021 p.100) ”

Antananarivo

Budget Flow

The CUA has two departments responsible for the finances:

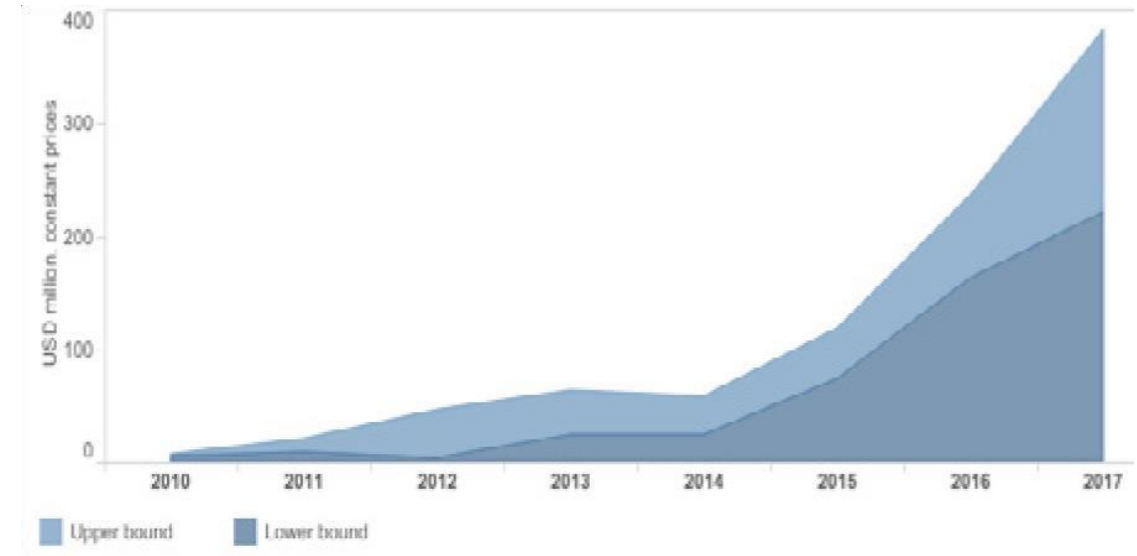
- The Department of financial resources: responsible for payments and monitoring.
- The Department of budget management: responsible for the budget, the expenses and for setting up a plan for planned expenses.

Reflections from the Chief of Staff (2022):

- The city has a very limited budget.
- This year a new city budget plan will be set-up.

There is a department responsible for the coordination of institutions and lenders:

- This ensures that international projects/funds are coordinated and in line with the city's strategies and ambitions.



Evolution of climate financing between 2010-2017 in USD ([OECD-DAC](#))

Madagascar

Main Governance Challenges

1. There is a lack of efficient coordination which results in overlap of certain initiatives (Interview Chief of Staff, 2022).
2. There is a lack of technical and institutional capacity (Weiskopf et al., 2021).
3. There is a lack of funding and insight about available international funding opportunities. (Interview Chief of Staff, 2022)
4. There is suboptimal communication between the national and regional levels (Weiskopf et al., 2021).

“More than sixty climate vulnerability studies have been done, but often they come, do their study and then leave again with the information and findings” (Interview BN-CCREDD+ , 2022). ”

**Hazard
assessment**



**Impact
assessment**



Hazard and Impact Assessment

Introduction

Hazards & Impacts

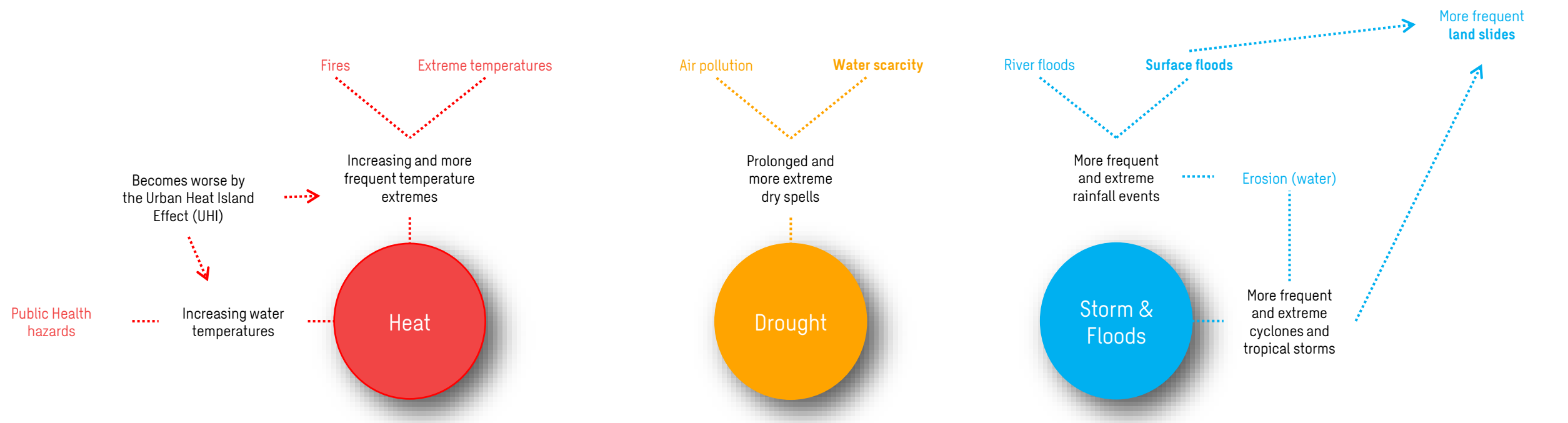
Based on an extensive literature study and stakeholder interviews, the hazard assessment determines the most important **climate hazards** for the **themes heat, drought and floods & storms**. These climate hazards are the **physical climate effects** that Antananarivo is exposed to. For each of the climate hazards, this assessment gives the current trends and future predictions.

Subsequently, the impact assessment focusses on the **impacts** of the climate hazards on different sectors. The selection of sectors is based on the sectors in the National Climate Adaptation plan. The impacts were found during a literature study and then validated with local stakeholders during interviews.

Impacts in bold have been validated by stakeholders as being priorities for the city.

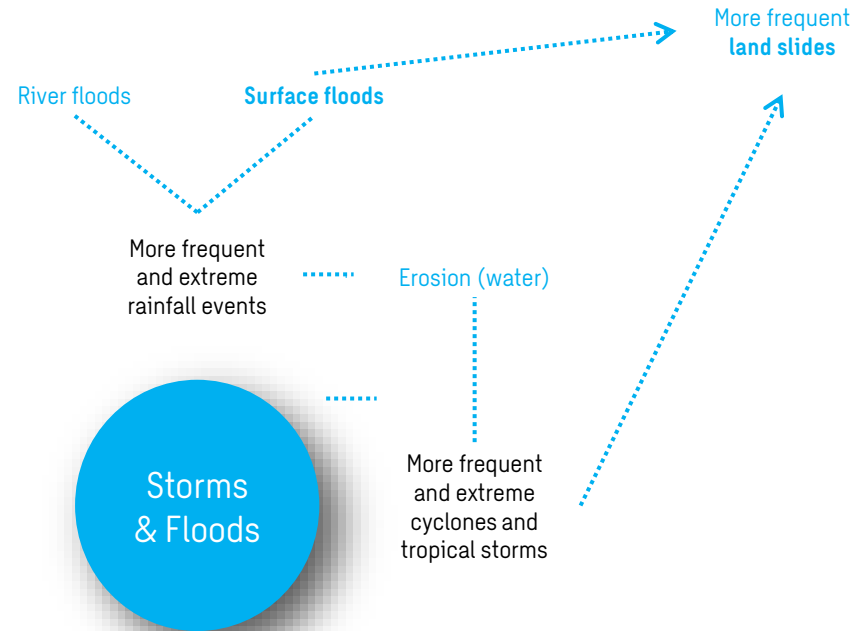


Main climate hazards



LEGEND
In black: Primary Climate Hazard
In colour: Secondary Climate Hazard

Floods and storms in Antananarivo



LEGEND

In black:

Primary Climate Hazard

In blue:

Secondary Climate Hazard

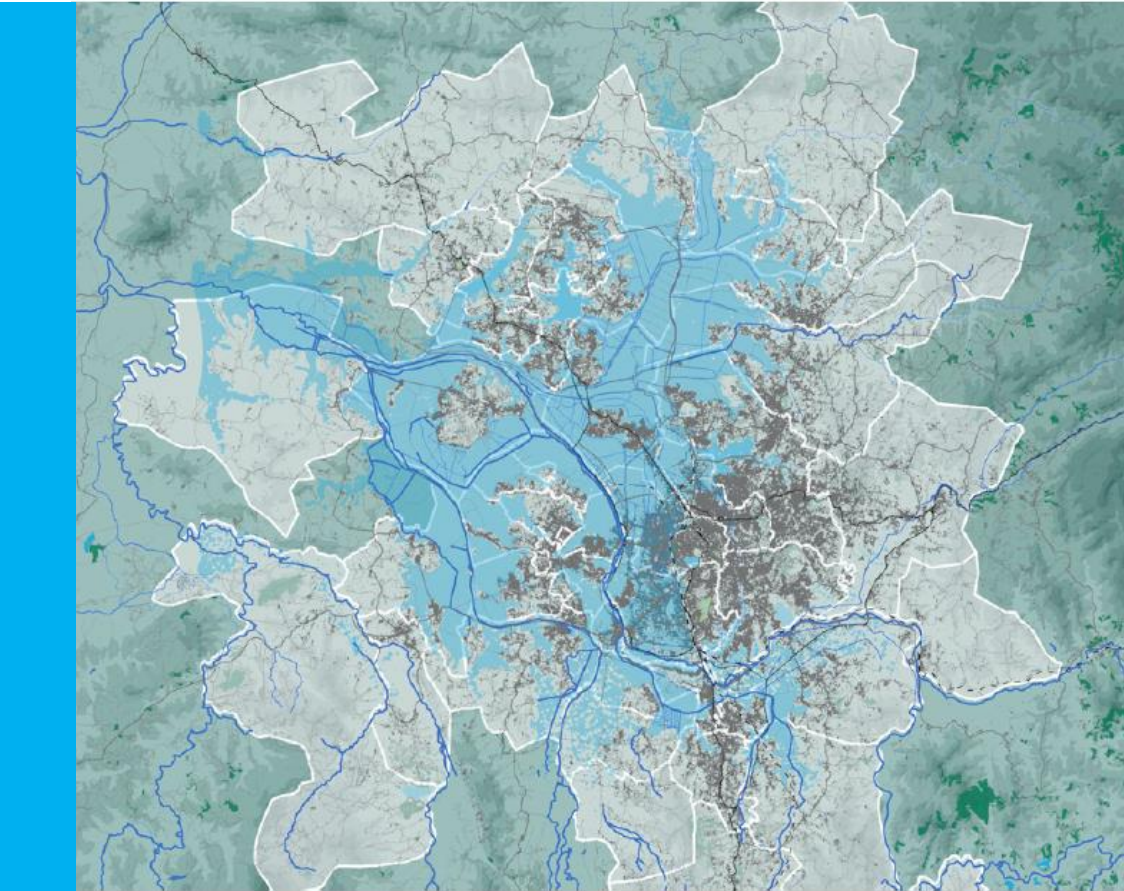
An aerial photograph of a city, likely Antananarivo, showing a large river flowing through it. The river is surrounded by dense urban development. A significant portion of the city, particularly along the riverbanks, appears to be flood-prone. The river itself is wide and has a braided channel with exposed sandbars and vegetation. A bridge crosses the river in the upper middle part of the image. The surrounding area is filled with buildings, roads, and some green spaces.

