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SWECO

Final Report

Climate Risk Assessment Urban Adaptation and Resilience in Africa

DODOMA

Accountability

Titel	Climate Risk Assessment Urban Adaptation Africa
Project Number	51008339
Client	Global Center on Adaptation
Project Management	Enrico Moens
Version	Final
Date final delivary	8th of April 2022
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Approved by	Enrico Moens

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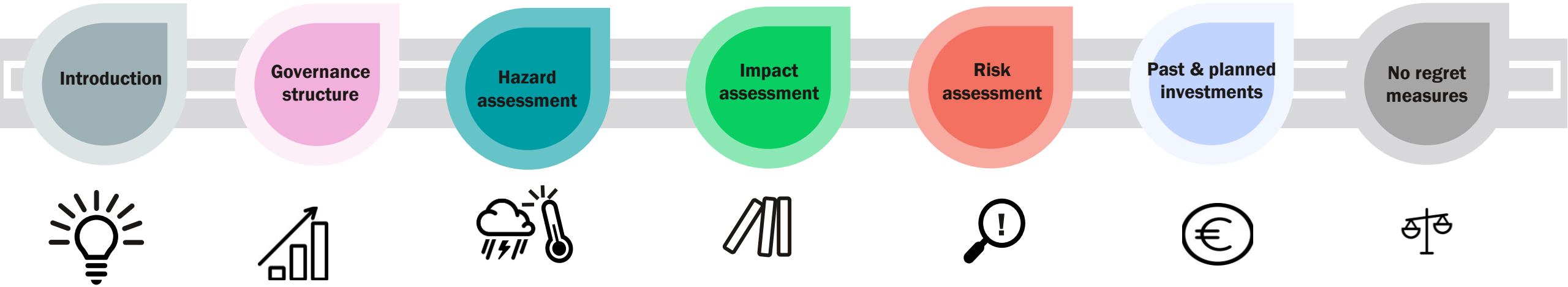
Steps Climate Risk Assessment

The conducted Climate Risk Assessment consists of the 7 steps below. This report presents the results per step. Results are based on an **extensive literature and climate data 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 Dodoma. Their input is crucial for obtaining good results. City stakeholder participation took place on 3 levels:

City Advisor. In Bi-weekly calls with the city advisor (the environment officer from the city of Dodoma), relevant information was gathered, and preliminary results were validated. The city advisor also coordinated the broader city stakeholder involvement.

Primary and Secondary City Stakeholders working for the City of Dodoma. In addition to the calls with the city advisor, interviews with primary and secondary stakeholders took place (see next page). In these interviews the goals of the project, the data availability, the planned, current and past investments, and the no regret measures were discussed.

Online Questionnaire. With an online questionnaire, city individuals from vulnerable groups, specifically women groups, youth groups and people with disabilities, were addressed. By asking their input on e.g. the most important climate impacts and community involvement, the participation process was broadened. The questionnaire was also filled in by some primary and secondary stakeholders. Due to confidentiality issues, no information on names or profession was gathered. In total **21 individuals** filled in the questionnaire.

City Stakeholder Participation

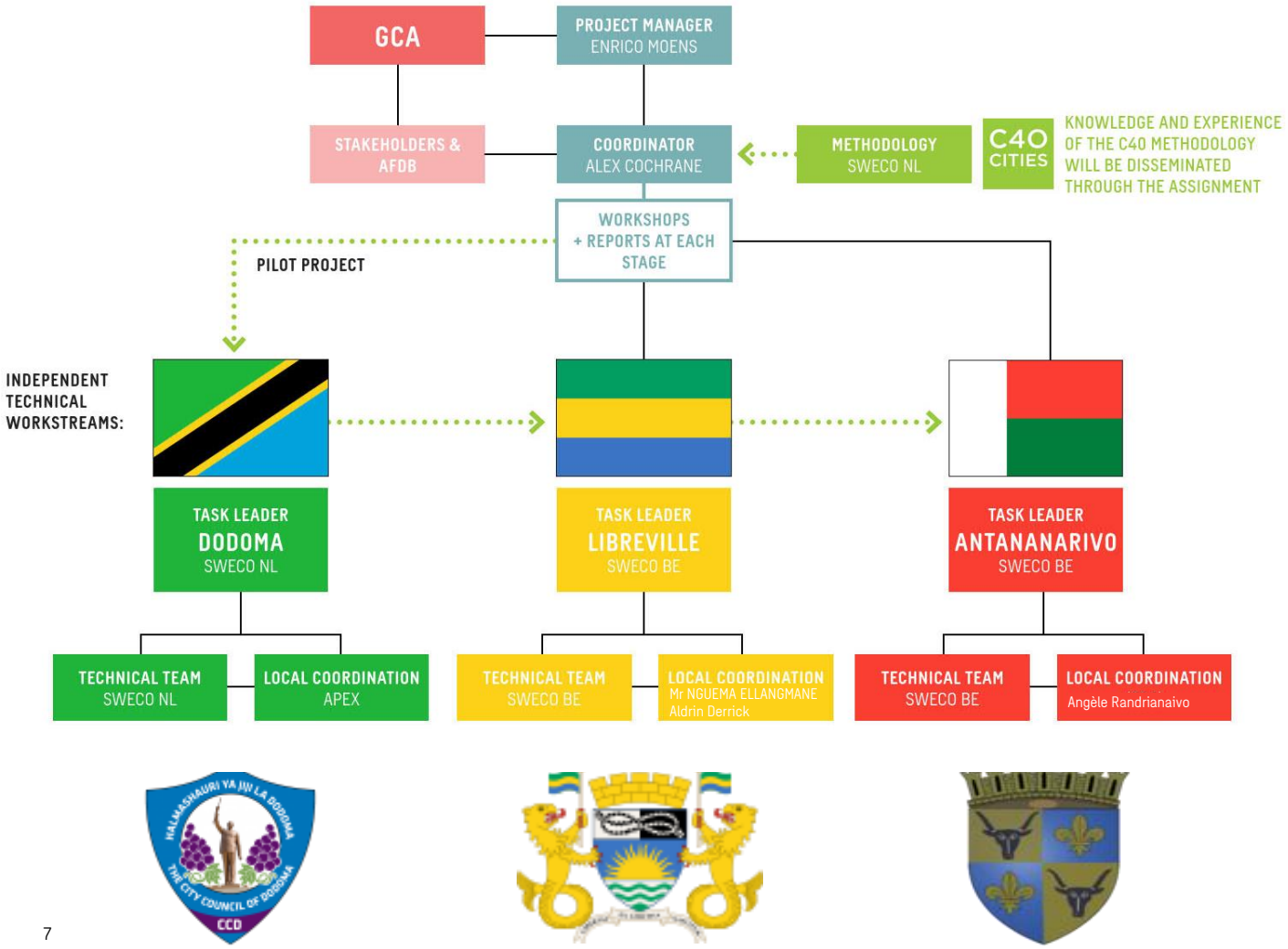
Primary and secondary stakeholders

These are the most important ***Primary and Secondary Stakeholders*** in the local climate governance of Dodoma city. Most of these stakeholders were interviewed related to their knowledge on climate hazards, climate governance, past – current- planned investments and no regret measures.

