

City Scoping and RCRA for Urban Africa

Conakry



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Methodology

- Part A– City Scan was conducted in February 2022
- Field mission in Conakry (7-11 March 2022) covering parts B & C
- Methodology based on:
 - Key informant interviews and workshops
 - GIS analysis and use of open data (Part B)
 - Climate Risk Assessment approach developed by C40 Cities Climate Leadership Group
 - Operational approach: elaboration of project sheets in discussion with stakeholders to guide investments
- Key stakeholders met:
 - Governorate
 - Ministère de l'environnement
 - Centre de protection du milieu marin et de la zone côtière
 - Direction nationale de la météorologie)
 - Centre nationale des ressources halieuthiques
 - Centre national de gestion des catastrophes et urgences environnementales
 - Association des maraichaires de Sonfonia
 - Ministère de l'urbanisme, de l'habitat et de l'aménagement du territoire

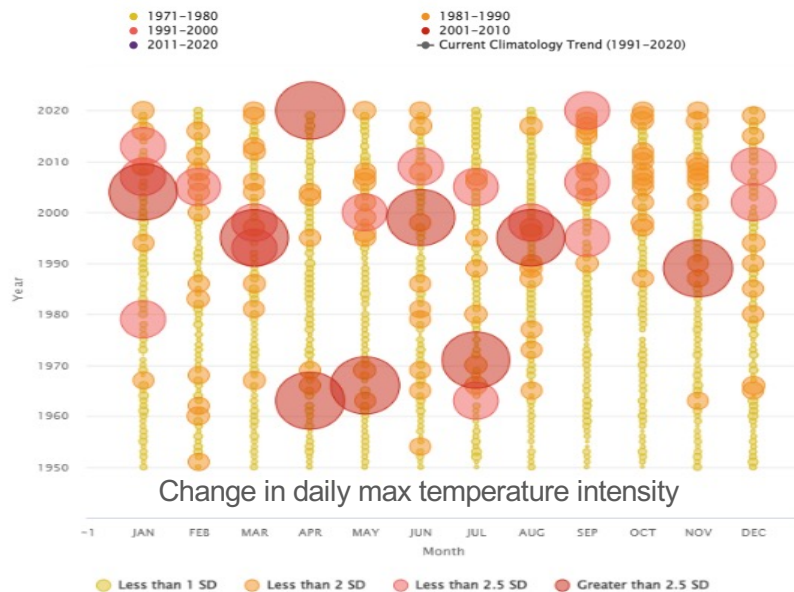
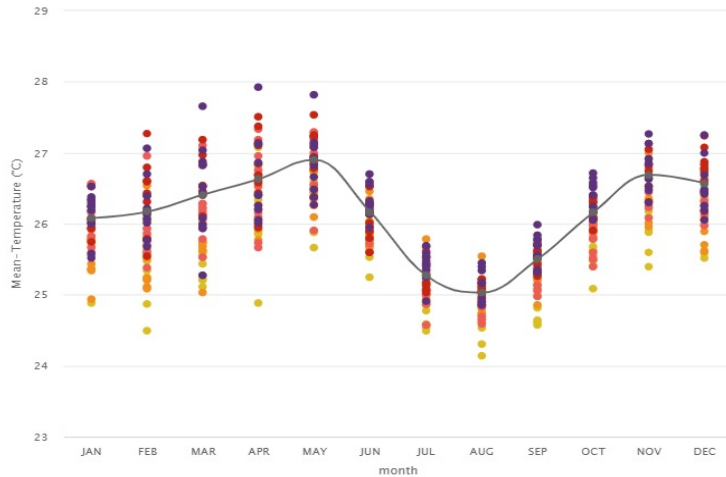
Rapid Climate Risk Assessment

Hazard analysis

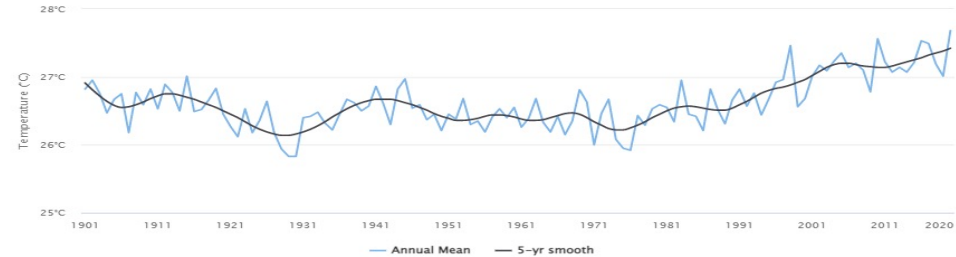
Physical parameters – recent evolution



Variability and Trends of Mean-Temperature across Seasonal Cycle, 1971-2020; Conakry, Guinea



Observed Average Annual Mean-Temperature of Conakry, Guinea for 1901-2020



Temperature

- Increase of 2 to 4 degrees depending on the month over the past 5 decades
- Average annual mean temperature: clear increasing trend starting from 1970 / +1.3°C between 1981 and 2021
- Increase of intense events in daily max temperature intensity starting in the 90s
- **Projection:** +1.4°C by 2035 and +2.5°C by 2060 / Increase in daily maximum temperature +4°C by 2060

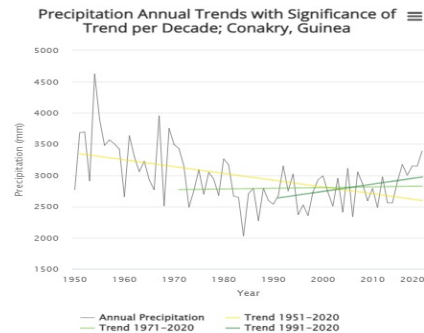
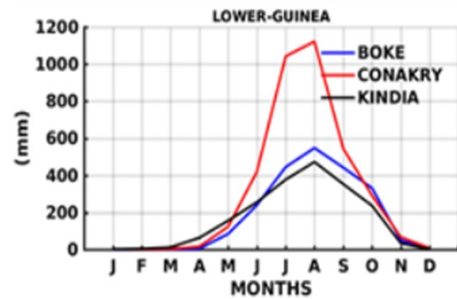
Hazard analysis