2/3 of the city consists of flood prone areas

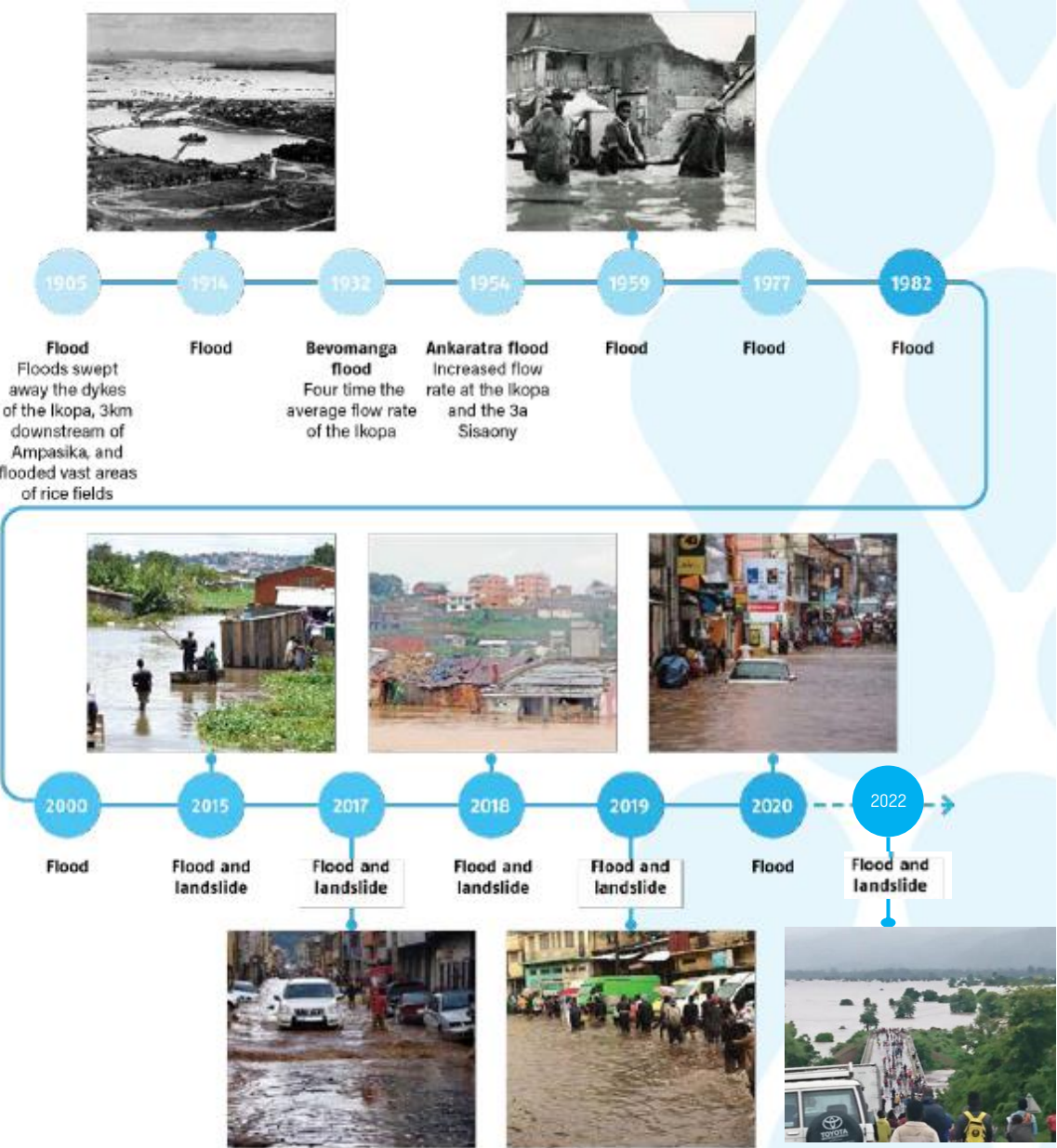


© PIAA

More frequent and extreme rainfall events

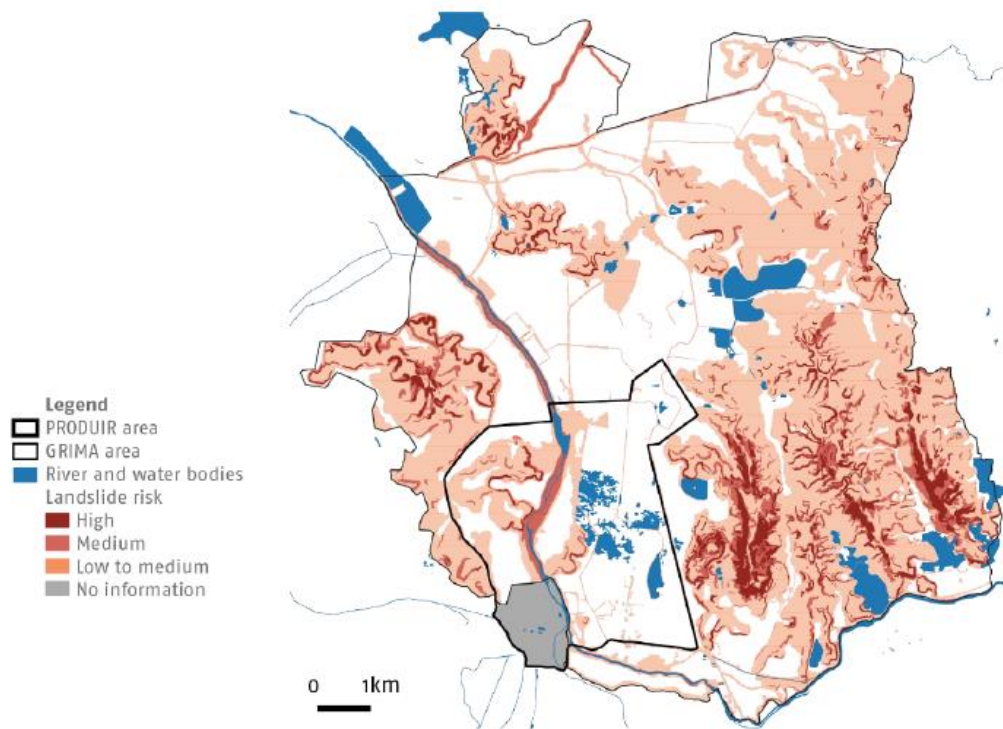


Map of flood risk zones in Antananarivo(City Diagnostic,2021)



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

Increase in landslides



Map of landslide risks (PRODUIR, 2021)

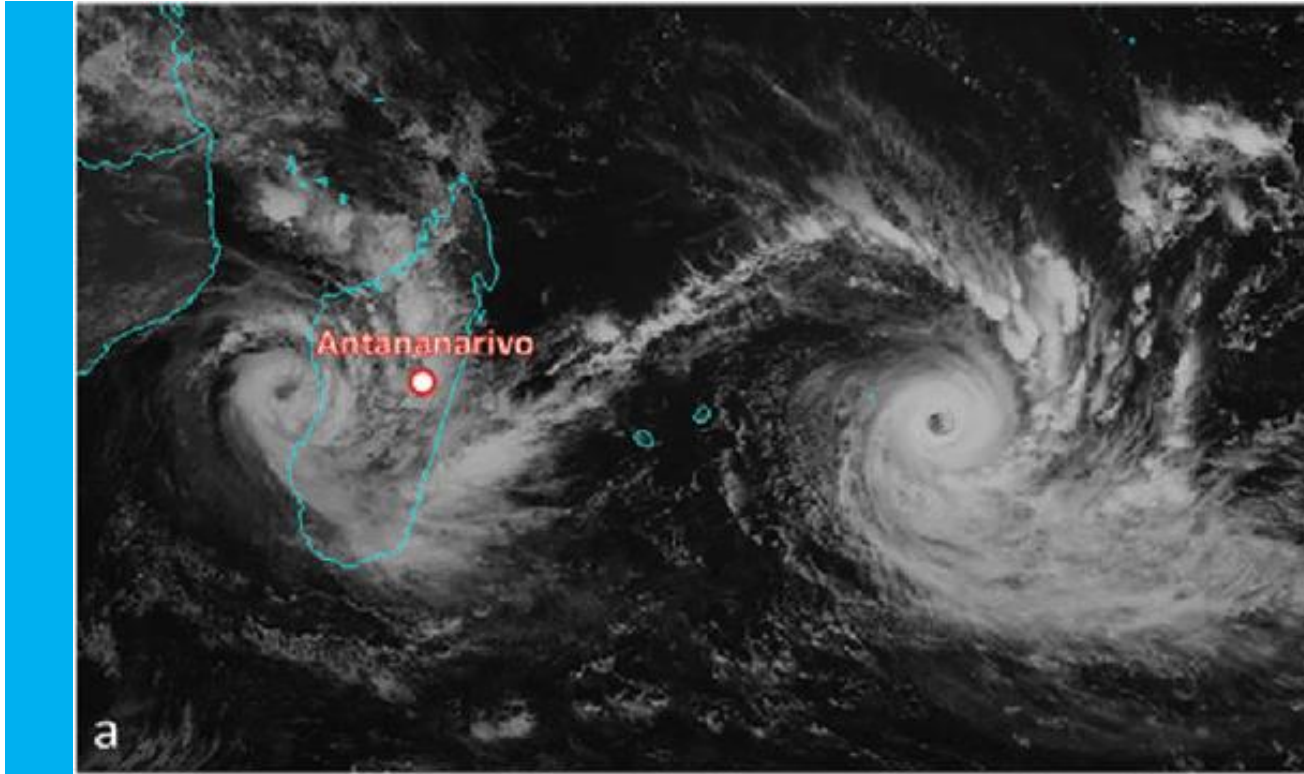
Landslide risks are exacerbated with intense rains

While residents of Antananarivo living near to the city's rivers are suffering from the recent floods, those in the hillsides live in fear of deadly landslides as days of heavy rain have made slopes and hillsides wreak havoc across the slopes of the city.