Name	Function	Organization
Key City Official		
Ally Mfinanga	Environment Officer	City of Dodoma
Primary Stakeholder		
Dr Damas Mapunda	Environmental Expert	Vice Presidents Office
Hidaya Maendeleo	Community Liaison Officer	City of Dodoma
Aisha Masanja	Head of Town Planning	City of Dodoma
Aziza Mumba	Assist. Regional Secretary for Economic Issues	Dodoma Region
Nicodemus Kileo	Civil Engineer	City of Dodoma

Name	Function	Organization
Secondary stakeholders		
William Alfayo	Planning and coordination division	City Council
Hidaya Mizecia Abdallah	Community development division	City Council
Ludigija Ndatwa	Infrastructure, rural and urban development division, Works section	City of Dodoma
Innocent P. Kimweri	Agriculture, livestock and fishery division	City of Dodoma
Kibona J. John	Agriculture, livestock and fishery division	City of Dodoma
Yustina Munishi	Agriculture, livestock and fishery division	City of Dodoma
Hadija Nyamsingwa	Environmental officer	City of Dodoma
Aziza R. Mumba		Regional Administrative Secretary office (RAS)

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

Tanzania

Tanzania

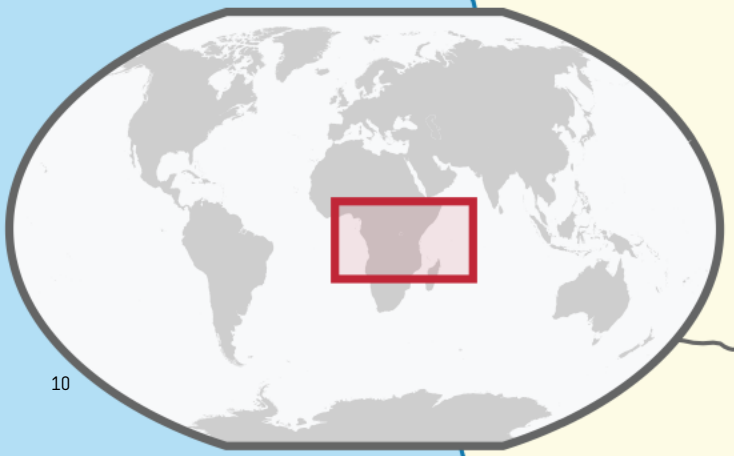
Topographics

Regions: 31

Population: 62 million

Capital: Dodoma

Location Dodoma in Tanzania (ECO ACT fact sheet, 2019)



Tanzania

Population

Population	GDP
2021	2021
62	**61,4**
(million people)	(billion USD)
2,98% per year	
2050 projection	GDP annual growth
129	**2%**

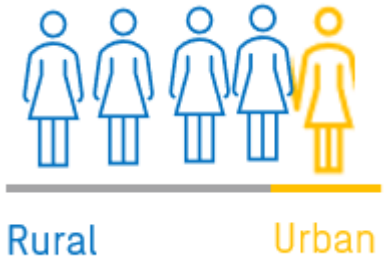
Source: World Population Review (2022) and The World Bank (2022)

Tanzania

Urbanization

Tanzania has 1 city with more than a million people (Dar es Salaam), 15 cities with between 100,000 and 1 million people, and 222 cities with between 10,000 and 100,000 people.

Urban proportion of total population:

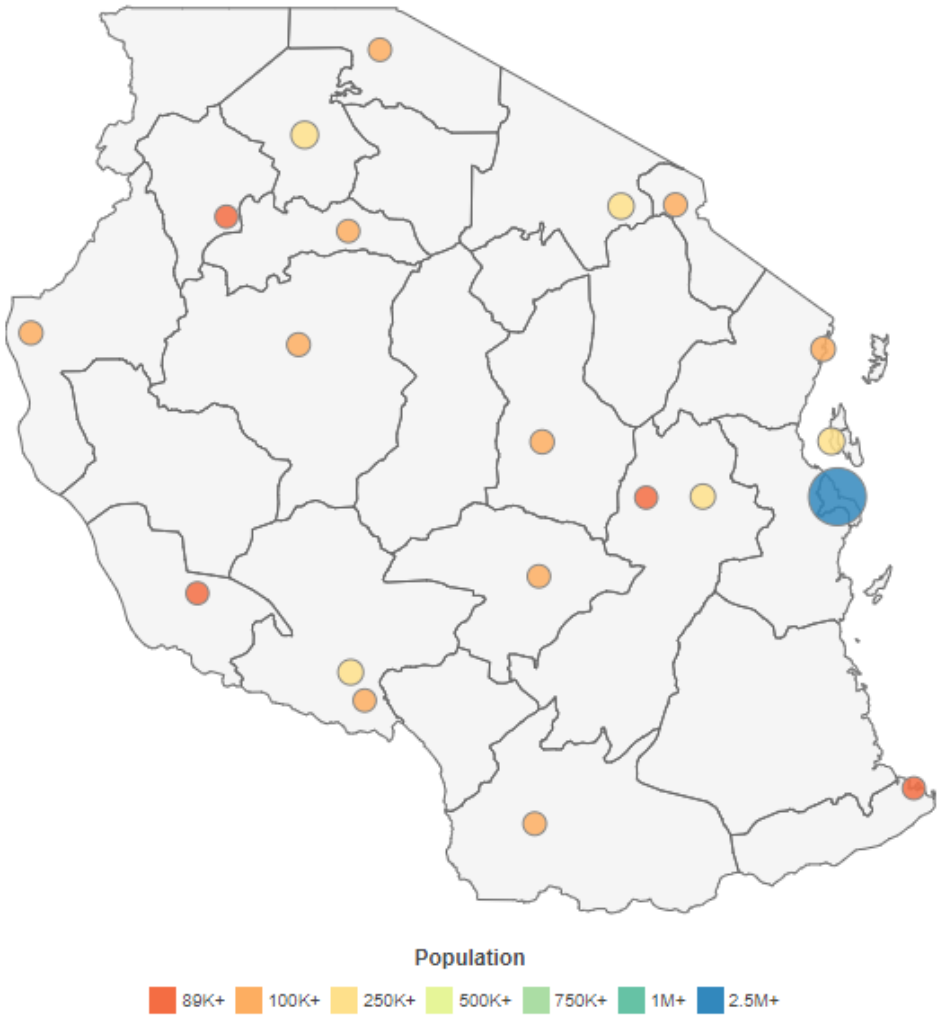


Urbanization rate of Tanzania:

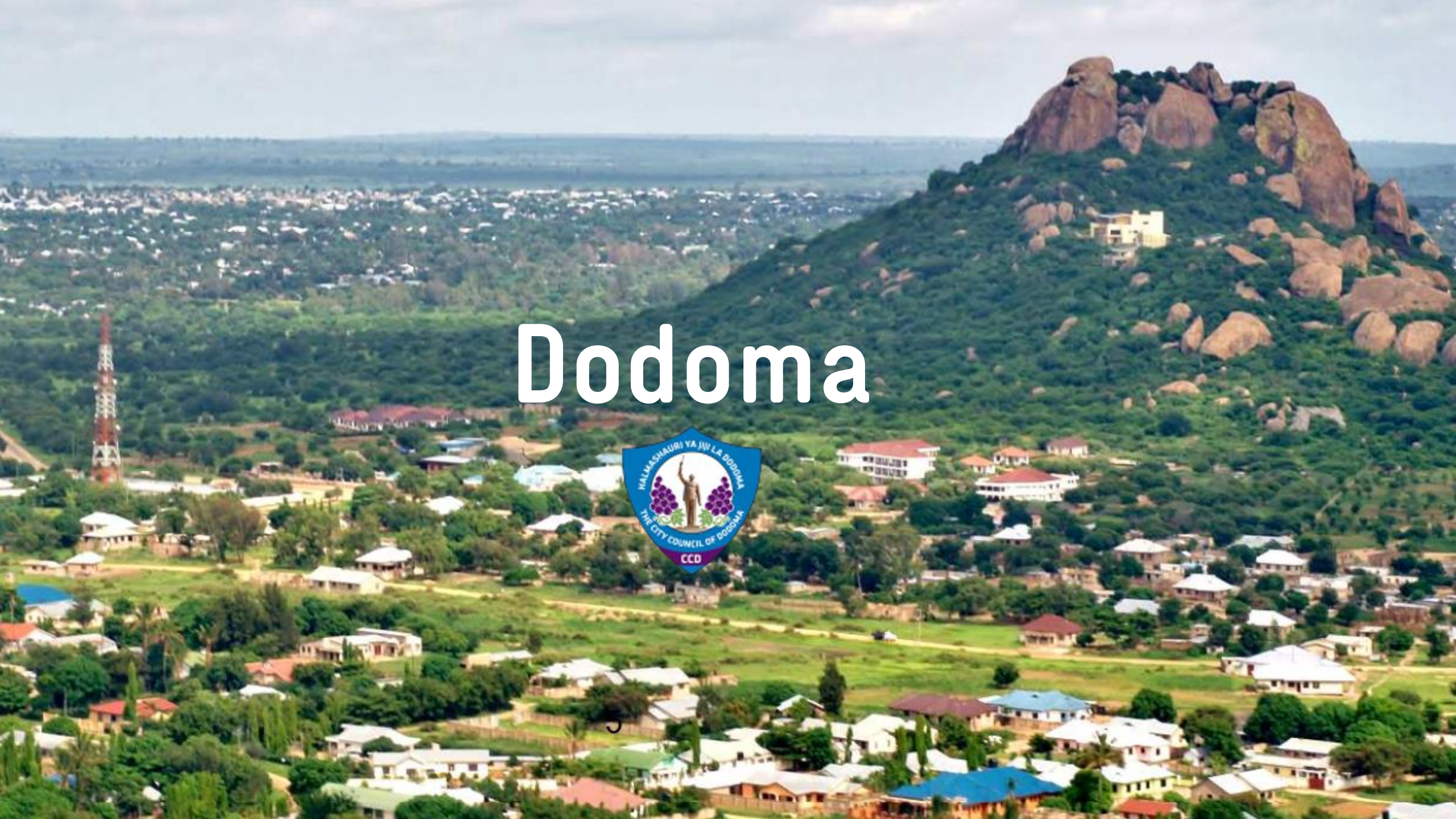
↑ 35%

Source: The World Bank (2022) & World Population Review (2022)

Tanzania Population Density Map



Source: World Population Review (2022)
Note: The Dodoma population size indicated by this source differs from the information given in national population and the National Population and Housing Census report of 2017. The latter is used in the report.