Physical parameters – recent evolution

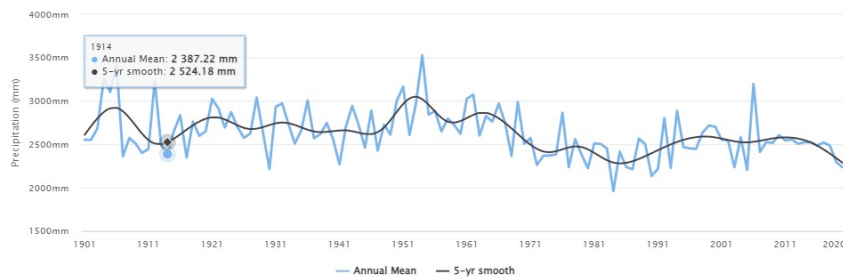


Precipitations

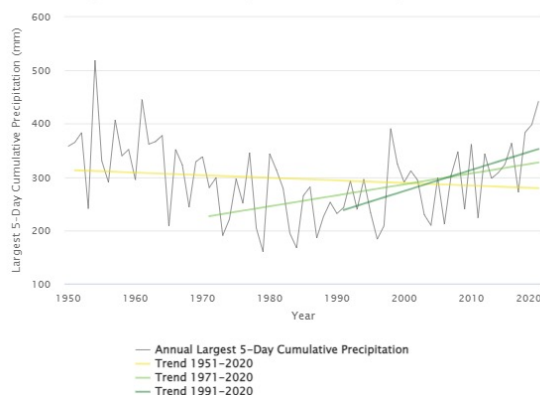
- Rainfall concentrated between June to September
- Annual trends over 1951-2020 show a decrease over the full period. However, there is an increase over the period 2000-2020
- Increase of intense events with largest annual 1- and 5-day rainfall increasing since 70s, with an acceleration over the past two decades
- Increase of droughts events, with the decrease of the number of wet days
- Projection: high-level of uncertainties in all scenarios



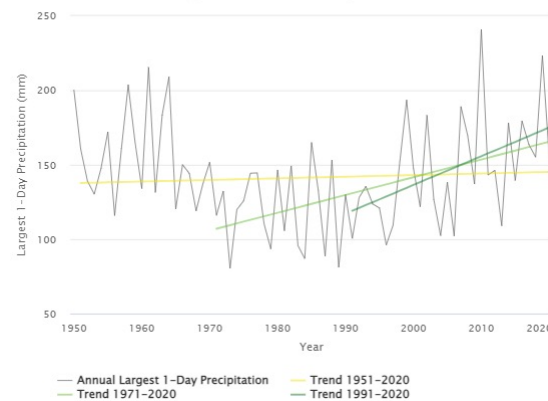
Observed Average Annual Precipitation of Conakry, Guinea for 1901-2020



Largest 5-Day Cumulative Precipitation Annual Trends with Significance of Trend per Decade; Conakry, Guinea



Largest 1-Day Precipitation Annual Trends with Significance of Trend per Decade; Conakry, Guinea



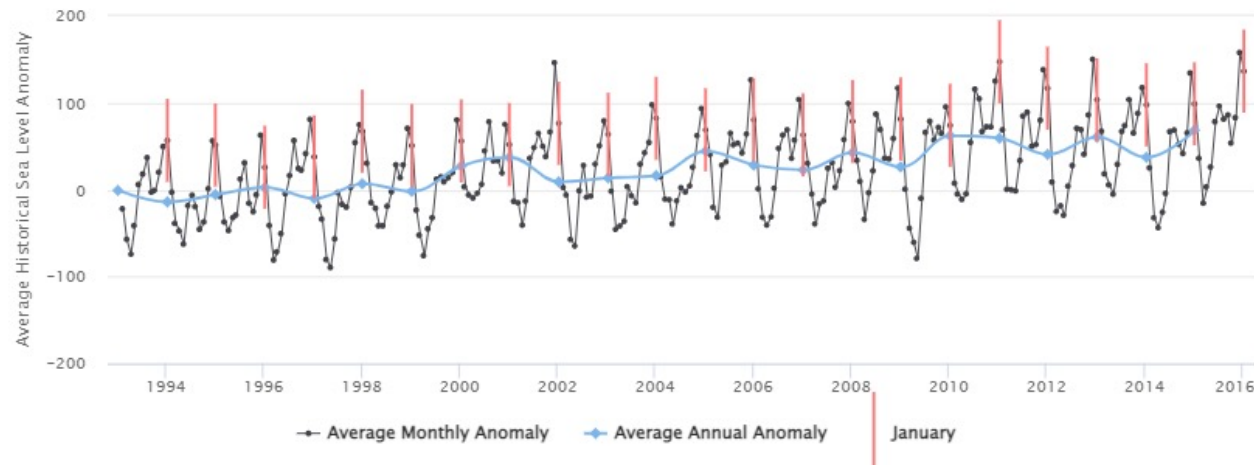
Hazard analysis

Physical parameters – recent evolution



Historical Sea Level for coastal Guinea (1993-2015)

observed anomalies relative to mean of 1993-2012

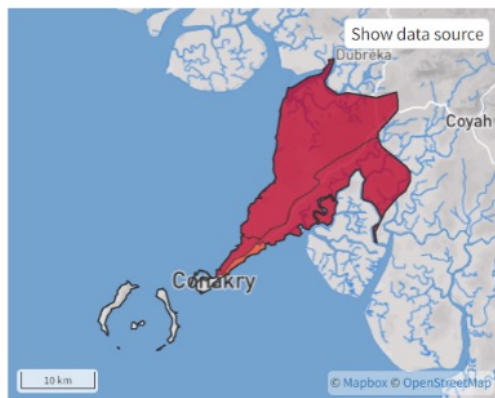
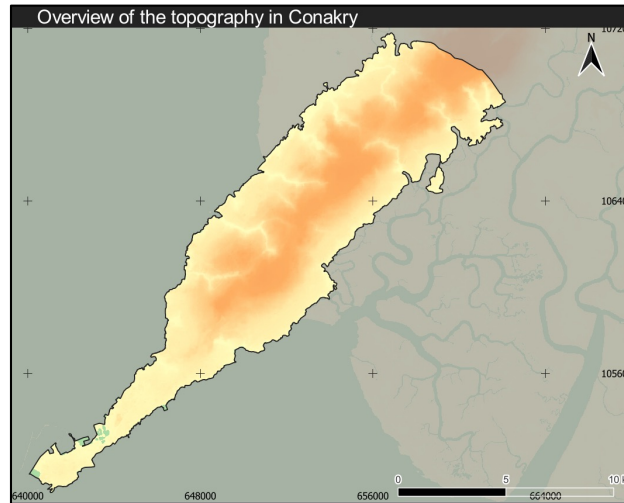
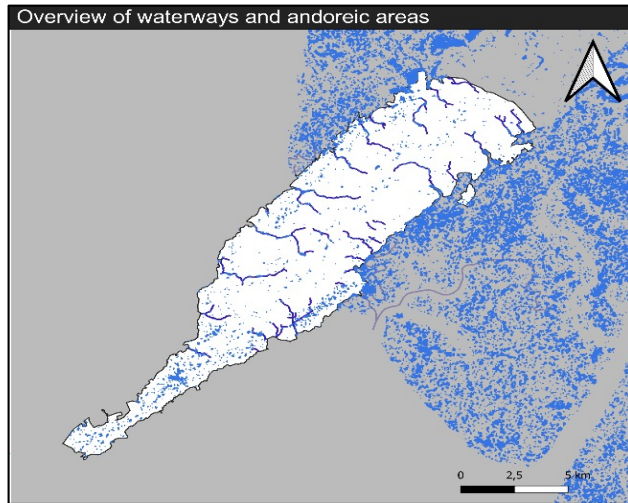