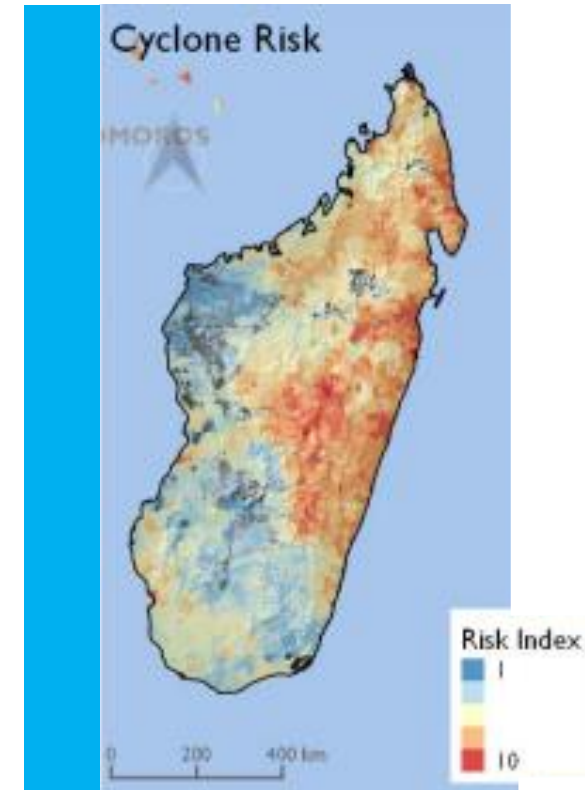


Press article, 2022

More frequent and intense cyclones and tropical storms



Picture of incoming cyclone (Ciampalini, 2019).



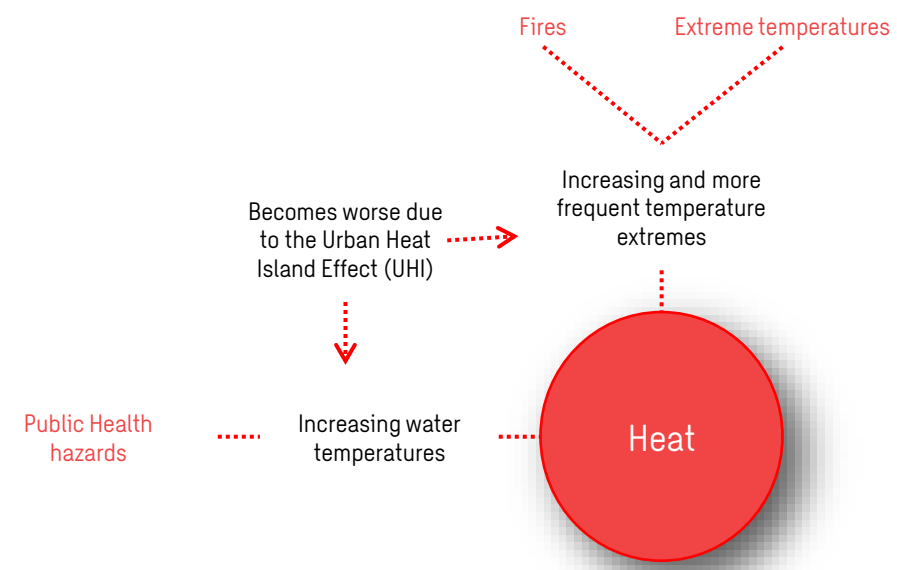
(USAID, 2018- Cyclone risks in different geographic regions).

Impact Floods & Storms on relevant city sectors

LIST OF SECTOR-BASED IMPACTS (FLOODS & STORMS)

Hazard theme	Capital	Sector	Impacts
FLOODS & STORMS	SOCIAL	Health	During floods latrines overflow, water stagnates causing a major health risk.
			Damage to health centers negatively impacts the health services.
		Water Resources	During heavy rains the water treatment infrastructure is not able to cope with the amount of water thus water provided by the public utility is contaminated in January and February every year.
			Cyclones cause damage to infrastructure and flooding lowers the water pressure and also completely submerge certain water taps.
		Education	As a result of floods and landslides many areas become uninhabitable. This results in a high number of evacuees and casualties – increasing the number of school drop-out.
			Many schools are also evacuation sites in case of floods, which results in the interruption of classes.
	NATURAL	Agriculture & Livestock	The rice fields and low lying lands flood , which damages crops. In addition, cyclones damage crops such as banana, coffee and cacao. This leads to increased food shortages and hunger.
			Due to rainfall intensity and lack of rainwater drainage there is more and more erosion and slope instability.
		Forests & Biodiversity	Ecosystems can degrade.
		Fishing	Vulnerability of the fishers increases due to reduced fish migration and impacted reproduction cycles.
	ECONOMIC	Infrastructure	There are high costs for pumping to avoid flooding, and high costs for maintenance and repair of damaged infrastructure.
			When the floods come into the neighbourhoods this often results in huge traffic jams (people can be stuck for hours) .
			Due to an increased cyclone intensity, an increase in damage to infrastructure and buildings is expected. In 2015 damage due to floods was 1% of the GDP.
		Habitats & New Towns	Cyclones and strong winds can collapse buildings that do not follow the building standards. Due to climate change the intensity of cyclones is increasing.
			During floods water goes into houses. Employment decreases, travelling is difficult and the environment becomes dirty, odorous and very unpleasant. There are long queues for the kiosks.

Heat in Antananarivo



LEGEND

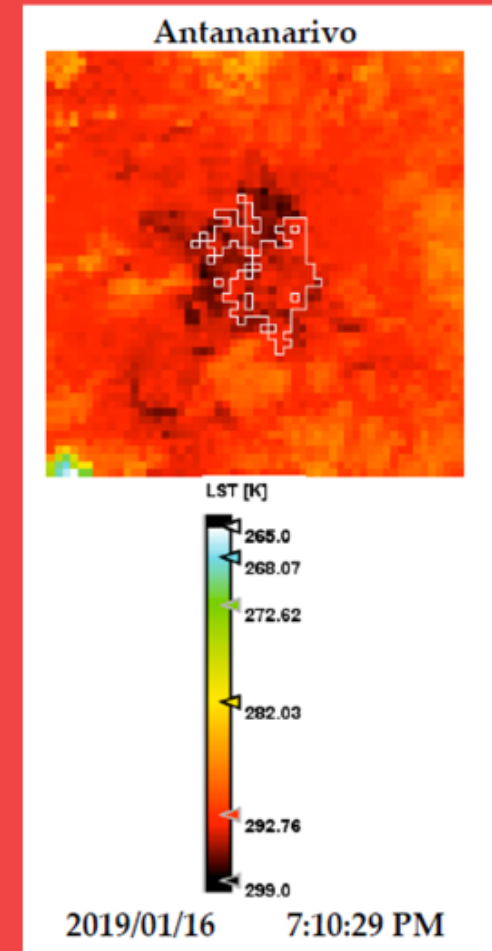
- In black: Primary Climate Hazard
In red: Secondary Climate Hazard

Urban Heat Island

(Sobrino & Irakolis, 2020 – Surface temperature)

Heat effects become worse through the urban heat island effect.

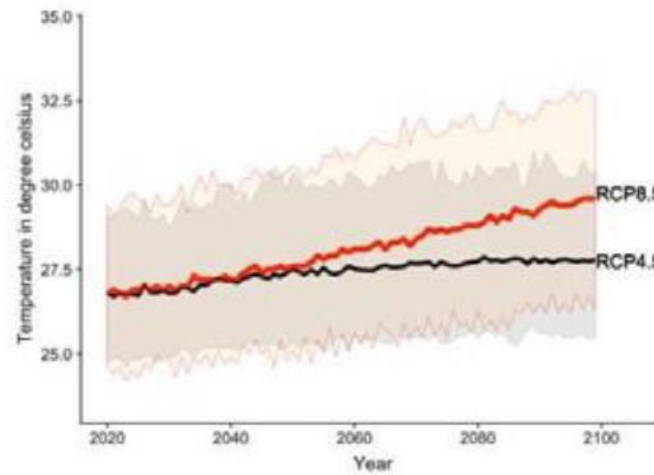
This study illustrates that the difference of surface temperature in Antananarivo in January 2019 in certain parts of the city was as much as 6,2°C hotter.