Dodoma
HALMASHAURI YA JIJI LA DODOMA
THE CITY COUNCIL OF DODOMA
CCD

Dodoma

Topography

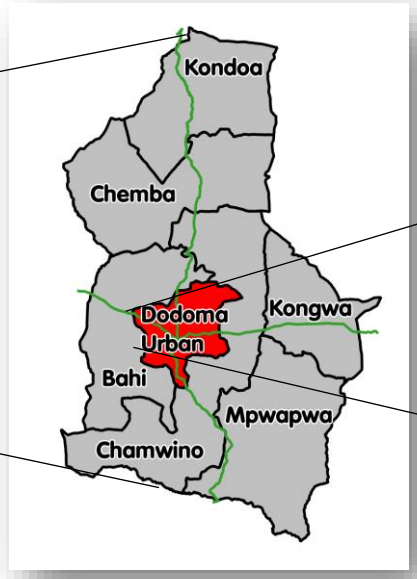
Dodoma Region

- Population: approx. 2 million
- Dodoma Region has 7 districts among which Dodoma Capital City District (CCD)

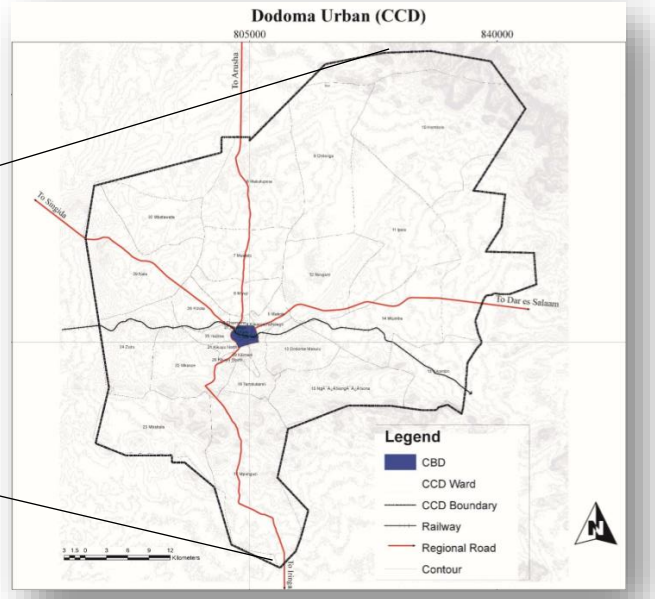
Dodoma Capital City District (CCD):

- Population: 580.000 (0,9% of national population)
- Dodoma was founded in 1907 by German colonists. Dodoma was declared the **new capital** of Tanzania in 1973 after the Tanzanian government decided to move the national capital from Dar Es Salam to a more central location with room to expand. Source: Dodoma City Diagnostic (2021)
- **Project scope:** Dodoma Capital City District (CCD) area.

Dodoma Region (Wikipedia, 2022).



Dodoma Capital City District within Region (Wikipedia, 2022).



Dodoma Capital City District (Dodoma City Masterplan, 2019).

Dodoma

Land use – current situation

Dodoma CCD is characterized by broad upland plains which are part of the East Africa's plateau with a total area of 261,529.96 hectares. Dodoma CCD remains a comparatively **open and low-density capital** by Sub Saharan African standards.

Current land use Dodoma CCD:

S/No	Land use category	Area (Ha)	% of Total Area
1	Residential	34,072.97	13.03
2	Commercial and CBD	887.15	0.34
3	Institutional	34,460.14	13.18
4	Industrial	333.34	0.13
5	Nature reserve and recreation	47,775.68	18.27
6	Scattered settlements and farming	20,4240.9	35.95
7	Mzakwe water source field	34,505.74	13.19
8	Catchment area for well fields	6,411.26	2.45
9	Dry Port	536.37	0.21
10	Marshalling Yard	499.68	0.19
11	Airport	4,429.68	1.69
12	Government City	742.17	0.28
13	Water bodies	2,868.29	1.10
Total		**261,529.96**	**100.00**

Dodoma Capital City District existing land uses (Dodoma Masterplan, 2019)

Upland plains (Dodoma Masterplan, 2019)

Detached villa in Dodoma residential area (Dodoma City diagnostic, 2021)

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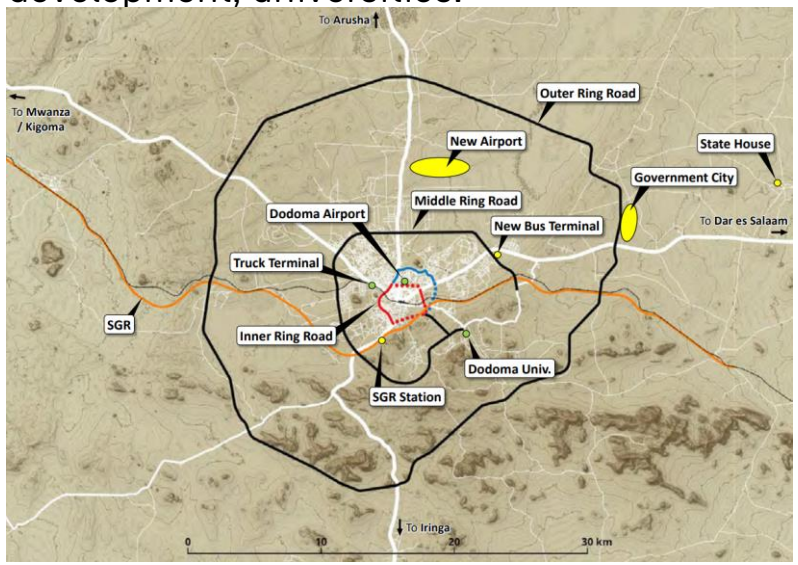
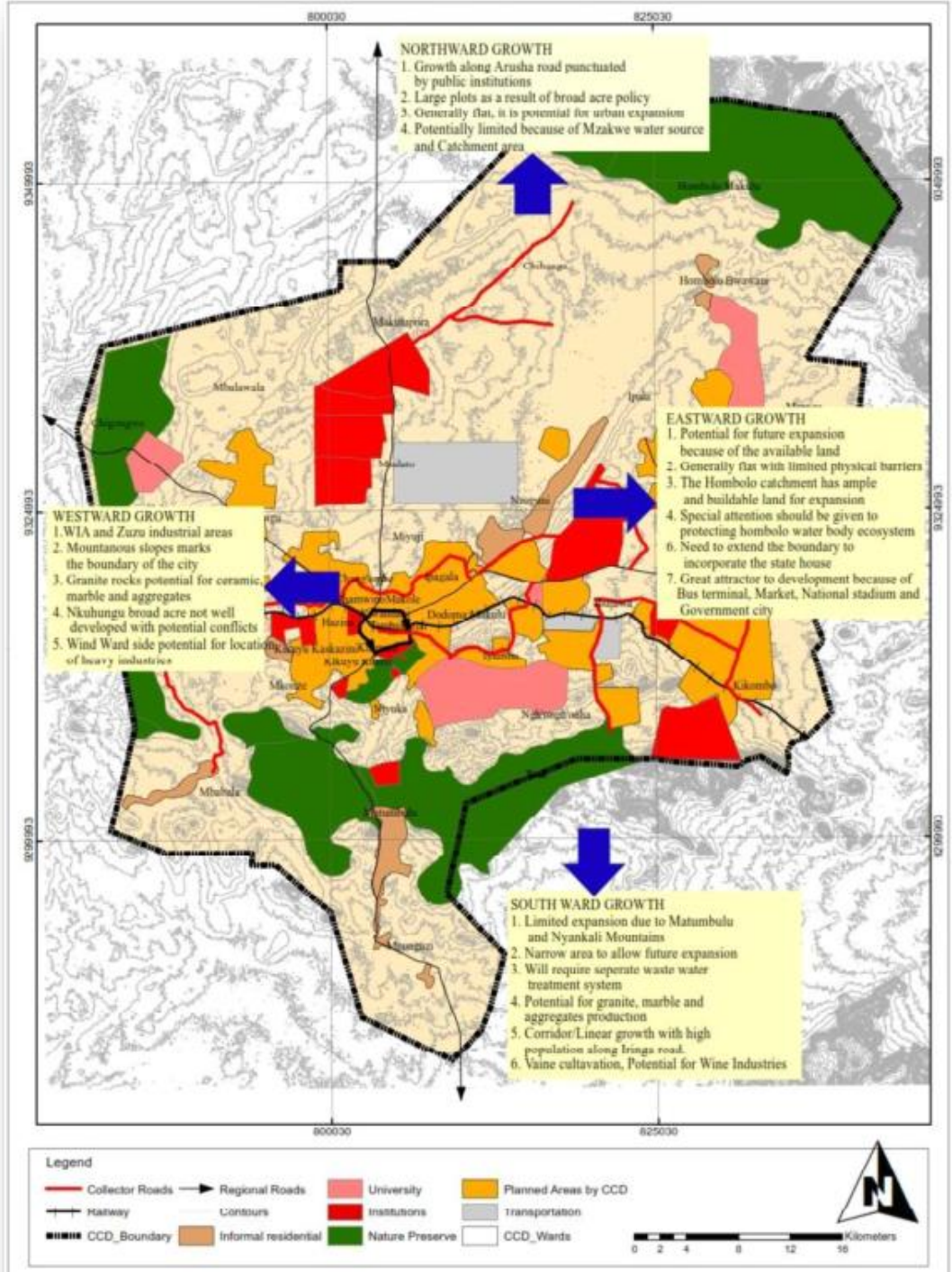
Land use – Growth of the City