Sea water level rise

- Increase in the sea water level over the period 1993-2015, with an average annual increase of 2.59mm/year
- Projection: **+0.4m** by 2070

Hazard analysis

Floods



- Increase of heavy rainfall events and high tides
- Low topography of the shoreline, city entirely located on a peninsula
- Numerous low-lying areas and endorheic zones in the city
- Coastal flooding hazard is classified as high (*Think Hazard*)
- Numerous and increasing flooding events in the past years, classified as n°1 hazards during consultations
- Intensifying factors: poor waste management, lack of correctly designed drainage network, informal constructions in flood prone areas

Hazard analysis

Coastal erosion



- Coastline recession reaches 85cm/year
- Increasing strength and frequency of storms and sea level rise
- Enhanced by buildings on embankments, obstruction of rivers that drag sediments, destruction of the mangrove
- Recent events: some buildings (schools) are washed away; the corniche road needs rehabilitation every year
- Beaches are disappearing



Hazard analysis

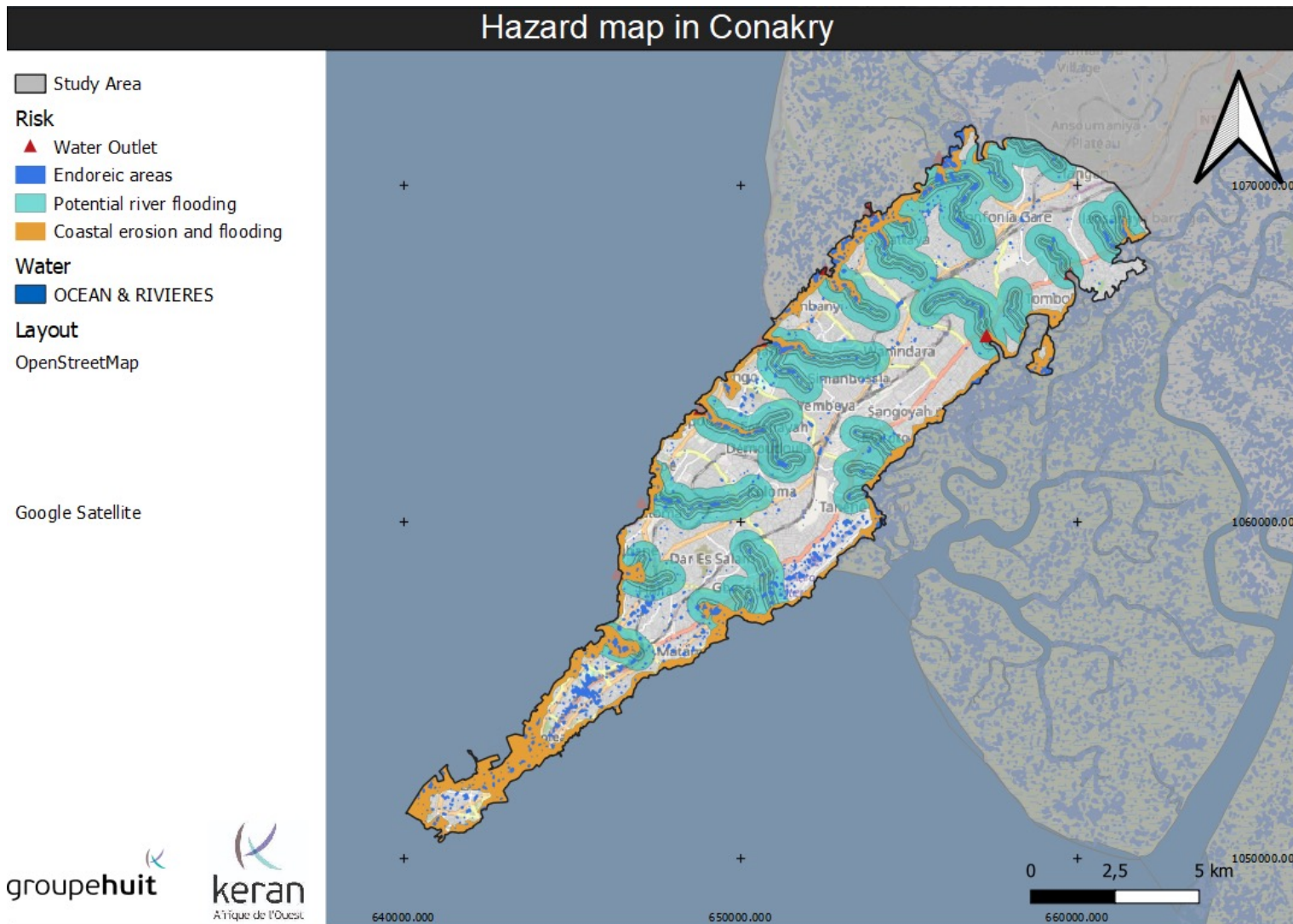
Water scarcity



- Decrease of water availability: decrease of annual rainfall, soil waterproofing, and water salination
- Water supply central system covers about half of the population, the other half using boreholes, wells, water cans, natural springs especially in precarious neighborhoods > increased and uncontrolled use of water sources
- Water supply central system source is the Grandes Chultes Dam. Transfer and treatment capacities have been expanded by the Urban Water Project funded by the World Bank.
- Very limited data on the actual quantities of water available in the water tables. Increasing demand
- Heat waves: classified as medium (Think Hazard), loss of natural spaces and obstruction of marine air circulation axes by high buildings on the shoreline conduct to heat islands in the four corners of the city
- Water salination: reported to become progressively saltier in the estuary (but no data), impacting the mangrove ecosystem, and the biodiversity it supports