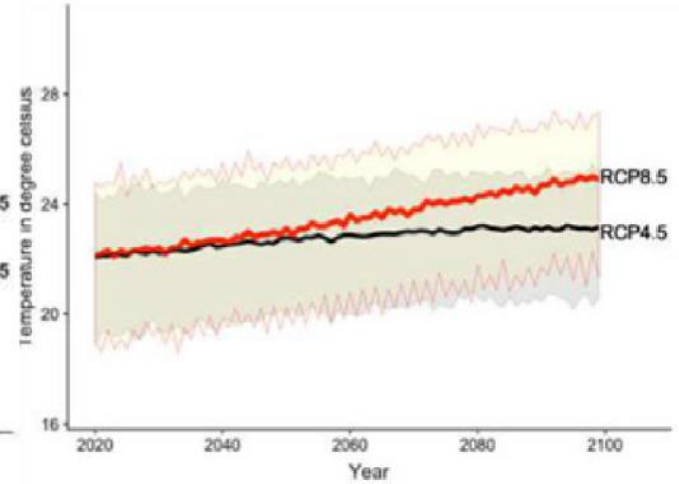
Extreme high temperatures and fires

It is estimated that the maximum temperature will increase with two degrees by 2050 (RCP 8.5)(PNA, 2021).

Extreme heat can lead to fires that can quickly spread in the densely build parts of the informal settlements. (Urban Diagnostic, 2021).



Evolution of the annual maximum temperatures (°C) for the period 2020-2100 for the RCP 4.5 and RCP 8.5 scenarios. Source: DGM, 2019



Evolution of the annual minimum temperatures (°C) for the period 2020-2100 for the RCP 4.5 and RCP 8.5 scenarios. Source: DGM, 2019



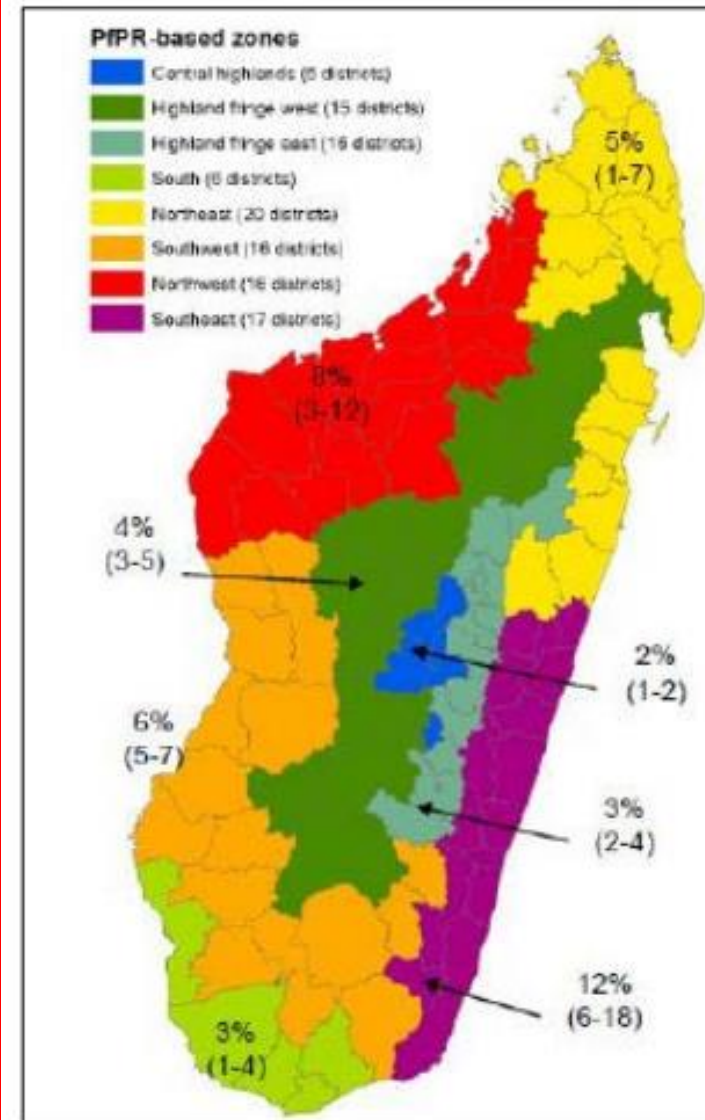
Fire in the 67Ha neighbourhood



Housing and pollution in the Ankasina neighbourhood

Public Health Hazards

The projected increase in the average annual temperature will result in many areas becoming more favourable for the transmission of climate-sensitive vector-borne diseases. This includes malaria, as well as dengue, chikungunya, and yellow fever ([MDPI.COM](https://www.mdpi.com))

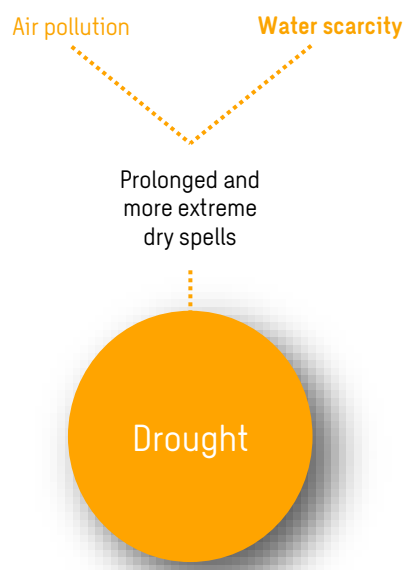


@ Presidents Malaria Initiative Madagascar Malaria Operational Plan FY (2022)

Impact of heat on relevant city sectors

LIST OF SECTOR-BASED IMPACTS (HEAT)			
Hazard theme	Capital	Sector	Impacts
HEAT	SOCIAL	Health	Increases the risk of respiratory diseases and pre-existing conditions (such as cardiovascular problems). Many areas become more favourable to the transmission of climate-sensitive vector-borne diseases, including malaria, as well as dengue, chikungunya, and yellow fever. Also, there is an increased risk of water borne diseases.
		Water resources	Risks of higher evaporation rates, leading to reduced humidity in the soil and reducing the refill of groundwater.
		Education	Previously mentioned risks will also affect school children.
	NATURAL	Agriculture & Livestock	The increased average, minimum and maximum temperature will lead to increased evapotranspiration and reduced soil humidity. This will lead to increased livestock deaths and crop failure. There will be a higher need for irrigation, especially for the rice agriculture.
		Forests & Biodiversity	Increased risks of degradation of ecosystems due to deforestation.
		Fishing	Risks of degradation of the fish habitat and ecosystems, resulting in fish migration.
			Evaluated risks to fish reproduction cycles.
	ECONOMIC	Infrastructure	Risks of fragilisation of the infrastructure during periods of extreme heat.
		Habitats & New Towns	The heat can lead to fires that can quickly spread in the densely build part of the informal settlements. As an example, in 2020 the neighbourhood 67Ha had a fire that burned 290 houses and left 1000 people homeless (City Diagnostic).
			Temperatures might increase with 1-5 degrees depending on the climate scenario. The heat has a negative impact on the structural integrity of buildings that do not follow the building standards.
			The urban heat island effect becomes worse, as well as problems with ventilation.

Drought in Antananarivo



LEGEND
In black: Primary Climate Hazard
In orange: Secondary Climate Hazard

Average yearly precipitation

(National Adaptation Plan, 2021)

2050



-13%

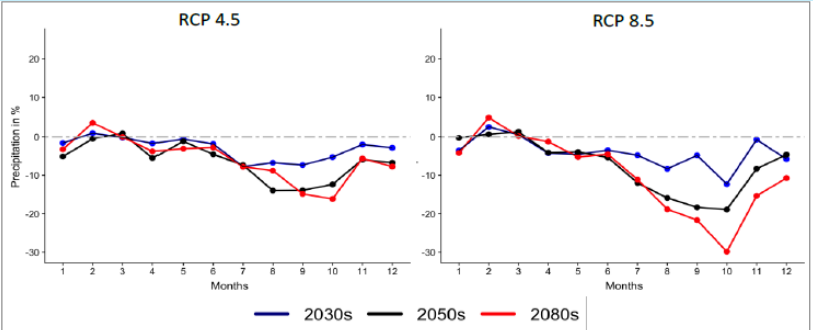
2100



-16%

Drought

CHANGEMENT DES PRECIPITATIONS MENSUELLES (%) AVEC LES SCENARIOS D'EMISSION MODEREE (RCP 4.5) ET ELEVEE (RCP 8.5)



SCÉNARIOS SUR LES CHANGEMENTS CLIMATIQUES AU NIVEAU NATIONAL

Paramètre	Scénarios d'émissions	2030s	2050s	2080s
Précipitations (%)	RCP 4.5	-3.1%	-6.4%	-5.9%
	RCP 8.5	-4.2%	-7.5%	-9.9%
	RCP 4.5	-0.6%	-3.2%	-2.3%
	RCP 8.5	-1.2%	-1.9%	-3.8%
	RCP 4.5	-5.6%	-9.5%	-9.6%
	RCP 8.5	-7.1%	-13.0%	-16.0%
Température maximale (°C)	RCP 4.5	+0.9°C	+1.4°C	+1.7°C
	RCP 8.5	+1.0°C	+1.6°C	+2.9°C
Température minimale (°C)	RCP 4.5	+0.9°C	+1.3°C	+1.7°C
	RCP 8.5	+1.0°C	+1.6°C	+2.9°C

(National Adaptation Plan, 2021)