The development pattern of Dodoma CCD has been influenced by previous master plans and follows a growth pattern towards the west- and eastward directions.

- **Eastward development:** availability of gently sloping land to the east that is suitable for all kinds of developments such as the location of the government city, the marshalling yard, a dry port, city bus terminal, city market and national stadium.
- **Westward development:** pull factors in this area for i.a. industrial development, universities.



Major ongoing and planned projects (Data collection survey on Dodoma City roads, 2019)



Current city development patterns in Dodoma CCD (Dodoma City Masterplan, 2019)

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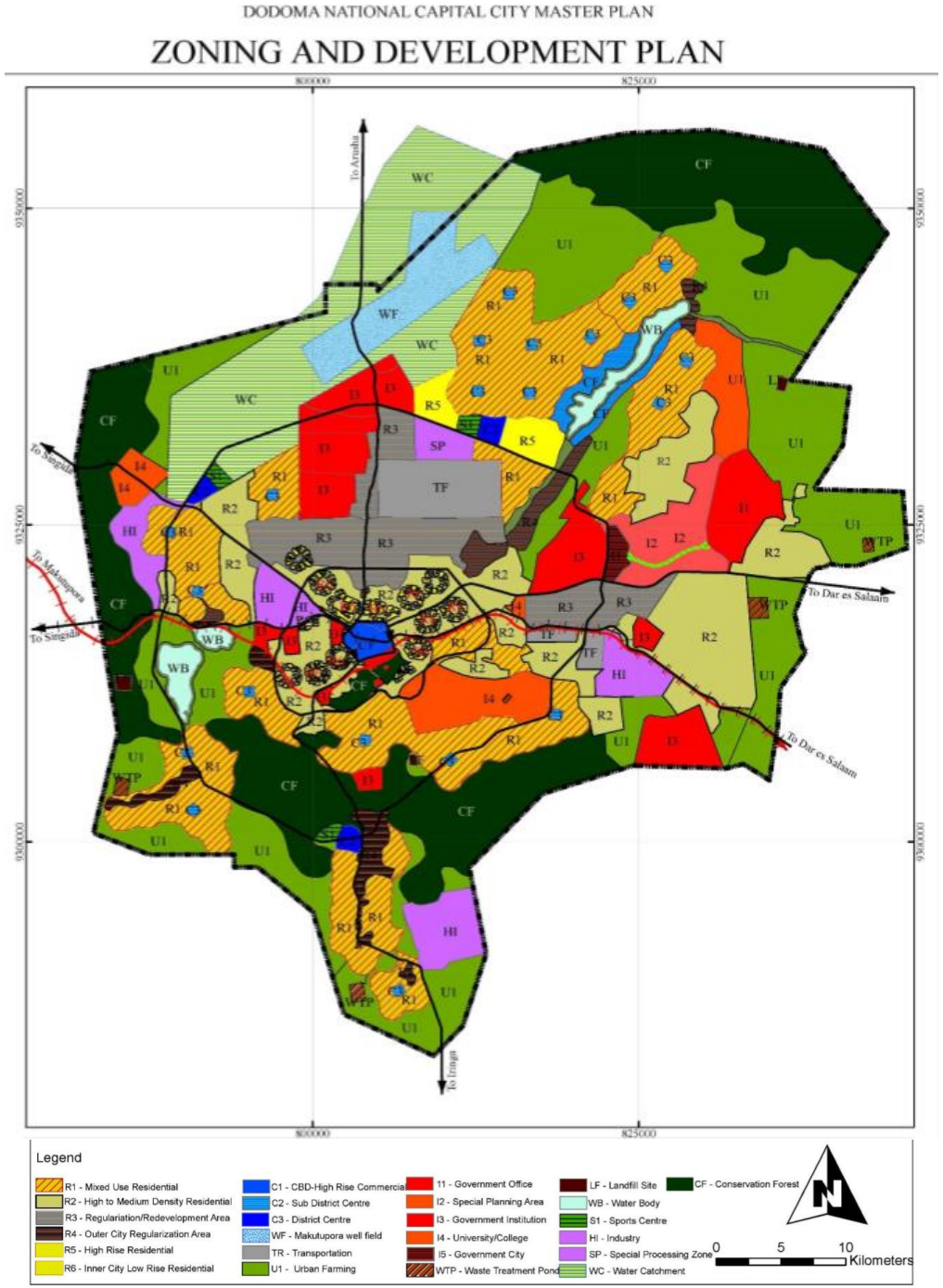
Dodoma

Land use - development

The City Master Plan of 2019 proposed a Zoning and Development Plan for Dodoma CCD for **2019-2039**.

- This plan provides guidance to 25 various land uses and is to be used in complimentary with the Urban planning regulations and other guidelines.
- The plan also provides recommendations for the future development within the boundaries of the city.