Hazard analysis

Synthesis



Exposure and vulnerability

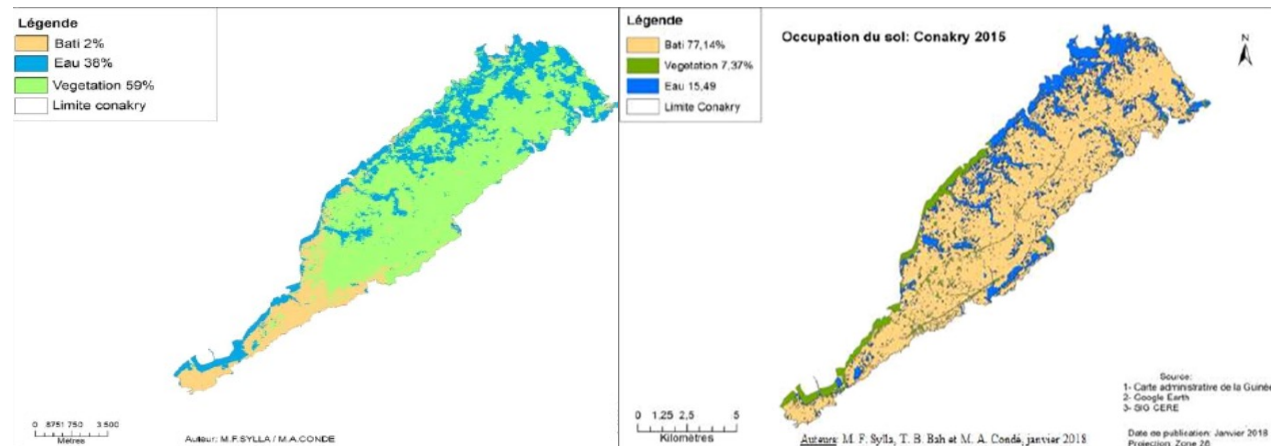
Impacts on environment and natural resources



- **Land / Shoreline:** high vulnerability of coastline due to sea level rise and strong erosive pressure
- **Water:** little information. Pressure on water resources due to decrease in annual rainfall, evaporation, and anthropogenic reasons (waste pollution, pumping in the water tables, ...)
- **Ecosystems** (forest, mangrove, green spaces): highest temperature and salination destroy local ecosystems. Significant pressure due to urbanisation on natural ecosystems



Land use in 1975 and 2015: disappearance of the vegetation cover



Exposure and vulnerability

Impacts on economic activities / assets

- **Fishing activities:** 3% of the population in Conakry; fishing resources impacted by water temperature increase, increased turbidity (bad waste management), destruction of ecosystems. Fishermen have to go every year a little further to keep their activity profitable.
- **Agriculture:** impacted by disruption of rainfall patterns (more intense and sometimes destructive), and by water availability reported by local farmers, including decline in soil fertility (salination of ground water)
- **Industrial areas:** little info on the industrial fabric, located and scattered within the urban area. During flooding episodes, many economic and industrial activities are at a standstill, with traffic being impossible. Increased risk in case of natural disaster with the concentration of dangerous materials (fuel, etc) in highly populated areas.

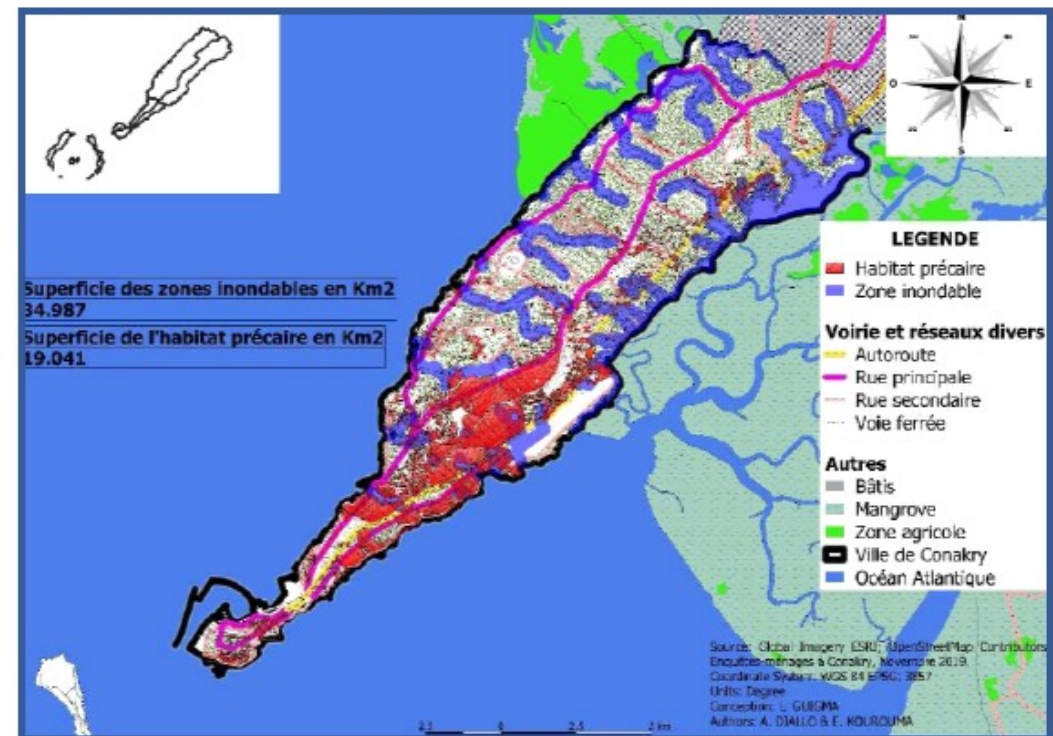


Exposure and vulnerability

Impacts on people

- **Habitat:** floods and coastal erosion destroy people habitat and threaten their quality of life, causing accidents, disrupting delivery of public basic services
- **Income:** people incomes are vulnerable to climate impacts on economic activities (fishery, agriculture, industries)
- **Water:** drinkable water availability is a significant issue for a large part of the population
- About **30%** of the urban population in Conakry lives below the poverty line, and more than **2/3 live in precarious neighborhoods: they are the most vulnerable people to climate hazards**

Vulnerable areas (precarious housing / flood)



Exposure and vulnerability

Intensifying factors

- **Urban regulatory framework:** lack of urban planning and lack of enforcement of existing rules. Spontaneous urbanisation in flood-prone areas, for instance on river banks. Earth filling in wetlands for urban development projects, blocking the natural recipients of surplus water in case of heavy rainfall.
- **Mangrove wood exploitation:** only ¼ of the population is connected to the electricity network, the rest use firewood (often from mangrove wood). Mangrove wood is also used to smoke fish and to dry salt.
- **Agriculture practices:** extensive production system. Clearing of large areas at the expense of the mangrove forest.
- **Lack of sanitation:** less than half of the population has conventional sewage disposal system (septic tanks). Poor solid waste collection and disposal. Contribute to pollution of the marine environment, of the groundwater, and of flooding (blockage of drainage pipes and riverflows).
- **Uncontrolled drilling** (domestic and industrial use): difficult to control the drinking water resource, make it vulnerable to pollution, pumping creates a phenomenon of subsidience, cracks in buildings, landslides.