Impact of drought on relevant city sectors

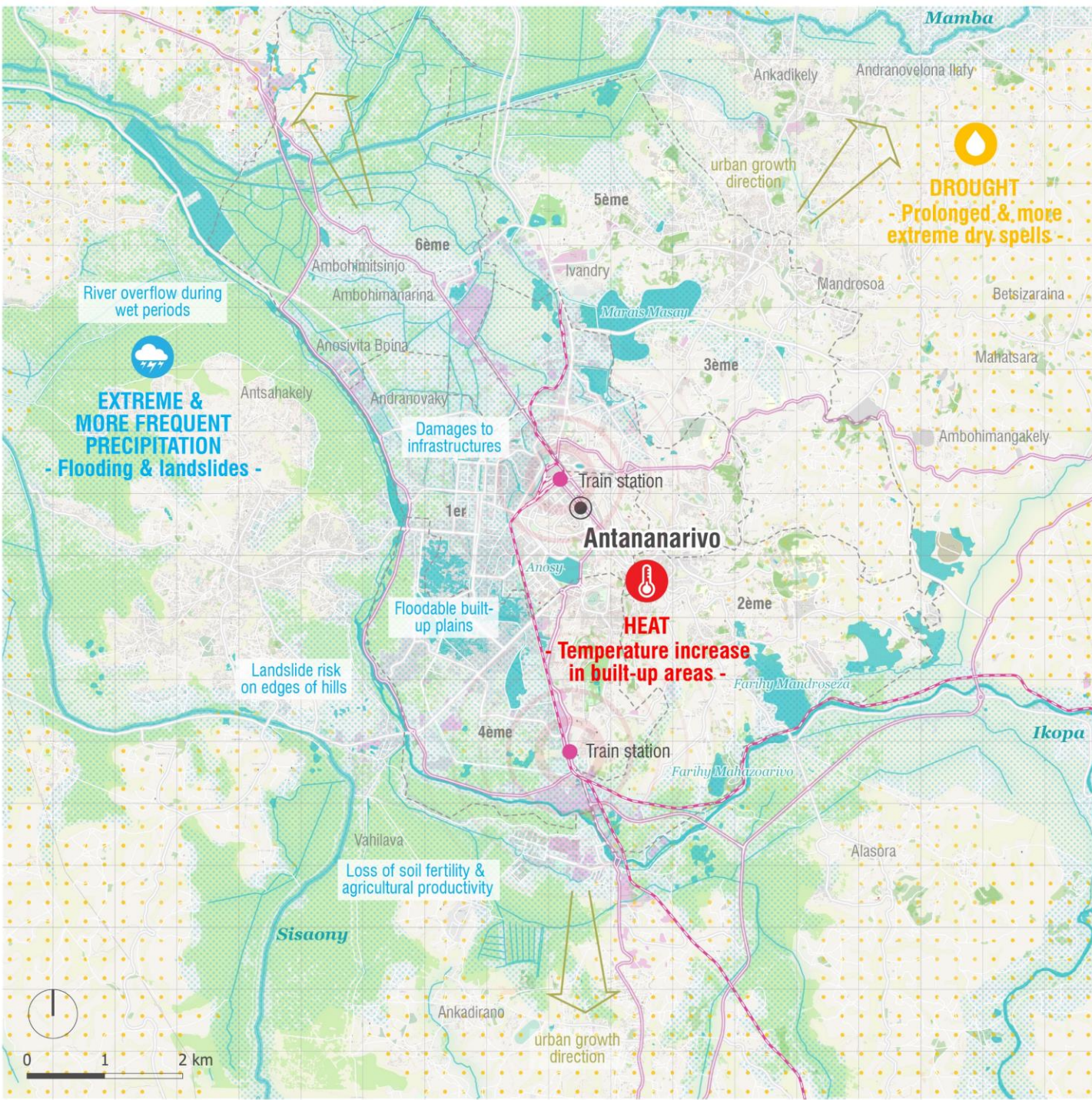
LIST OF SECTOR-BASED IMPACTS (DROUGHT)			
Hazard theme	Capital	Sector	Impacts
DROUGHT	SOCIAL	Health	Insufficient piped water supply can lead to waterborne diseases such as cholera, typhoid, amoebiasis, cyclosporiasis and giardiasis.
		Water resources	Drought can lead to increased water shortages for tap water due to a lack of river and groundwater.
			Due to changing rainfall patterns, Madagascar has suffered from droughts in the last years. The hydro power stations are dependent of rainfall rivers, and less rainfall could mean that less energy could be generated. This could be a problem as 55% of the energy in Antananarivo comes from hydro power.
		Education	The food is coming from the rural areas. Famine and drought have been major issues in the rest of the island including Antananarivo, which also affect school aged children.
		Security	Negative impact on security in the city as a result of climate migrants coming to the city and they are unable to farm in the city.
	NATURAL	Agriculture & Livestock	There will be a higher need for irrigation, especially for the rice agriculture.
			A shortage of rainfall can be a disaster for rainfed crops. Reduced precipitation and a longer dry season are projected to decrease the growing season up to 50 days by 2100, especially in southern and western Madagascar. Droughts can also lead to outbreaks of migratory grasshoppers that can extend over large areas and destroy entire fields. Madagascar is projected to become more suitable for cassava pests as well.
			Droughts cause food insecurity and nutritional insecurity leading to humanitarian emergencies. For example, the 2017-2018 drought in the southern regions reduced agricultural production by 60% and threatened 1.3 million people with food security issues.
	ECONOMIC	Fishing	Water scarcity can reduce survival of plant species and thus reduce productivity. In addition, this can lead to greater food insecurity for other species.
		Infrastructure	Drought can impact the socio-economic development - When people do not have access to enough (drinking) water they are dehydrated - this has an impact on the efficiency of labour.

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



Antananarivo

Hotspots

	Affected areas - communes	Comment
Flooding	Ampagamben Ambohitrimanjaka, CUA (Arr. 1,3, 5,6), Antehiroka, Ambatolanpy, Ambohimananga Rova, Anosy Avaratra, Sabotsy Nanchana, Ankodiely, Ilfaly, Fenoarivo, Ankadimanga, Fiobonana, Ambihidrapeto, Betmasoavollro, Itaosy, Andranonahcatra, Anosizato, Andrefana, Soavina, Tanjombato, Ankaraobato, Amparety, Andoharonofotsy.	<p>1/3 of the city's surface are flood prone areas (<i>see floodmap on page 46</i>). Especially the areas along the Mamba, the Sisaony and the Andromba rivers.</p> <p>Note that these are for a large part also the communes where the informal settlements are and where the vulnerable population lives.</p>
Heat	CUA Arr.1, CUA Arr.2, CUA Arr.3, CUA Arr.4, CUA Arr.5, Bemasoandro, Andranonahoatra, Anosizato Andrefan, Tanjombato, Ankaraobato.	The heat problem is worsend through the urban heat island effect. This is worse in densly urbanised parts of the city with little greenery (<i>see map on population density on page 19</i>).
Drought	In the “bas-qaurtier” in: Ambohitrimanjaka, CUA (Arr. 1,4,6), Antehiroka, Ambatolanpy, Anosy Avaratra, Sabotsy Nanchana, Ankodiely, Ilfaly, Ankadimanga, Fiobonana, Ambihidrapeto, Betmasoavollro, Itaosy, Andranonahcatra, Anosizato. Andrefana, Soavina, Tanjombato, Ankaraobato, Amparety, Andoharonofotsy.	The impact is mostly felt in informal settlements (“bas quartier”) because people that flee the effects of drought in rural areas move to these neighbourhoods. These are often very poor people, with no jobs (<i>see map of informal settlements on page 25</i>).
Cyclones		The exposure is equal accross the city but the impact is worst in precarious neighbourhoods as their buildings often do not respect construction and safety norms (<i>see map of informal settlements on page 25</i>).

Risk assessment



Risk assessment

Introduction

Priority impacts

The impacts on the next page were identified as **priority impacts** by the **city stakeholders** and **the city advisor**.

Together with the city stakeholders (during interviews) the impacts were plotted in a **risk diagram**. The impacts in the right top corner (next page) can be seen as the **key climate risks** for the city of Antananarivo.



© EageInews

CLIMATE CHANGE

HAZARDS

PRIORITY CLIMATE RISKS

HEAT



The Urban Heat Island Effect increases



Extreme temperatures

DROUGHT



Longer & more extreme droughts



Water scarcity

FLOODS & STORMS



More frequent & extreme precipitation events



More frequent & extreme cyclones and tropical storms



Rainfall-induced landslides



Flash floods



River floods



Social

1. Displacement and loss of lives.
2. Negative health impact.
3. Disruption of community life.
4. Disruption of service provision.



Environment

1. Food insecurity.
2. Climate migration.
3. Reduction of arable land.
4. Damage to crops and livestock.



Economic

1. Damage to buildings and infrastructure.
2. Costs for disaster management and repair.
3. Negative impact on socio-economic development.