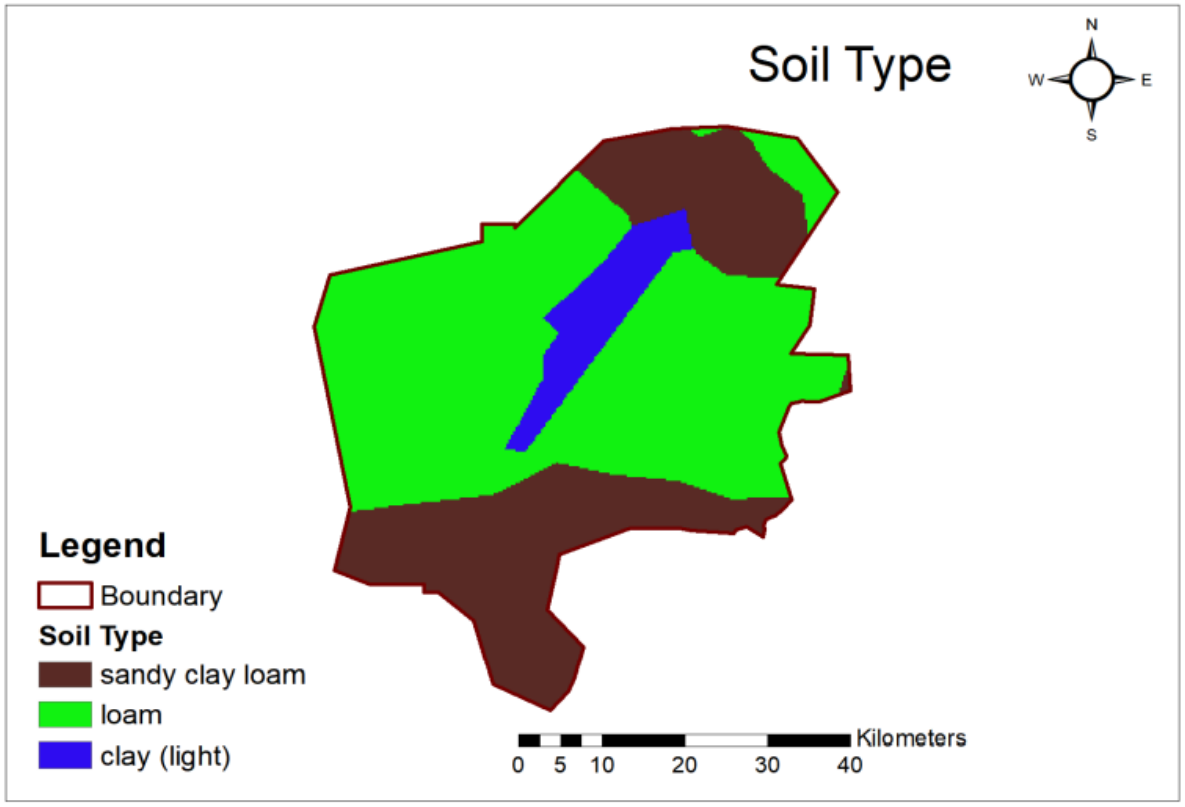


Zoning and Development plan Dodoma CCD (Dodoma City Masterplan, 2019)

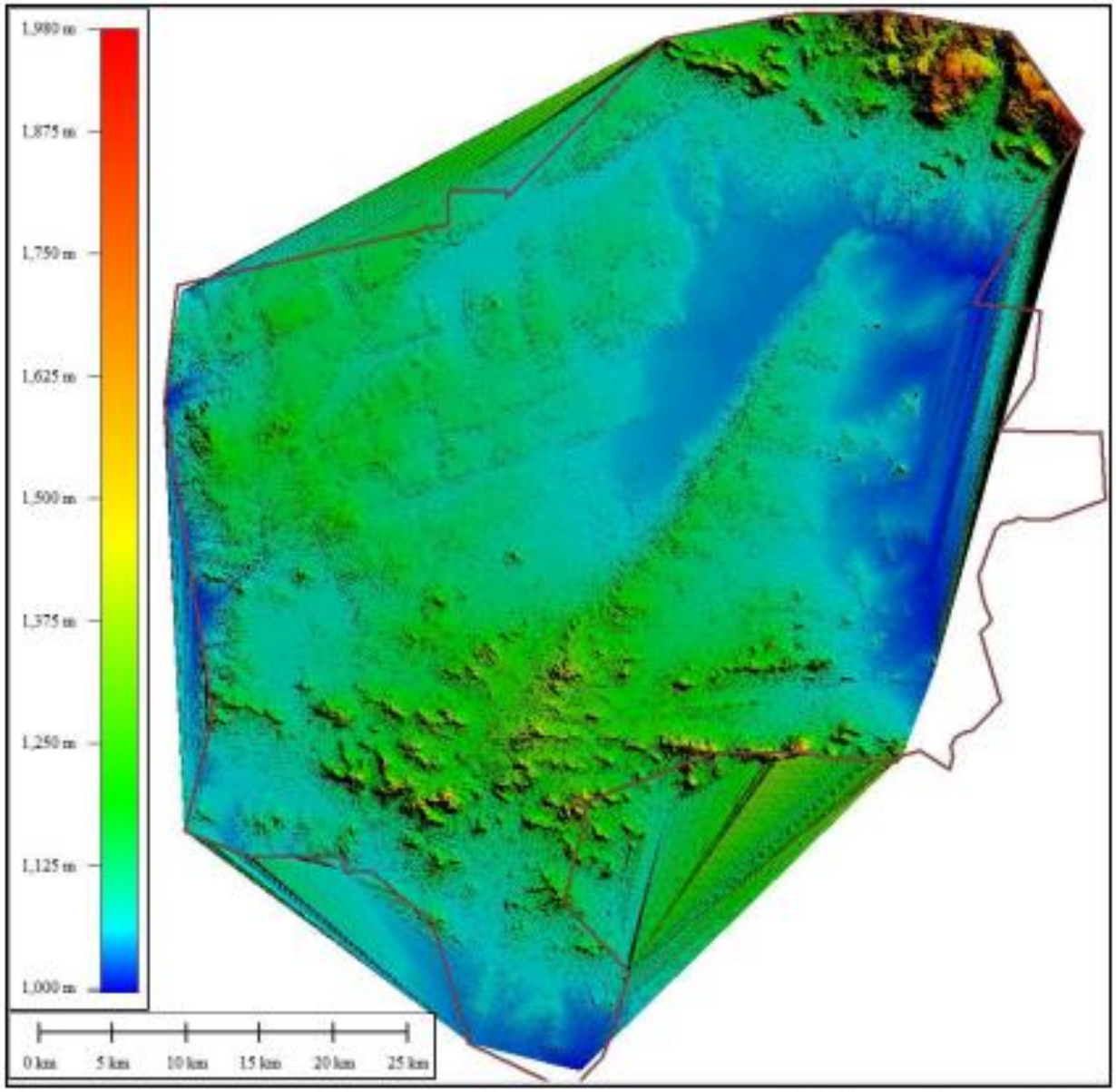
Dodoma

Main geographic features

- Dodoma CCD is located on ***upland plains ~ 1160 m.a.s.l.***
- The city mostly consists of ***Loamy Soils*** with poor permeability.



[18]Average temperatures and precipitations in (Drainage and Sanitation Development Plan for Dodoma City, 2019).



Elevation of Dodoma (Drainage and Sanitation Development Plan for Dodoma City, 2019).

Dodoma
Demographics

GDP per Capita

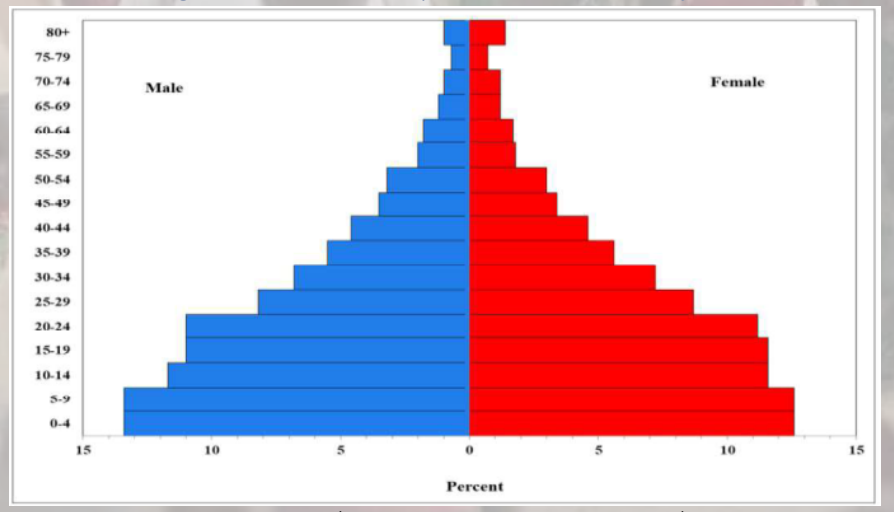
TZS 470,000 (~ €180)
In 2019

POP	2020	2040
	580*	1,7
	Thousand	**Million**

*0,9% of national population

Population growth: 5,5% per year

Source: Drainage and Sanitation Development Plan for Dodoma City (2019)



Population pyramid for Dodoma (National Bureau of Statistics, 2012)