Housing program



Exposure and vulnerability

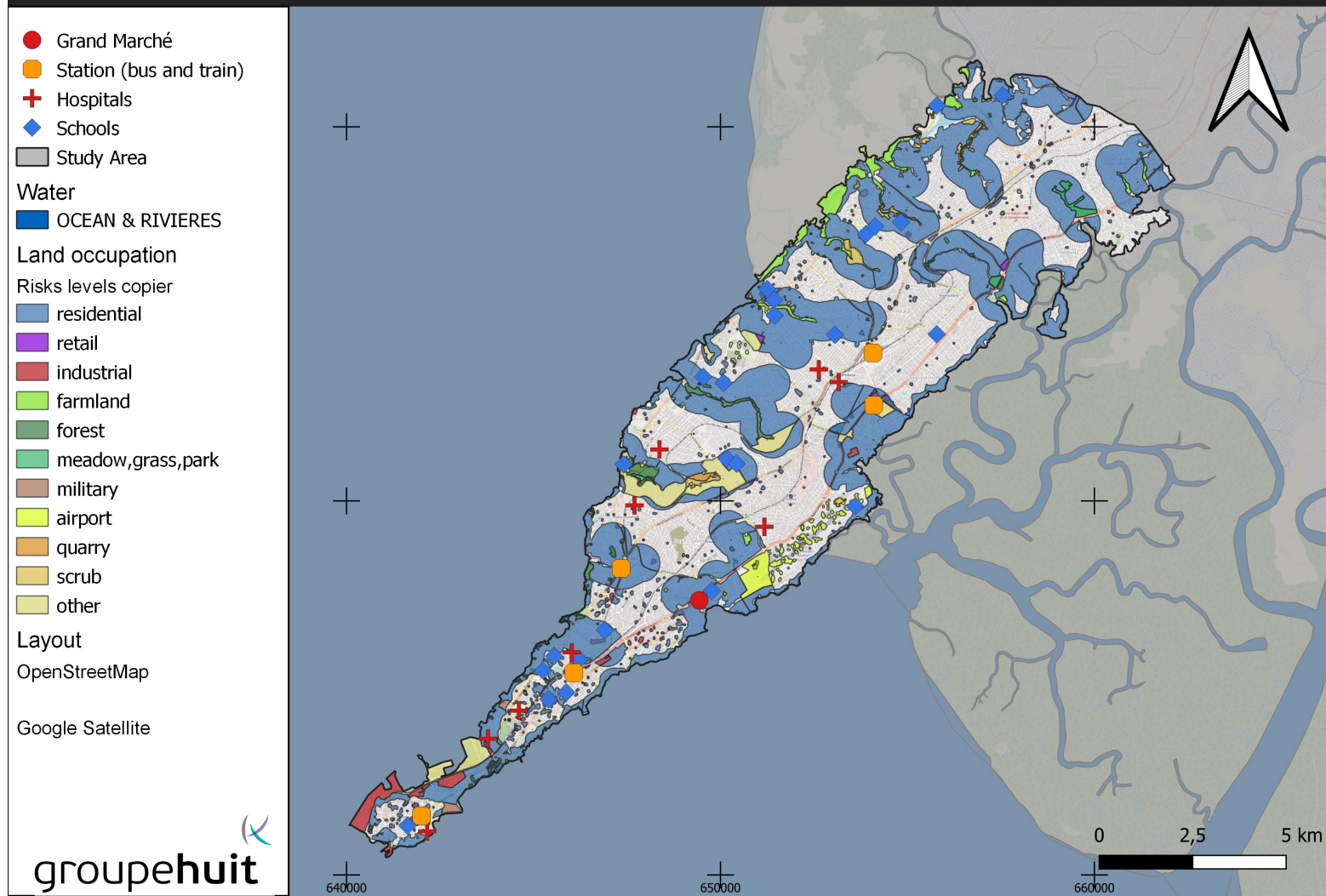
Adaptation capacities

- **Institutional level:** overall very weak capacities both regarding the legal and operational documents and regarding the institutional structures and their means of actions. lack of coordination and visibility in current and future projects. Difficulties in enforcing laws and no binding tools for land use.
- **Individual level:** little initiatives and knowledge of climate hazards and individual actions to adapt to it. At the private sector level, dynamics are sometimes in opposition with the logic of adaptation, for instance real estate programs in swampy areas are commonplace in Conakry.