Risk matrix¹

Susceptible to happen:
In 10 years

5 years

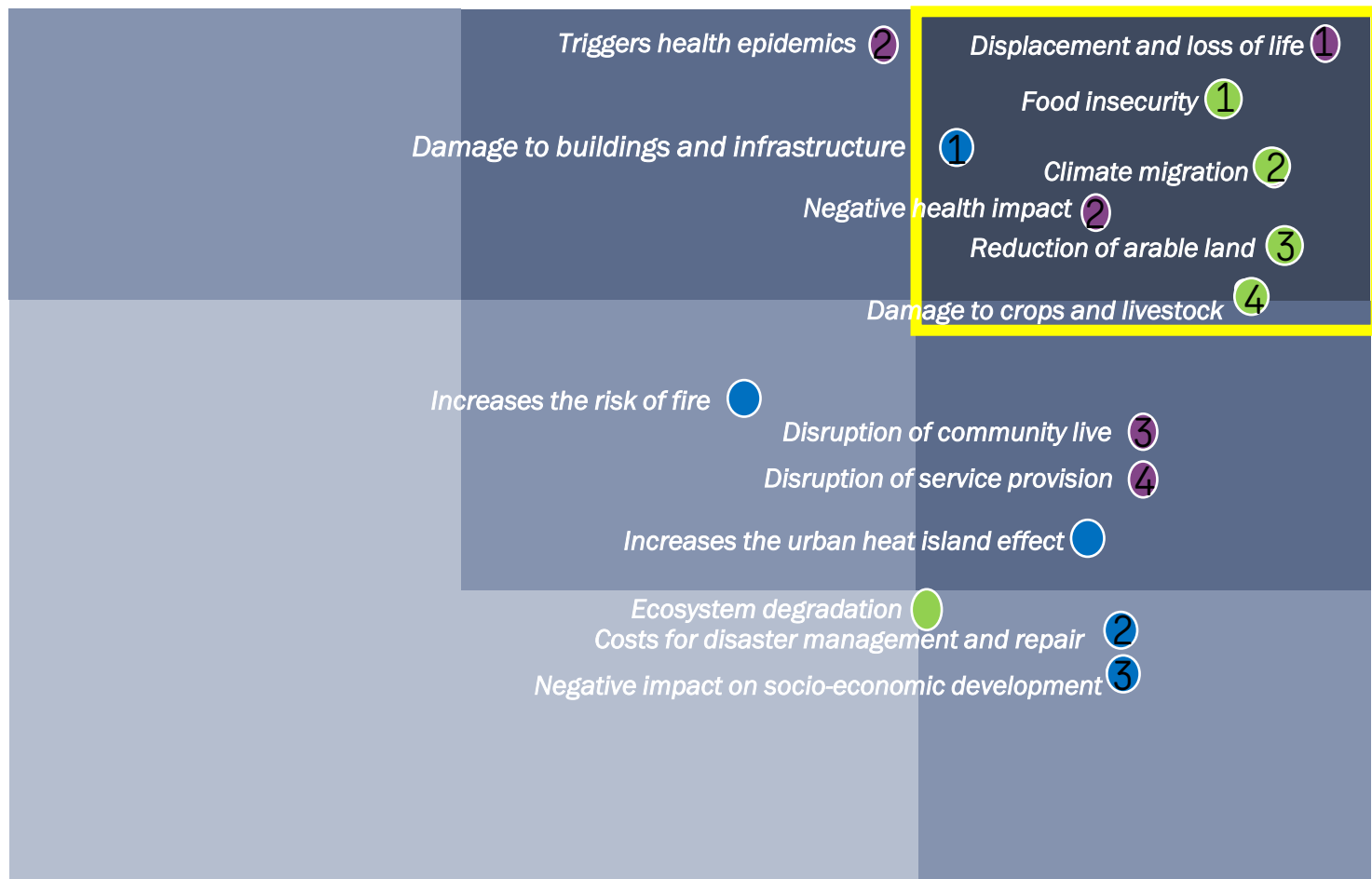
2 years

**Key
climate risks**

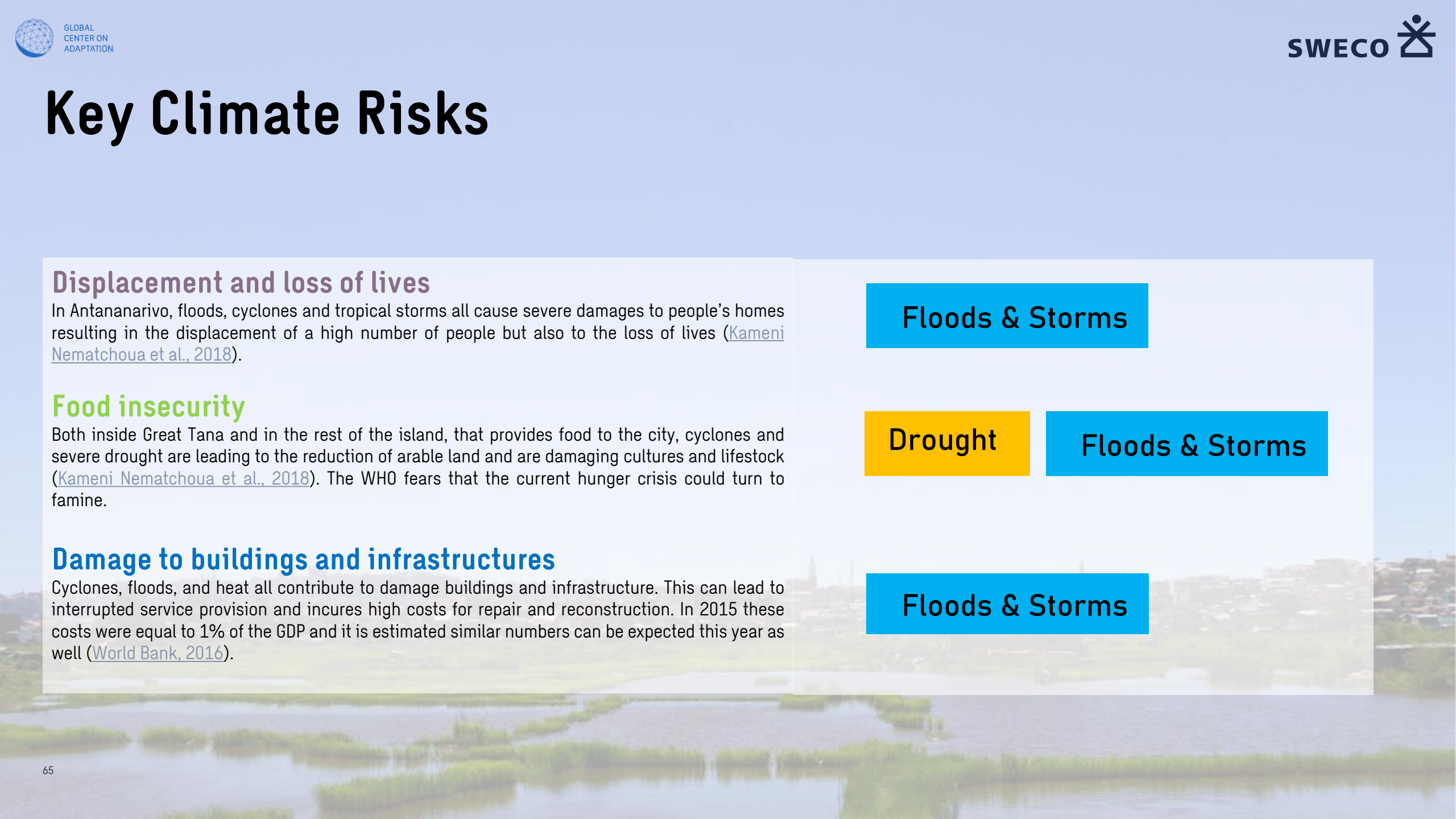
Disruptive

Nuisance

- Social
- Environment
- Economic



¹Note: the risks and their corresponding frequencies and impacts were identified during stakeholder interviews (see page 6 for the City Stakeholder Participation) . A selection of the top five risks was made based on the priorities set by the stakeholders.



Key Climate Risks

Displacement and loss of lives

In Antananarivo, floods, cyclones and tropical storms all cause severe damages to people's homes resulting in the displacement of a high number of people but also to the loss of lives ([Kameni Nematchoua et al., 2018](#)).

Food insecurity

Both inside Great Tana and in the rest of the island, that provides food to the city, cyclones and severe drought are leading to the reduction of arable land and are damaging cultures and livestock ([Kameni Nematchoua et al., 2018](#)). The WHO fears that the current hunger crisis could turn to famine.

Damage to buildings and infrastructures

Cyclones, floods, and heat all contribute to damage buildings and infrastructure. This can lead to interrupted service provision and incurs high costs for repair and reconstruction. In 2015 these costs were equal to 1% of the GDP and it is estimated similar numbers can be expected this year as well ([World Bank, 2016](#)).

Floods & Storms

Drought

Floods & Storms

Floods & Storms

Key Climate Risks

Negative health impact

The projected increase in the average annual temperature will result in many areas becoming more favourable to the transmission of climate-sensitive vector-borne diseases, including malaria, as well as dengue, chikungunya, and yellow fever ([Brand et al., 2016](#)). The potential disruption of service provision or inability to adequately dispose of wastewater can lead to waterborne diseases such as cholera, typhoid, amoebiasis, cyclosporiasis and giardiasis. There is a higher risk for respiratory and cardiovascular diseases ([Werner, 2004](#)).

Climate migration

As a result of cyclones, floods and drought a lot of people are fleeing the rural areas where farming seems to become more and more difficult. They come to the city to find better living conditions. These people tend to come to the informal settlements in the city, and the city is having difficulties providing them with even the most basic services such as water and sanitation ([Faist & Schade, 2013](#)).

Heat

Floods & Storms

Drought

Floods & Storms

No regret measures



No regret measures

Introduction

Adaptive capacity

For each of the key risks, **three supporting and challenging factors** were identified to get a first impression of the adaptive capacity of the city in relation to the key risks.

No regret measures

No regret measures have been identified through a literature study and during interviews for each of the key climate risks in the city. These are measures that help to adapt the city to a changing climate and the hazards that result from it. In the following pages examples of no regret measures are presented.





© Bosch Slabbers

Adaptive Capacity

Introduction

Adaptive capacity: according to the IPCC (2007) adaptive capacity is the potential or ability of a system, region, or community to adapt to the effects or impacts of climate change. Certain **factors support** or enhance this adaptive capacity providing practical means of coping with the impacts of climate hazards. Other **factors that further diminish the adaptive capacity can be challenging**.

Socio-economic 	Governmental 	Physical & Environmental 	Services 
Cost of living	Political stability	Rapid Urbanization	Access to basic services
Housing	Political engagement	Resource availability	Access to healthcare
Poverty	Government capacity	Environmental conditions	Access to education
Inequality	Budgetary capacity	Infrastructure condition	Public health
Unemployment	Safety and security	Infrastructure maintenance	
Migration	Land use planning	Infrastructure capacity	
Economic health	Access to quality / relevant data		
Economic diversity	Community engagement		

Examples of factors that depending on the local context can either enhance or diminish the city's adaptive capacity

Adaptive Capacity



Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Awareness	People are very aware of the problem. It is also cyclical and comes back year after year.	High
2. Government priorities	The national government has set up a cross-sectoral governance structure to ensure that climate adaptation is considered within all sectors. In addition, on the city scale a lot of importance is given to the coordination of stakeholders.	High
3. Plans and studies	The national government has made up a national climate adaptation plan. There are also several studies that are currently happening with regards to climate adaptation in Antananarivo.	High

KEY RISK:

Displacement and loss of lives



Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Poverty	Madagascar is the 4th poorest country in the world.	High
2. Inequality	Those most affected are the poor living in the low-lying informal settlements.	High
3. Rapid Urbanisation	The city grows with 100 000 new inhabitants per year, but the city is unable to follow pace.	Moderate

* Supporting degree is the level (high, moderate or low) to which the supporting factor contributes to reduce the impacts of the respective key risk. A challenging degree is the level (high, moderate or low) to which the challenging factor obstructs the process of reducing impacts of the respective key risk. These degrees have been defined by the city stakeholders.