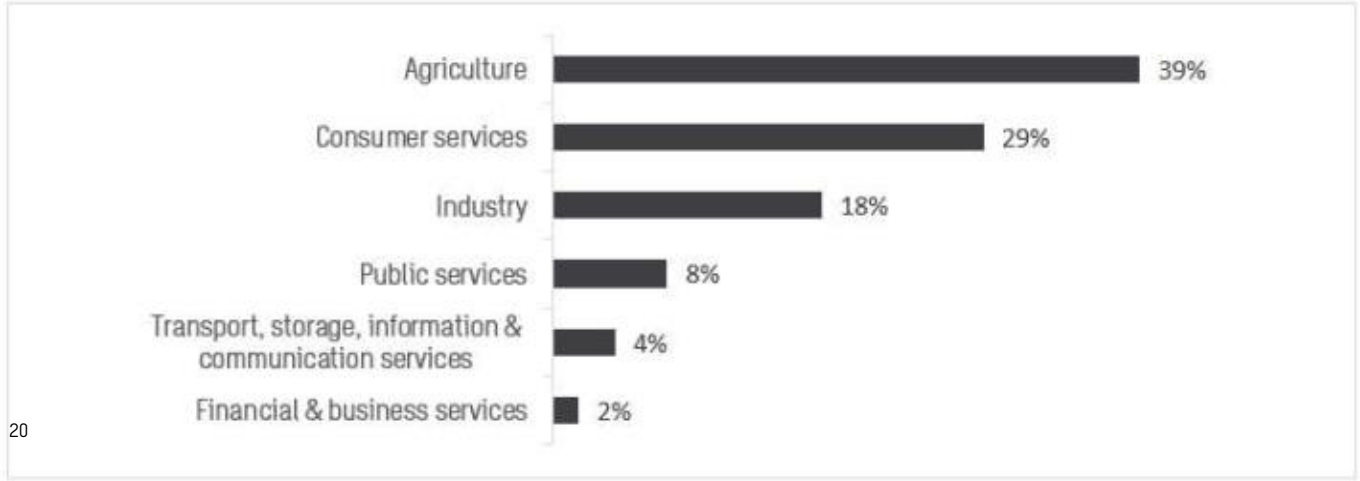
Dodoma

Key economic information

Driving forces of the economic activities in Dodoma CCD that generate employment are:

- **Agriculture** – food crops (such as maize, sorghum), cash crops (such as groundnuts, grapes), forestry and beekeeping.
- **Consumer services/informal services** – food stalls, tailoring shops, beauty salons, automobile repair services.
- **Industry** – industry products include wood, furniture, beverages, processed food, milled rice and flour, soap and oil.

Source: Dodoma City Diagnostic (2021)



Employment by sector Dodoma (Oxford Economics, 2020)

Maize plots, Dodoma City (Dodoma Masterplan, 2019)

Local shopping area in Dodoma (Dodoma City Diagnostic, 2021)

Dodoma

Key economic information

Agriculture

In Dodoma CCD 80% of the population **depends on agriculture and livestock** keeping for their livelihoods notwithstanding the semi-arid condition of the area.

This economic base is **vulnerable to climate change** variations and impacts.

- The **Agriculture Department** of the City Council of Dodoma is working diligently to reduce vulnerability to climate change by following up activities that are aimed at boosting agricultural production both at household and City level.

Source: Dodoma City Diagnostic (2021)

Dodoma

Income Generation

Income generation

75%	25%

- Agriculture
- Livestock keeping
- Forestry
- Beekeeping

- Petty business
- Small and medium scale industries
- Consultancy
- Construction works
- Transportation
- Social and administrative services

Informal/formal sector

Informal	Formal

2/3 of work in Tanzania is done in the informal sector in 2014.
This includes informal activities such as the sale of clothes, merchandise etc.

Local Beehives at Zuzu Villages (Dodoma Masterplan, 2019)

Source: Dodoma City Diagnostic (2021)

Dodoma

Recent developments

Since 2017 all Government Administrations moved to Dodoma.

→ As a result the **population boomed**

Recent Developments

Expansion of airstrip
In 2019, a US$272M loan plan was announced to build a new, far bigger airport

Significant ***increase in banking services*** (> 11 banks) and businesses.

Modernization of ***water, electricity*** and other basic ***social services***, incl. $420 million Farkwa Dam project.

Source: Drainage and Sanitation Development Plan for Dodoma City (2019)

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Water Management

The Dodoma City District is endowed with multiple water sources:

1) **Surface water** (springs and dams)

- **Makutupora (Mzakwe) well field:** currently main source of water
  - Deficit of 34,000 m3 /day → expected to further increase.
  - 21 of 41 city wards are supplied with water from Mzakwe well field.
- **Farkwa Dam:** currently constructed dam ($420 million project) to limit the water deficit.

2) **Groundwater** (deep and shallow wells)

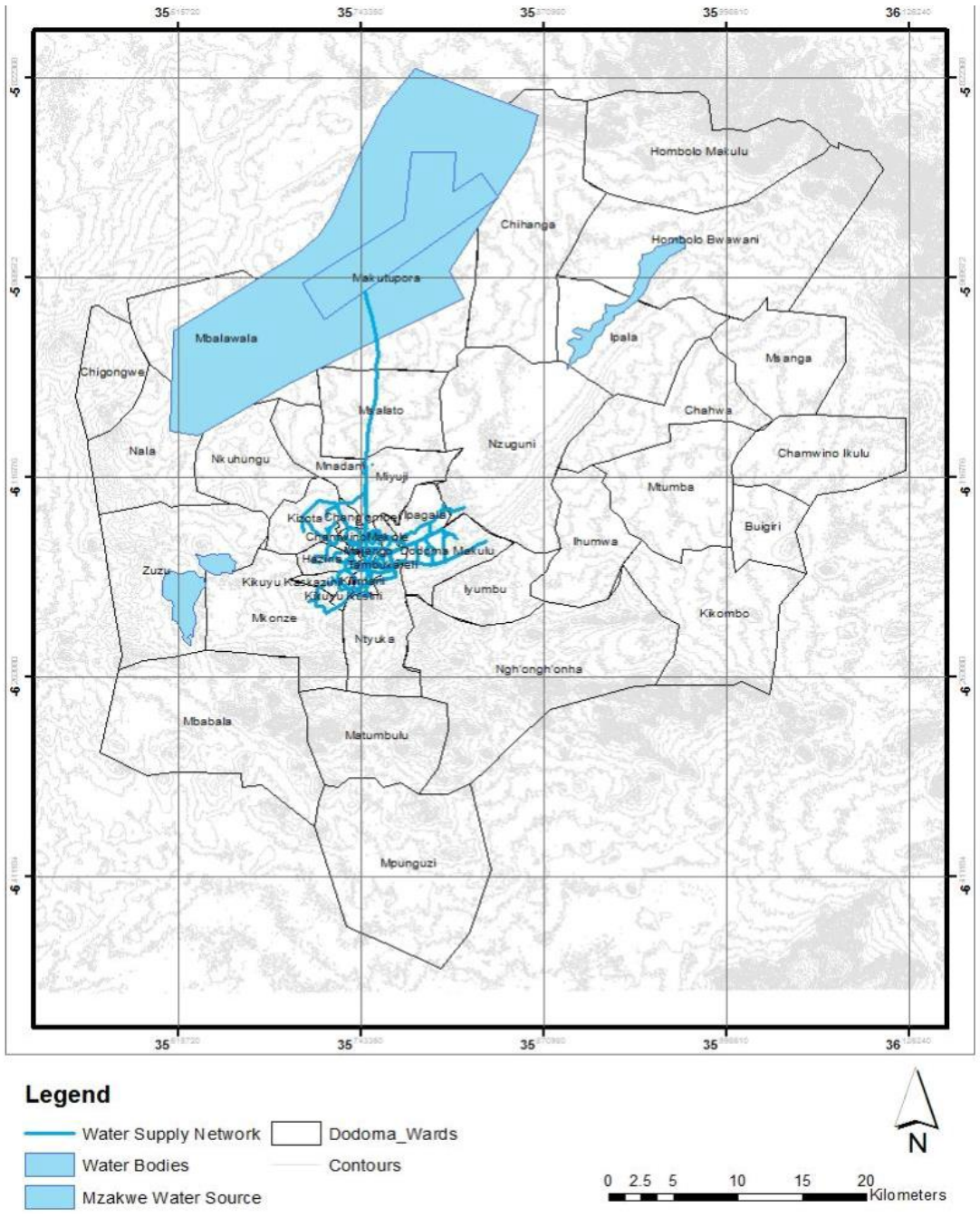
Dodoma is located in an earthquake prone area which makes the infrastructure of **water sources vulnerable in case of a heavy earthquake** which can be a threat to the water supply distribution network to the growing CCD.