Exposure and vulnerability

Synthesis







Map of land use in the hazard prone areas of Conakry



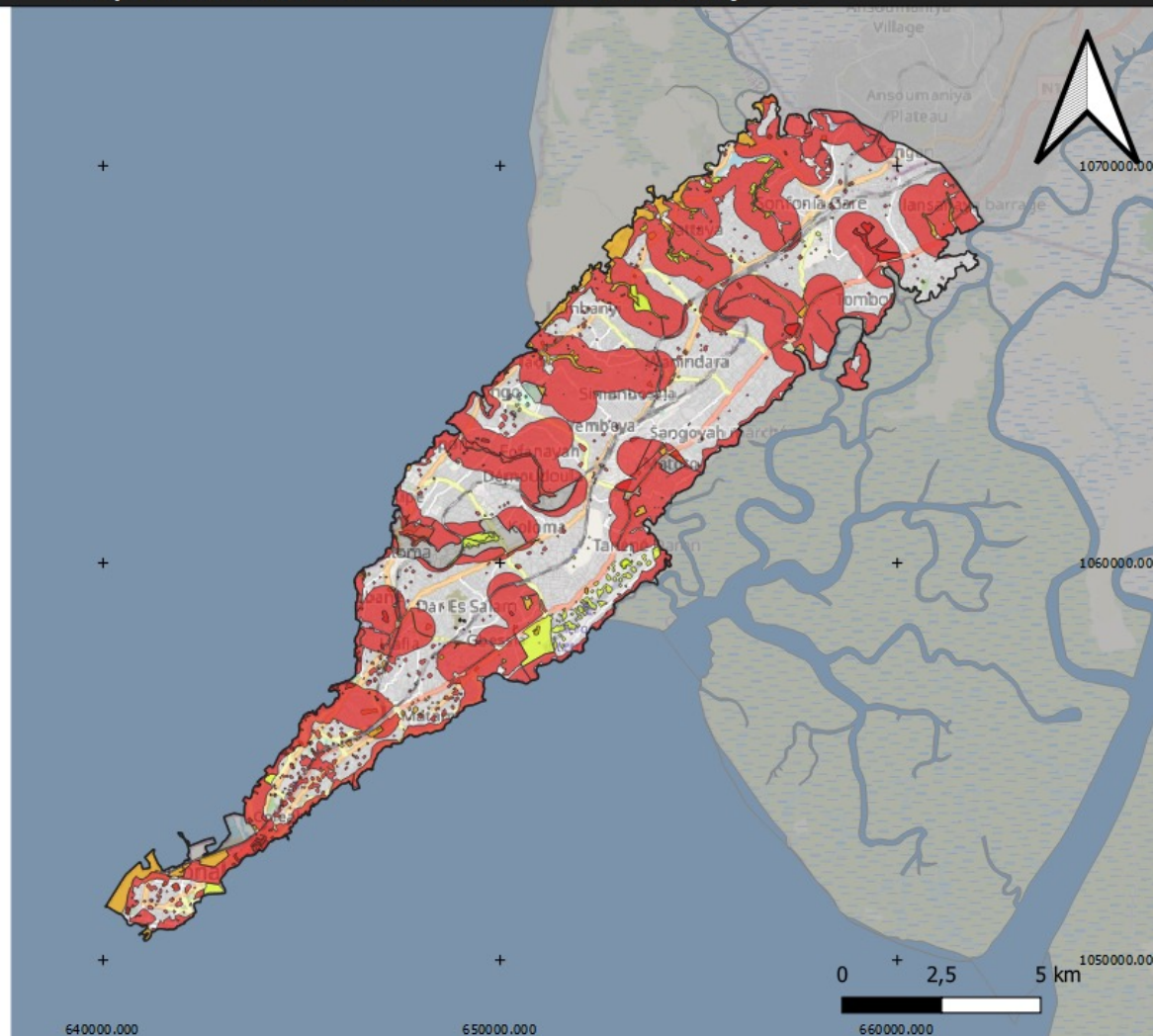
Risk assessment

Climate related risks

Map of climate-related risks in Conakry

-  Study Area
- Water**
-  OCEAN & RIVIERES
- Land occupation**
- Areas at risk
-  High Risk
-  Medium Risk
-  Low Risk
-  other
- Layout**
- OpenStreetMap

Google Satellite



Risk assessment

Risk identification

| Risk identification matrix | | Vulnerability | | | | | | | | |
|----------------------------|-----------------------------------|------------------------|-------------------------------|---------------------------|-------------------------------|--------------------------------|----------------------|----------------------------|----------------|----------------------------|
| | | Environment | | | Economy | | | People | | |
| | | Land | Water | Ecosystem | Fishing | Agriculture | Industrial | Human | Human | Human |
| Exposure to hazards | <i>Floods</i> | Loss of available land | Pollution of water | Destruction of ecosystems | Destruction of ecosystems | Loss of available land | Industrial accidents | Loss of available land | Health impacts | Loss of economic resources |
| | <i>Coastal erosion</i> | | | | | | | | | |
| | <i>Water scarcity, salination</i> | | Decrease of quantity of water | | Decrease of quantity of water | Increase in raw material costs | | Health impacts (Sunstroke, | | |

| Impacted entities | Risks considered |
|------------------------------------|---|
| Environmental Resources | Loss of available land Pollution of water tables and sea water Decrease of quantity of water available Destruction of ecosystems |
| Economy and infrastructures | Destruction of fishing resources Loss of available land Decrease of quantity of water available Industrial accidents Increase in raw material costs (water, energy, etc.) |
| Society / People | Health impacts (diseases spreading, sunstroke) Accidents from collapses Loss of economic resources |

Risk assessment

Risk level



| | | Risk | Hazard | | Exposure | | Vulnerability | Risk |
|-------------|-------------------------|---|--|---|--|---|--|------|
| Environment | Land | Loss of available land | Sea level rise (+0.4m by 2070) -> Coastal erosion, floods | 2 | Peninsula All Conakry city is a coastal area | 2 | Construction on high embankments Low adaptation capacities: low households income and low public budget | 4 |
| | Water | Pollution of groundwater, surface water and sea water | Temperature increase (+2,5°C in 2070) -> water scarcity Unpredictable precipitation -> water scarcity, flood Sea level rise (+0.4m by 2070) -> Salinization, foods | 2 | Increasing risks of pollution due to flooding events Lack of data regarding the water tables in Conakry | 3 | Shallow superficial water table highly polluted Wastewater and solid waste management issues Low adaptation capacities: lack of awareness, lack of institutional framework, tools and budget for enforcing environmental preservation | 6 |
| | | Decrease of quantity of fresh water available | Temperature increase (+2,5°C in 2070) -> water scarcity Unpredictable precipitation -> water scarcity, floods Sea level rise (+0.4m by 2070) -> Salinization, floods | 2 | Increasing risks of pollution due to flooding events Lack of data regarding the water tables in Conakry | 3 | More than 50% of the population rely on the water tables High pollution rates of the groundwater Wastewater and solid waste management issues Low adaptation capacities: lack of awareness, lack of institutional framework, tools and budget for enforcing environmental preservation | 6 |
| | Ecosystems | Destruction of ecosystems | Temperature increase (+2,5°C in 2070) -> water scarcity Unpredictable precipitation -> water scarcity, floods Stronger and more frequent extreme events -> floods Sea level rise (+0.4m by 2070) -> coastal erosion, floods | 3 | Trees and mangrove are sensitive to changes in salinization, temperature and pollution | 3 | Poor conditions of mangrove and green spaces within the urban area Strong anthropologic pressure (exploitation of mangrove wood and the building of housing programmes). Low adaptation capacities (legal discrepancies, lack of law enforcement, low public budget, low awareness) | 9 |
| Economy | Fishing | Destruction of fishing resources | Temperature increase (+2,5°C in 2070) -> Increase of sea temperature Sea level rise (+0.4m by 2070) -> coastal erosion, floods | 3 | Destruction of the areas for fish reproduction (mangroves) Fish migration | 2 | The sea water is highly polluted by the wastewater, the solid waste and various particules (boxite) from port activities. Low adaptation capacities (legal discrepancies, lack of law enforcement, low public budget, low awareness) | 6 |
| | Agriculture | Decrease of quantity of water available | Temperature increase (+2,5°C in 2070) -> water scarcity Unpredictable precipitation -> water scarcity, floods Sea level rise (+0.4m by 2070) -> Salinization, floods | 2 | Increasing risks of pollution due to flooding events Lack of data regarding the water tables in Conakry | 3 | More than 50% of the population rely on the water tables High pollution rates of the groundwater Wastewater and solid waste management issues Low adaptation capacities: lack of awareness, lack of institutional framework, tools and budget for enforcing environmental preservation | 6 |
| | All economic activities | Loss of available land | Sea level rise (+0.4m by 2070) -> Coastal erosion, floods | 2 | Peninsula All Conakry city is a coastal area | 2 | Construction on high embankments Low adaptation capacities: low households income and low public budget | 4 |
| | Industrial activities | Increase in raw material costs (water, energy, etc.) | Temperature increase (+2,5°C in 2070) -> water scarcity Stronger and more frequent extreme events -> floods, heat waves, storms | 2 | The industrial areas are spread over the city Floods, heat waves and storms can cause industrial explosions, or general disfunctionnements Temperature increase can cause additional costs in terms of ice production for fish conservation, climatization, etc. | 2 | Temperature are already high, and the marine wind is blocked out of the city by high buildings on the water front. The city is not well equipped with climatization. The private sector is pro-active and resilient but it has low means for adaptation. It also sometimes have counter-productive practices, depending on potential economic incentive, to increase the climate-related risks. | 4 |
| | | Industrial accidents | Stronger and more frequent extreme events -> floods, heat waves, storms | 2 | The industrial areas are spread over the city without specific consideration of climate-related risks Floods, heat waves and storms can cause industrial explosions, or general disfunctionnements | 2 | There is no separation of industrial areas and residential areas. The port is hosting fuel storage tanks and other highly dangerous substances. Lack of urban planning and implementation of environmental laws. | 4 |