Disaster evacuation planning

Explanation of no regret measure

During disasters this can contribute to an efficient and save evacuation, and refuge for affected communities. This is important because a lot of the informal settlements lack access to infrastructure and trails, making it difficult for people to evacuate during flooding.

Benefits of no regret measure

- + Enables an efficient and safe evacuation during floods.
- + It makes the settlement more accessible (heavier loads can be carried/transported) to provide services to these settlements (such as clean water, waste disposal etc.).

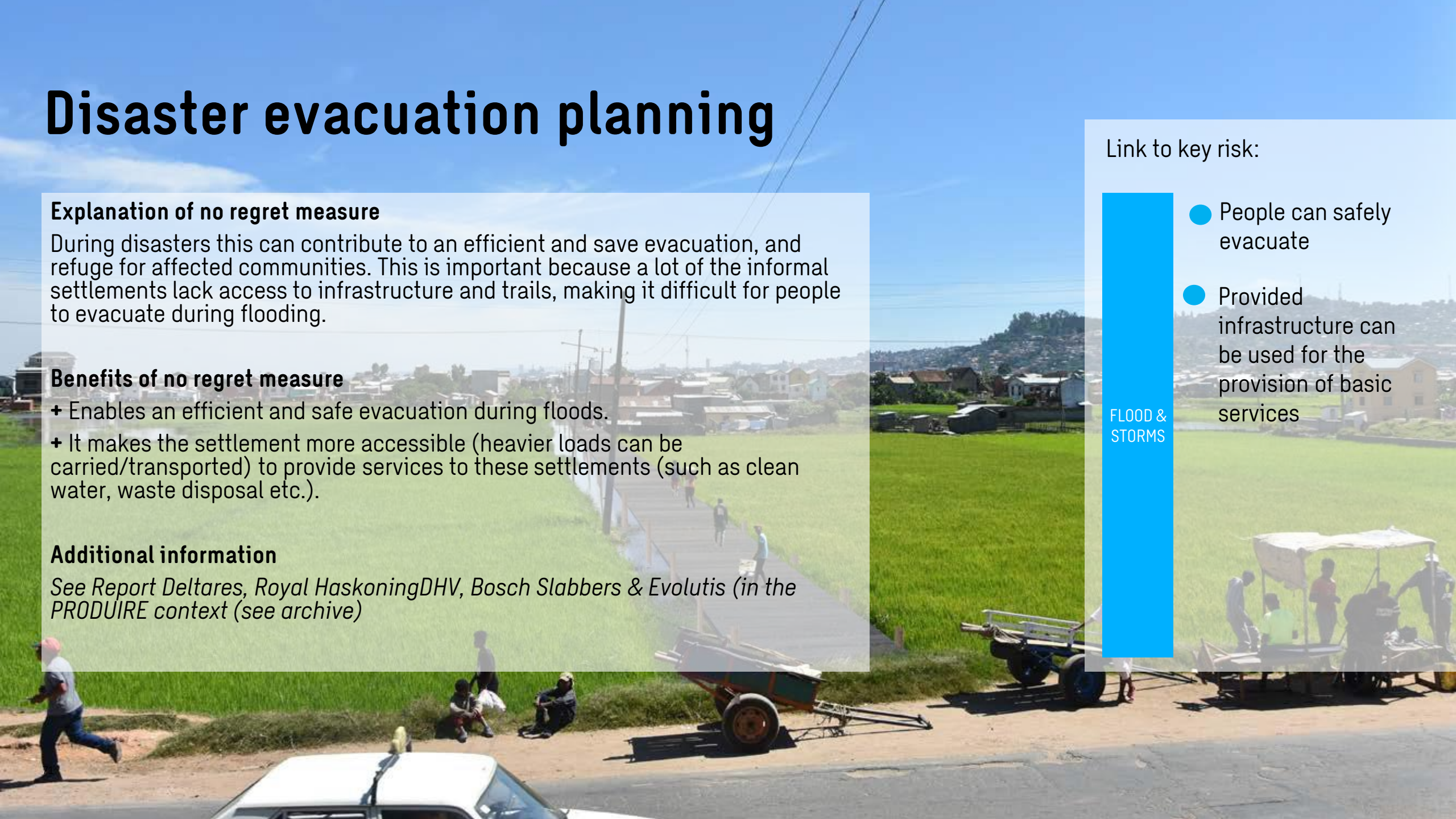
Additional information

See Report Deltares, Royal HaskoningDHV, Bosch Slabbers & Evolutis (in the PRODUIRE context (see archive)

Link to key risk:

FLOOD &
STORMS

- People can safely evacuate
- Provided infrastructure can be used for the provision of basic services



Adaptive Capacity

KEY RISK: Food insecurity



Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Urgency	Millions of people in Madagascar are facing famine.	High
2. Readiness of international community	Many international aid agencies are already on the ground and are preparing for a difficult year ahead.	High
3. Existing programmes	Today there are already examples of climate adaptive agriculture programmes, which can be up-scaled.	High



Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Poverty	Madagascar is the 4th poorest country in the world.	High
2. Inequality	Those most affected are the poor living in the low-lying informal settlements.	High
3. Rapid Urbanisation	The city grows with 100 000 new inhabitants per year, but the city is unable to follow pace.	High

* Supporting degree is the level (high, moderate or low) to which the supporting factor contributes to reduce the impacts of the respective key risk. A challenging degree is the level (high, moderate or low) to which the challenging factor obstructs the process of reducing impacts of the respective key risk. These degrees have been defined by the city stakeholder.

Micro- (drip) irrigation

Explanation of no regret measure

Adaptation of irrigation practices in a future-proof and climate adaptive way. Micro-irrigation kits are distributed at a low cost to smallholder families. Each unit is able to irrigate 100 – 400 m² of land. Currently two small companies oversee manufacturing and distribution.

Benefits of no regret measure

- + Increases food security by ensuring an efficient use of available water during drought.
- + Affordable: for a smallholder family investment costs are paid back after one growing season.
- + Higher revenues: micro-irrigation reduces the water demand and increases yields.

Additional information

[See The Scampis project – funded by FIDA by COOPERNIC](#)

Link to key risk:



HEAT

- Increases the available arable land



DROUGHT

- Increases food security
- Improves health

Adaptive Capacity

KEY RISK:

Damage to buildings and infrastructure



Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Criticality of infrastructure	Some of the infrastructure is critical to the functioning of the city. This makes it a priority when it comes to investing the limited budget available or receiving funding (for example: the road access to bring fuel and food to the city).	High
2. Current investments	There are currently different projects such as the PIAA and PRODUIRE projects that are investing into infrastructure.	High
3. Recurrent problematic	Considering the cyclone and flooding season every year, there are structures and processes in place.	High



Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Informality	The buildings in informal settlements do not fulfill the building standards as they are built with sub-par materials. This makes them extra vulnerable.	High
2. Unmaintained infrastructure	A majority of the infrastructure has not adequately been maintained over the years. Much damage that was caused by cyclones years ago has still not been repaired.	High
3. Poverty and a lack of resources	Madagascar is the 4th poorest country in the world. Furthermore, the city of Antananarivo has a very limited budget to invest into maintenance and repair.	High

* Supporting degree is the level (high, moderate or low) to which the supporting factor contributes to reduce the impacts of the respective key risk. A challenging degree is the level (high, moderate or low) to which the challenging factor obstructs the process of reducing impacts of the respective key risk. These degrees have been defined by the city stakeholder.

Improving water and sanitation infrastructure

Explanation of no regret measure

The lack of waste water treatment, stagnating water and recurrent floods are the core of public health problems in Antananarivo.

Benefits of no regret measure

- + The reduction of waterborne diseases
- + The reduction of flooding instances

Additional information

See PIAA financed by the AFD

Link to key risk:

FLOOD &
STORMS

- Reduction of water borne diseases
- Reduction of flooding instances

DROUGHT

- Improved water quality and quantity even in periods of drought

Adaptive Capacity

KEY RISK:
Negative health impact



Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Urgency	Madagascar is facing a large health crisis.	High
2. Readiness of international community	Many international aid agencies are already on the ground trying to tackle these health problems.	High
3. Existing programmes	There are many programmes investing into public health (including in corona).	High



Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Malnutrition	Malnutrition is a problem in Madagascar and already weakens peoples immune system.	High
2. Poverty	Madagascar is the 4th poorest country in the world. Due to poverty people have to live in unhygienic conditions and cannot afford treatment.	High
3. Lack of adequate waste management	Especially in the informal settlements, a lot of waste is simply thrown in the drains and rivers. There is also no wastewater treatment.	High

⁷⁶ * Supporting degree is the level (high, moderate or low) to which the supporting factor contributes to reduce the impacts of the respective key risk. A challenging degree is the level (high, moderate or low) to which the challenging factor obstructs the process of reducing impacts of the respective key risk. These degrees have been defined by the city stakeholder.

Nature based solutions

Explanation of no regret measure

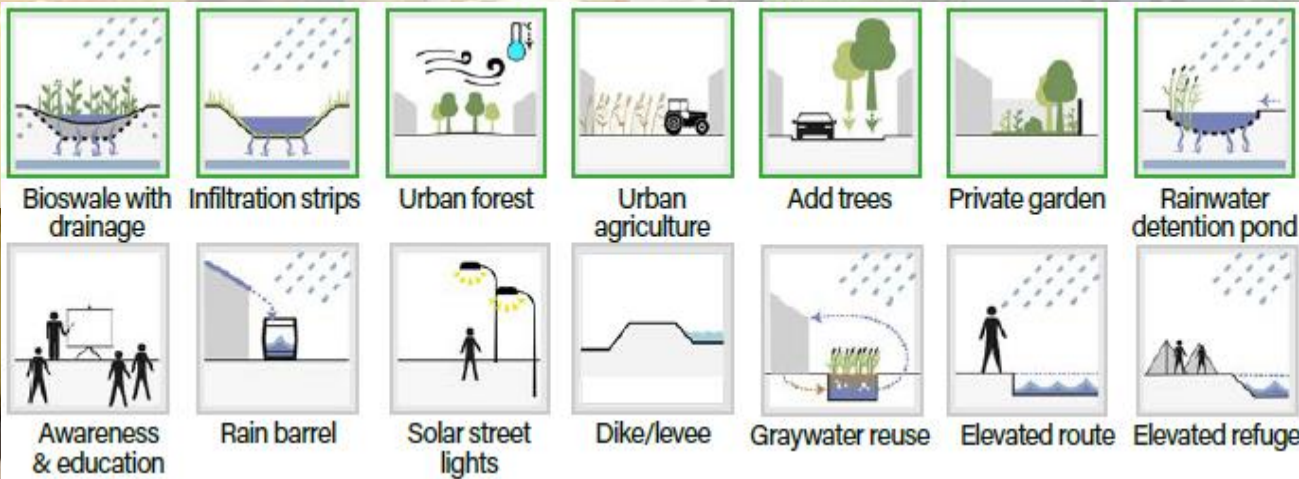
Nature-based Solutions (NbS) present an opportunity to address the challenges in a resilient and inclusive way.