Water is supplied by the Dodoma Urban Water and Sanitation Authority (**DUWASA**) for domestic, industrial, commercial and institutional uses. DUWASA is also responsible for wastewater treatment.

On-site sanitation system serves 94% of the total population.

- Only 6% served with a comprehensive reticulation sewers network.

Source: Drainage and Sanitation Development Plan for Dodoma City (2019) and Dodoma City Diagnostic (2021)



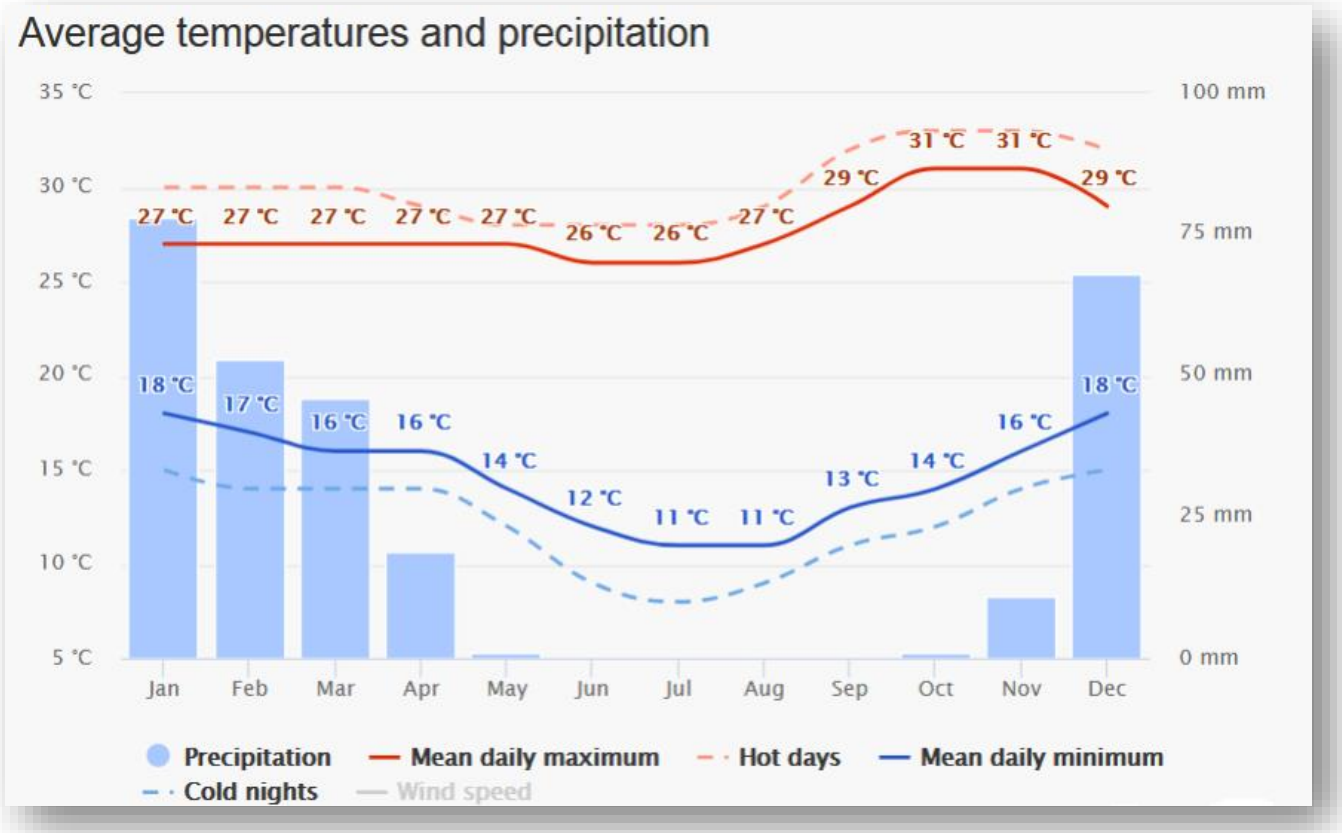
Areas served by water supply in Dodoma (Drainage and Sanitation Development Plan for Dodoma City, 2019).

Dodoma

Climate features

Dodoma CCD has a **Semi-arid climate** with warm temperatures throughout the year.

On average Dodoma CCD experiences **570 mm precipitation**/year; 85% of the rainfall occurs between November and April.



Average temperatures and precipitations in Dodoma (Dodoma City Diagnostic, 2021)

Dodoma
Main Challenges

1. **High dependance on the agricultural sector**: a big part of Dodoma's economy relies on agriculture. The agricultural sector is very sensitive to climate extremes which may lead to loss of income and food supply by decreased agricultural productivity.

2. **Fast urbanization of the city**: as all national Government Administrations moved to Dodoma since 2017, the city population is booming. Therefore, Dodoma faces multiple challenges associated with rapid urbanization in terms of built-environment and physical and social infrastructure planning. Also, this rapid urbanization brings challenges to ensure resilience to disaster risks hazards.

3. **Informal settlements:** informal development often happens in vulnerable locations which further exasperates the living conditions for the occupants.

4. **Drinking water supply:** currently Dodoma is highly dependent on limited drinking water sources that are extremely affected by drought and can be vulnerable to earthquakes.

Governance structure

Governance structure

Introduction

Presentation of governance structures

The presented information on the governance structure 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”.

Tanzania (Climate) Governance structure

National Level

The Governance structure at National Level consists of:

- **Ministries**
- Independent **Departments**
- Independent **Agencies** (National Climate Change Strategy, 2012)

At national level, ***the Vice President Office,*** delivers the ***Minister responsible for Environment – Division of Environment*** who is also responsible for Climate Change Adaptation.

Ruwasa: Rural Water and Sanitation Agency – ***Independent Agency***. Ruwasa is responsible for the development and sustainable management of water supply and sanitation projects and water service delivery in rural areas.

The Water Department was abolished due to the establishment of the Rural Water and Sanitation Agency (RUWASA) under the Ministry of Water. All water functions which were formally under the Water Department have been transferred to the RUWASA District office (President's Office Public Service Management and good Governance, 2022).

Tanzania (Climate) Governance structure

National Level

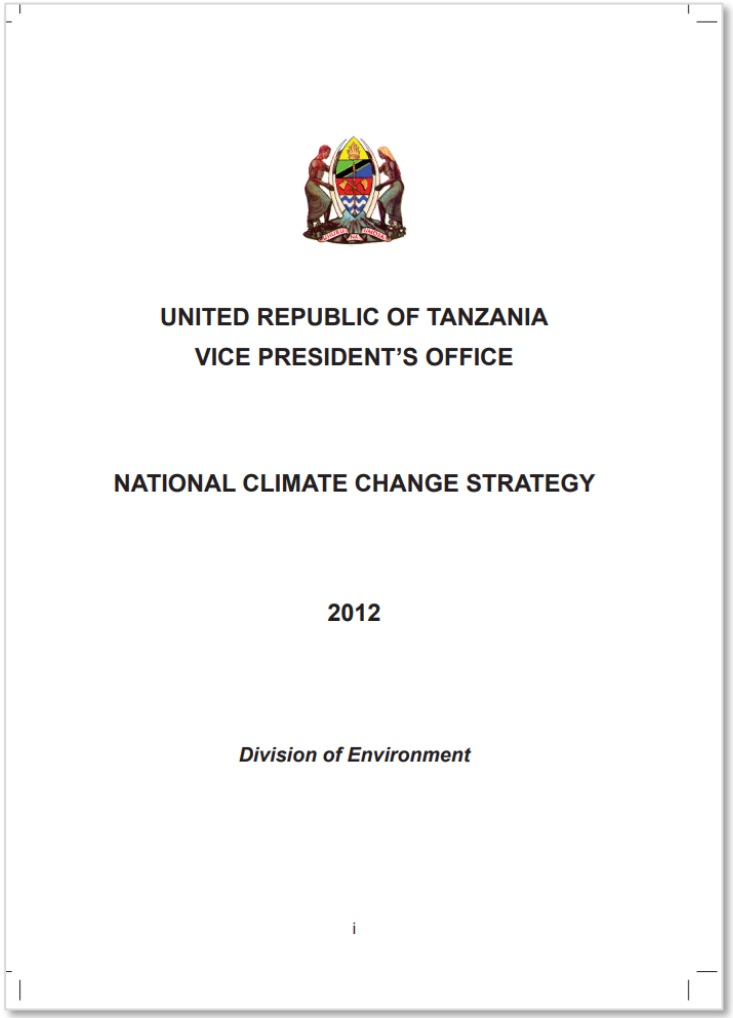
National Climate Adaptation Plans

- National Adaptation Program of Action (2007)
- National Climate Change Strategy (2012)

The Vice President Office, Division of Environment is supported by the following committees:

- The ***National Climate Change Technical Committee (NCCTC)*** and ***National Climate Change Steering Committee (NCCSC)*** will guide the coordination and implementation of this Strategy.
- The ***NCCTC*** shall provide technical advice to the ***National Climate Change Focal Point (NCCFP),*** while the ***NCCSC*** shall provide policy guidance and ensure coordination of actions as well as cross sectoral participation.