Risk assessment

Risk level

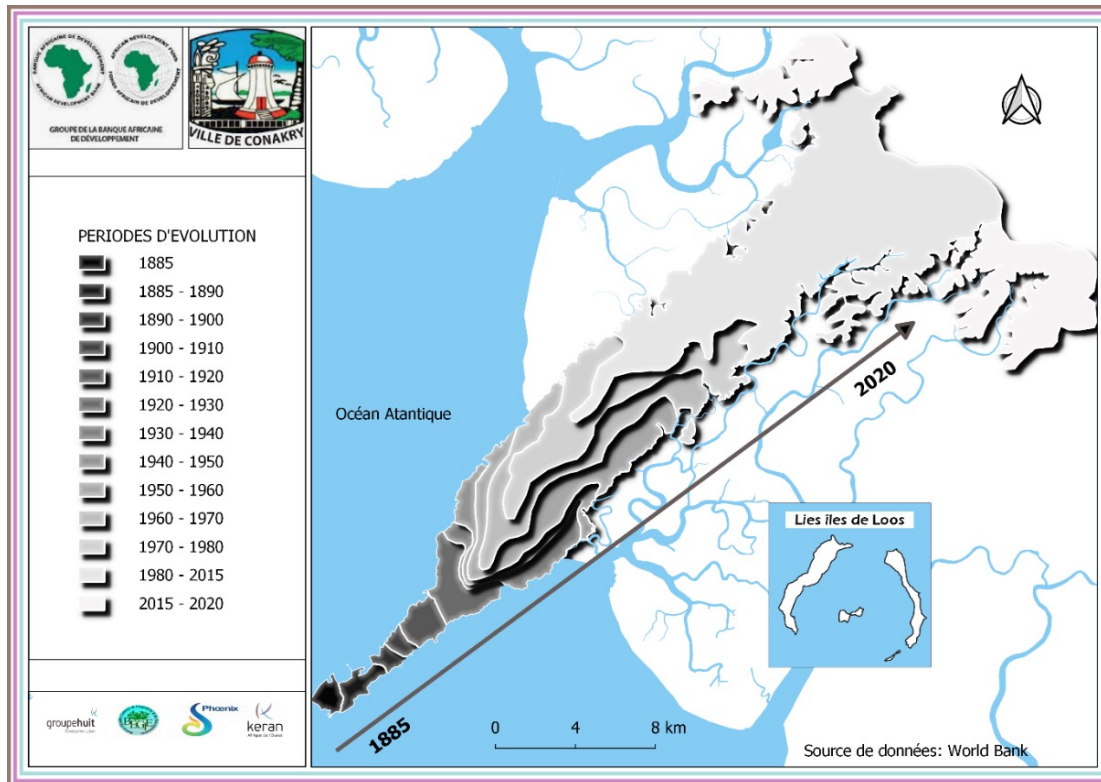


| | | Risk | Hazard | Exposure | | Vulnerability | | Risk |
|--------|------------------|--|---|----------|---|---------------|---|------|
| People | Human settlement | Loss of available land | Sea level rise (+0.4m by 2070) -> Coastal erosion, floods | 2 | Peninsula All Conakry city is a coastal area | 2 | Construction on high embankments Low adaptation capacities: low households income and low public budget | 4 |
| | Human health | Health impacts (diseases spreading, Sunstroke, dehydration) | Temperature increase (+2,5°C in 2070) -> water scarcity Stronger and more frequent extreme events -> floods, heat waves, storms | 3 | Increasing risks of pollution due to flooding events Lack of data regarding the water tables in Conakry | 3 | Temperature are already high, and the marine wind is blocked out of the city by high buildings on the water front. The city is not well equipped with climatization. In cemeteries, dead bodies are simply placed on the ground and can contaminate the water. Uncontrolled drilling. | 9 |
| | | Accidents from collapses | Temperature increase (+2,5°C in 2070) -> water scarcity Stronger and more frequent extreme events -> floods, heat waves, storms Sea Level rise -> coastal erosion | 2 | There is a lack of data regarding the water tables in Conakry and subsidence phenomenon | 2 | Coastal erosion already washed away infrastructure Uncontrolled drilling is fostering subsidence Construction on high embankments Low adaptation capacities: low households income and low public budget | 4 |
| | Human resources | Loss of economic resources | Temperature increase (+2,5°C in 2070) -> water scarcity Stronger and more frequent extreme events -> floods, heat waves, storms Sea Level rise -> coastal erosion | 2 | All resources are impacted by climate change (water, fish, land) so all economic activities and related incomes | 3 | The private sector is pro-active and resilient but it has low means for adaptation. It also sometimes have counter-productive practices, depending on potential economic incentive, to increase the climate-related risks. | 6 |

City Scoping

City scoping

Urban growth



- The built up area within the city's borders has increased from 89km² in 1990 to 116km² in 2018 (30%).
- Two axes of growth: towards Dubreka to the North, and Maneah and Coyah to the South.
- Conakry is surrounded by the sea and by wetlands and mangrove forests.
- Between 1990 and today, the city has lost almost all its natural spaces replaced by built up areas (green spaces represent 4% of the total area while it was 40% in 1990)
- The city develops in an anarchic and spontaneous way, and is extremely congested.
- There is a clear challenge in terms of **land use and planning**, which is a basic to address any other form of vulnerability.