See World Bank Report (archive)

Benefits of no regret measure

- + This enables to mitigate the urban heat island effect.
- + Increases water retention capacity during floods and storms.

Additional information



Link to key risk:

HEAT

- Reduces heat stress
- Reduces the urban heat island effect

FLOOD & STORMS

- Increases water retention capacity during rain events
- Has a positive health impact

DROUGHT

- Reduces water scarcity

Adaptive Capacity

KEY RISK: Climate migration



Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Awareness	In all our interviews with officials, it turned out that the issue of climate migration is a priority.	High
2. The City Action Plan (2025-2040)	In this plan it is proposed to make Antananarivo a polycentric, inclusive, resilient and green capital. These ambitions could provide a solution to the problem.	High



Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Climate change	In Madagascar cyclones, increasing temperatures and more intense periods of droughts are causing hazards in the rural areas. Many people cannot live of farming anymore.	High
2. Lack of funds (City)	The city lacks the funds to provide adequate services to everyone migrating to the city.	High
3. Inequality	These people move to the low-lying informal settlements, where they are more vulnerable to climate hazards.	High

⁷⁸ * Supporting degree is the level (high, moderate or low) to which the supporting factor contributes to reduce the impacts of the respective key risk. A challenging degree is the level (high, moderate or low) to which the challenging factor obstructs the process of reducing impacts of the respective key risk. These degrees have been defined by the city stakeholder.

A polycentric, inclusive and resilient vision

Explanation of no regret measure

In the city's action plan toward 2040 a vision is proposed that can help solve the city's demographic, socio-economic and climatic challenges. Antananarivo expects to double its population in the next twenty years, which means that the city needs to adapt in an inclusive and resilient way.

Benefits of no regret measure

+ By having numerous centers, the urban growth can be directed away from the flood plains. Incoming migrants can settle in other areas when job employment and affordable housing opportunities are provided.

Additional information

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

Link to key risk:



HEAT

- Reduces heat stress



FLOOD & STORMS

- Increased water retention capacity during rain events
- Less people living in the most vulnerable areas



DROUGHT

- Better living conditions for incoming migrants

**Past & planned
investments**



Passed and Planned Investments

Introduction

Past and Planned Investments

Please look at Annex 3 to see a full overview of identified past and planned investments. This overview shows what is happening in the city and what the next steps will be.

Here we have made a selection of what we consider the five most relevant past investments

1. Integrated Urban Development and Resilience Project PRODUIRE in Antananarivo (IDA – 75 million).
2. PIAA-SDAA Urban And Sanitation Master Plan for Antananarivo (FDA – 28 million).
3. ADAPT'ACTION setting up a national climate adaptation policy and governance framework (AFD, 30 million).
4. SUNREF mobilising the financial sector to invest into climate change (adaptation).
5. ANTANANARIVO Vision 2040 (2025-2040) (AfDB ,2021).

Identified as the ***most relevant planned investment:***

6. Setting up a city climate adaptation policy and plan.



**Past
investments**





13 CLIMATE ACTION



1. Integrated Urban Development and Resilience Project - PRODUIRE

Flood and drought risk management

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Enhance urban living conditions and flood resilience in selected low-income neighbourhoods of the Greater Antananarivo	The aim is to improve living conditions in the “PRODUIRE” area	75 million USD Funding: The World Bank	2019-2023
LINK: https://www.produir-madagascar.mg/			



13 CLIMATE ACTION



1. Integrated Urban Development and Resilience Project - PRODUIRE

Flood and drought risk management

ACTORS INVOLVED & IMPLEMENTING AGENCIES	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
Ministry of Land Management and Public works (MATSF), CUA, AGTIPA (works), APIPA, SMA	<i>The importance of considering the most vulnerable parts of the population</i>	Community engagement is a priority in this project. The development of a formal stakeholder engagement plan and best practice activities, including support for municipal consultation mechanisms, are integrated into the various stages of the project.	The project site is specifically relevant for the most vulnerable groups in Antananarivo. A resettlement site for affected populations is also included.



6 CLEAN WATER
AND SANITATION



2. PIAA-SDAA URBAN AND SANITATION MASTER PLAN - ANTANANARIVO

Improved spatial planning & water, sanitation and solid waste management

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Investments into urban sanitation, of which 2.000.000 people will benefit by 2037 LINK: http://piaa.mg/	To use the master plan as a tool in the decision-making processes for the Urban Municipality of Antananarivo	28 million Euro Funding: AFD & EU	2016-2022



6 CLEAN WATER
AND SANITATION



2. PIAA-SDAA URBAN AND SANITATION MASTER PLAN - ANTANANARIVO

Improved spatial planning & water, sanitation and solid waste management

ACTORS INVOLVED & IMPLEMENTING AGENCIES	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
Urban Municipality of Antananarivo (CUA), Ministry of Land Management and Public Works (MATSF), Ministry of Water, Sanitation and Hygiene (MEAH), MEF, MID, APIPA, SMA, BRL, BEST, MOIS, SOGEA, CARE, AGTIPA (works),	<i>The city is growing faster than the infrastructure can handle</i>	The public authorities responsible for the maintenance of the infrastructure are not sufficiently coordinated and have a very limited budget	Collective sanitation projects will be carried out. Rehabilitation of infrastructure in some of the informal neighbourhoods.





13 CLIMATE
ACTION



3. Facilitation ADAPT'ACTION

Flood and drought risk management

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Design of structural and transformational climate programmes and projects	Translation of the National Climate Adaptation Plan into sectoral public policies and action plans	30 million euros Funding: AFD, Expertise France	2017-2021



13 CLIMATE ACTION



3. Facilitation ADAPT'ACTION

Flood and drought risk management

ACTORS INVOLVED & IMPLEMENTING AGENCIES	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
MEDD, RAMBOLL, BN-CCREDD+	<i>The importance of considering the most vulnerable parts of the population</i>	Participation with official stakeholders and ministries.	Focusing on climate adaptation is focusing on the country's most vulnerable groups as they are specifically impacted by cyclones, floods and drought.





13 CLIMATE ACTION



4. SUNREF

Flood and drought risk management

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Mobilising the financial sector to invest into climate change (adaptation)	In line with the SUNREF model, the project will strive to create a supply of "green" financing by working with banks and a demanding credits that can support these businesses.	33 million euros Funding: AFD, EU, EIB, European Bank for reconstruction and development, UK Department for international development & the Swiss SECO.	2017-2021



13 CLIMATE ACTION



4. SUNREF

Flood and drought risk management

ACTORS INVOLVED & IMPLEMENTING AGENCIES	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
Burgeap, Solidis, GRET Private sector and Madagascar's financial industry	Risk reduction and insurances (also for the most impoverished)	Participation with stakeholders and ministries.	Including a focus on small-scale agriculture





11 SUSTAINABLE CITIES
AND COMMUNITIES



5. Diagnostic + ANTANANARIVO Vision 2040 (2025-2040)

Better Spatial Planning

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Vision for the city towards 2040	Antananarivo as polycentric, inclusive, resilient and green capital	100 000 USD Funding: The AfDB	2020-2021



11 SUSTAINABLE CITIES
AND COMMUNITIES



5. Diagnostic + ANTANANARIVO Vision 2040 (2025-2040)

Better Spatial Planning			
ACTORS INVOLVED & IMPLEMENTING AGENCIES	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
Citylinks/ Madexpertise International	The vision starts with a diagnostic of the city in which the challenges and solutions are analysed.	The process through which the vision has been developed is not clear.	The city's main challenges impact the most vulnerable parts of the population most. Thus, the proposed solutions also consider this part of the population, by taking into account the informal economy, need for affordable housing etc.



**Planned
investments**





13 CLIMATE
ACTION



6. A CLIMATE PLAN FOR ANTANANARIVO

Flood and drought risk management

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Setting up a climate policy and plan for the city of Antananarivo	The aims are to: <ul style="list-style-type: none">- Set up a policy framework- Set up an action plan- These can then be used as tools to guide decision making and fund searches	75 million dollar Funding: AFD and EU	2022



13 CLIMATE
ACTION



6. A CLIMATE PLAN FOR ANTANANARIVO

Flood and drought risk management

ACTORS INVOLVED & IMPLEMENTING AGENCIES

CUA

LESSONS LEARNED

A lot of studies and maps already exist. The hazards and future vision are clear. The next steps consist of the formalisation and identification of following actions.

COMMUNITY ENGAGEMENT

TBD

SUPPORT TO VULNERABLE GROUPS

As the most vulnerable groups are specifically affected by climate hazards, investing into a climate plan will benefit them.



Acknowledgements



Acknowledgement

Our local consultant

A special thanks goes out to our local partner

Angèle Randrianaivo arazafinombana@yahoo.fr



Annexes



Annexes

Annex 1: Antananarivo – Climate Hazard Identification.xlsx

Annex 2: Antananarivo – Climate Sector Impact Identification.xlsx

Annex 3: Antananarivo – Overview Past and Planned projects.xlsx

Annex 4: Antananarivo – Interview minutes

Annex 5: Antananarivo – Key documents

1. PNA, 2021
2. Urban Diagnostic, 2021
3. PRODUIR – nature based solutions, 2021
4. Building Urban Resilience to climate change, 2012
5. Vision 2025-2040



GLOBAL
CENTER ON
ADAPTATION