City scoping

Recommendations on adaptation measures



The following proposed projects have been identified

- Land-use planning and governance
- Nature-based solutions
- Stormwater drainage management
- Sewage and solid waste management
- Water management
- Coastal erosion
- Capacity strengthening for risk management

Project 01 - Land use planning and governance

Objective: Equip the city of Conakry with a legal framework that can regulate land-use planning in the light of resilience (cadastral plan, land use plan, capacity building)

Key components of the project:

1. **Study** – define the baseline: cadastral map, land use plan, integration of climate-adaptation objectives
2. **Works** – implementation of the regulatory framework

Justification/climate rationale :

- Obsolete and incomplete urban policy and strategy
- Lack of constraining document and capacities
- Land development pressure in areas subject to climate hazards
- Uncontrolled land use increases city vulnerability to climate change hazards

Project Owner: Ministry of Urbanism

Location: City of Conakry

Cost: Total 1 M€

The proposed project is linked with all other proposed projects



Project 02 - Nature-based solutions

Objective: Equip the city of Conakry with an array of **nature-based solutions** (NBS) to reduce the floods, heat waves, erosion and water scarcity hazards

Key components of the project:

- 1. Study** – preparation of a Master Plan for the Development and Management of Nature based solution (existing situation, institutional and feasibility study, investment program)
- 2. Works** – implementation of the NBS: population awareness raising, priority phase work

Justification/climate rationale :

- Significant disappearance of natural spaces (from 59% to 7% of the territory between 1975 and 2015)
- Disappearance of local biodiversity and decrease of the city capacity to adapt to flood, coastal erosion, water scarcity, heat waves.
- Threatens agriculture activities and local revenues

Project Owner: to be defined

Location: Grand Conakry

Cost: Total 0.3 M€ (study)

The proposed project is linked with all other proposed projects



Project 03 - Storm water drainage management

Objective: Decrease the alarming impacts of increasingly frequent floods in the city, and in particular in precarious districts

Key components of the project:

1. **Study** – preparation of a Master Plan for the Development and Management of Stormwater (existing situation, institutional and feasibility study, investment program)
2. **Works** – implementation of the Master Plan: capacity building, priority phase work

Justification/climate rationale :

- Flood from stormwater runoff is the most significant hazard in Conakry
- Half of the population and urban areas are concerned, especially vulnerable people
- Intensity and frequency of extreme rainfall events are increasing

Project Owner: to be defined

Location: City of Conakry and sub-catchment areas

Cost: Total 0.75 M€ (study)

The proposed project is linked with Project 04 Solid Waste Management and Project 02 Nature-based solutions



Project 04 - Sewage and solid waste management

Objective: Equip the city of Conakry with a sewage collection and treatment system, as well as to strengthen the capacities of the city for solid waste collection, recycling and reusing.

Key components of the project:

- 1. Study** – preparation of a Master Plan for the Development and Management of Sewage and gap analysis for solid waste (existing situation, institutional and feasibility study, investment program)
- 2. Works** – implementation of the Master Plan and capacity building

Justification/climate rationale :

- 90% of the population not connected to a central sewage system, septic tanks are discharged in the nature without treatment
- Very poor waste collection that are spread all over the urban space, conducting to the blockage of the drainage system and aggravating floods
- Cause water pollution and human diseases and make the city more vulnerable to water scarcity

Project Owner: to be defined

Location: City of Conakry

Cost: Total 0.75 M€ (study)

The proposed project is linked with Project 02 Nature-based solutions and Project 03 Stormwater drainage management



Project 05 - Water management

Objective: Assess the quantity of fresh water available and define adaptation projects to ensure long term fresh water supply for the city

Key components of the project:

1. **Existing situation of water resources:** groundwater levels, surface and ground water quality, impact of water salination, impact of water pollution.
2. **Water consumption:** assessment of the volumes of water needs by the city, and the current water resources.
3. **Recommendations and proposed investment program**

Justification/climate rationale :

- 50% of the population rely in groundwater, which consumption is unmonitored and unknown
- There is no information on the level of groundwater available
- Surface water is polluted and not suitable for human activities
- Climate change further threatens water availability (water salination, water scarcity through temperature increase and extreme rainfalls and droughts)

Project Owner: *Société des Eaux de Guinée*

Location: City of Conakry

Cost: Total 0.5 M€ (study)



Project 06 - Coastal erosion

Objective: To limit the impacts of sea-level rise on coastal erosion both on beaches and on the urban coast

Key components of the project:

- 1. Study** – protection of Conakry coast against coastal erosion (existing situation, institutional and feasibility study, investment program)
- 2. Works** – implementation of the investment program, awareness raising and capacity building

Justification/climate rationale :

- The city is located on a peninsula, and highly exposed to sea level rise
- Uncontrolled urbanization leads to buildings on embankments and destruction of the mangrove that further aggravates coastal erosion
- Coastline recession reaches 85cm/year, and beaches are disappearing

Project Owner: to be defined

Location: City of Conakry

Cost: Total 0.5 M€ (study)

The proposed project is linked with Project 01 Land use planning and governance



Project 07 – Capacity strengthening for risk management



Objective: To strengthen the governance of climate risks and increase the knowledge of climate risks of the local government

Project Owner: to be defined

Location: City of Conakry

Cost: Total 0.7 M€ (study)

Key components of the project:

Institutional study & training

- stakeholder mapping,
- capacity needs assessment,
- creation of a National Multisectoral Platform for Disaster Risk Reduction and Prevention
- assessment of existing studies

The proposed project is linked with Project 01 Land use planning and governance

Justification/climate rationale :

- The city has very little data (statistics, maps, etc.), studies and knowledge of climatic risks
- The authorities are not trained to take these risks into account in their urban planning and management activities





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