Flooding events in Tanzania (National Climate Change Strategy, 2012).



Tanzania (Climate) Governance structure

From National Level to Local Level

National Level

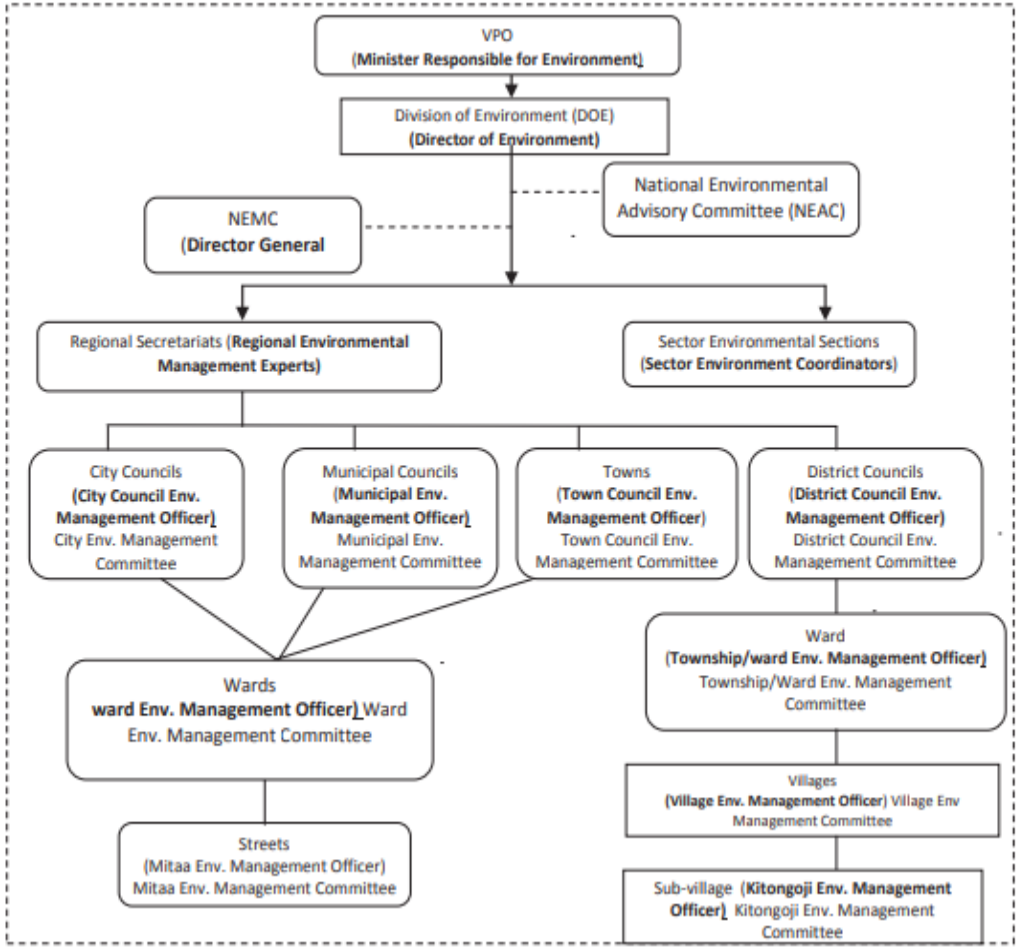
At national level, The Vice President Office (VPO) – Division of Environment - is responsible for Climate Change adaptation policies and activities

- Policies, actions
- Monitoring
- Evaluation

Regional Level

The regional secretariats (Regional Environmental Management Experts) have a secretary and supervising role. They are responsible for the coordination of (climate) actions and tasks related to monitoring and evaluation of these actions.

In January 2022 the structure for the Regional Government Authorities has changed to improve ***efficiency in service delivery*** and ***control of operation costs.*** The regional governance organogram (see page 32) shows a top-down structure with units and sections on different themes. The regional commissioner is the political head of the region.



National Governance on Environmental issues (National Climate Change Strategy , 2012)

Tanzania (Climate) Governance structure

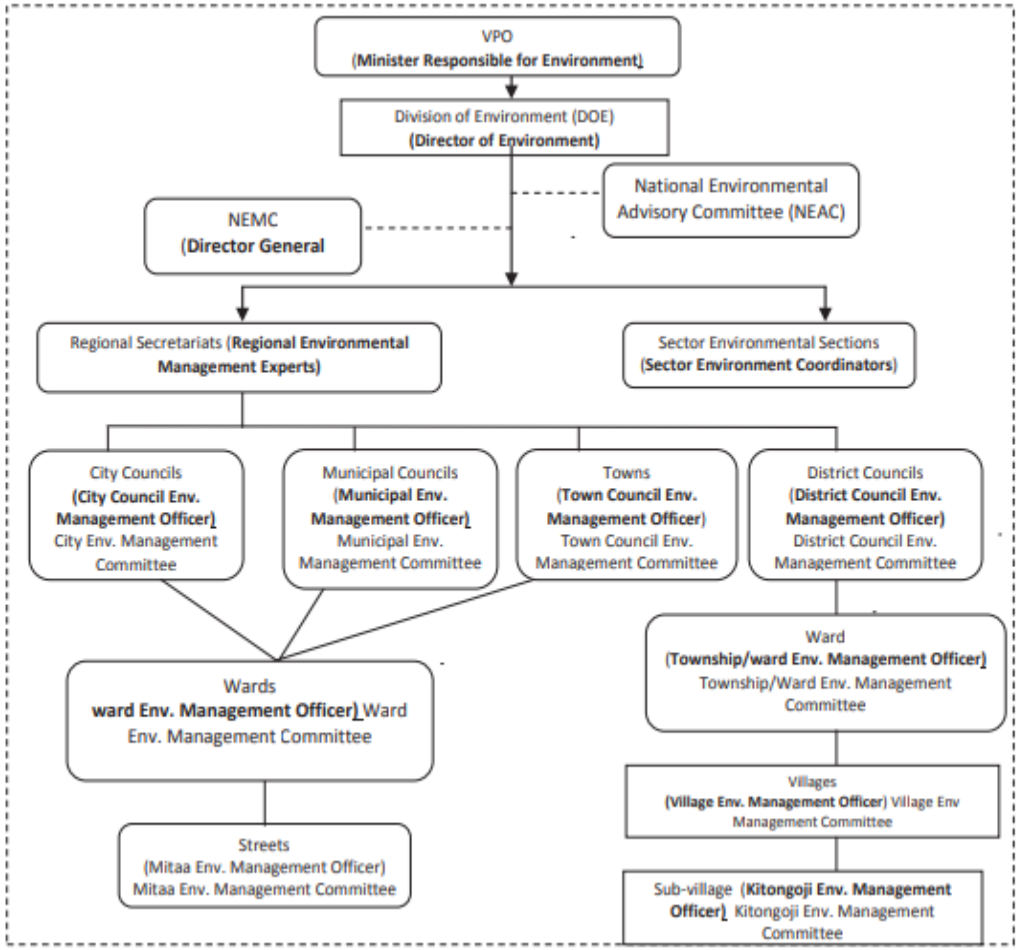
From National Level to Local Level

Local Level

At local level, the City Council, the Municipal Council, the Town Council or the District Council are responsible for the implementation of the (climate) actions and policies.

Ward/Village level

At the most local level, the Ward Officer takes care of the implementation of actions in the wards. Also, specific needs on ward level are identified by the Ward Officer.



National Governance on Environmental issues (National Climate Change Strategy , 2012)

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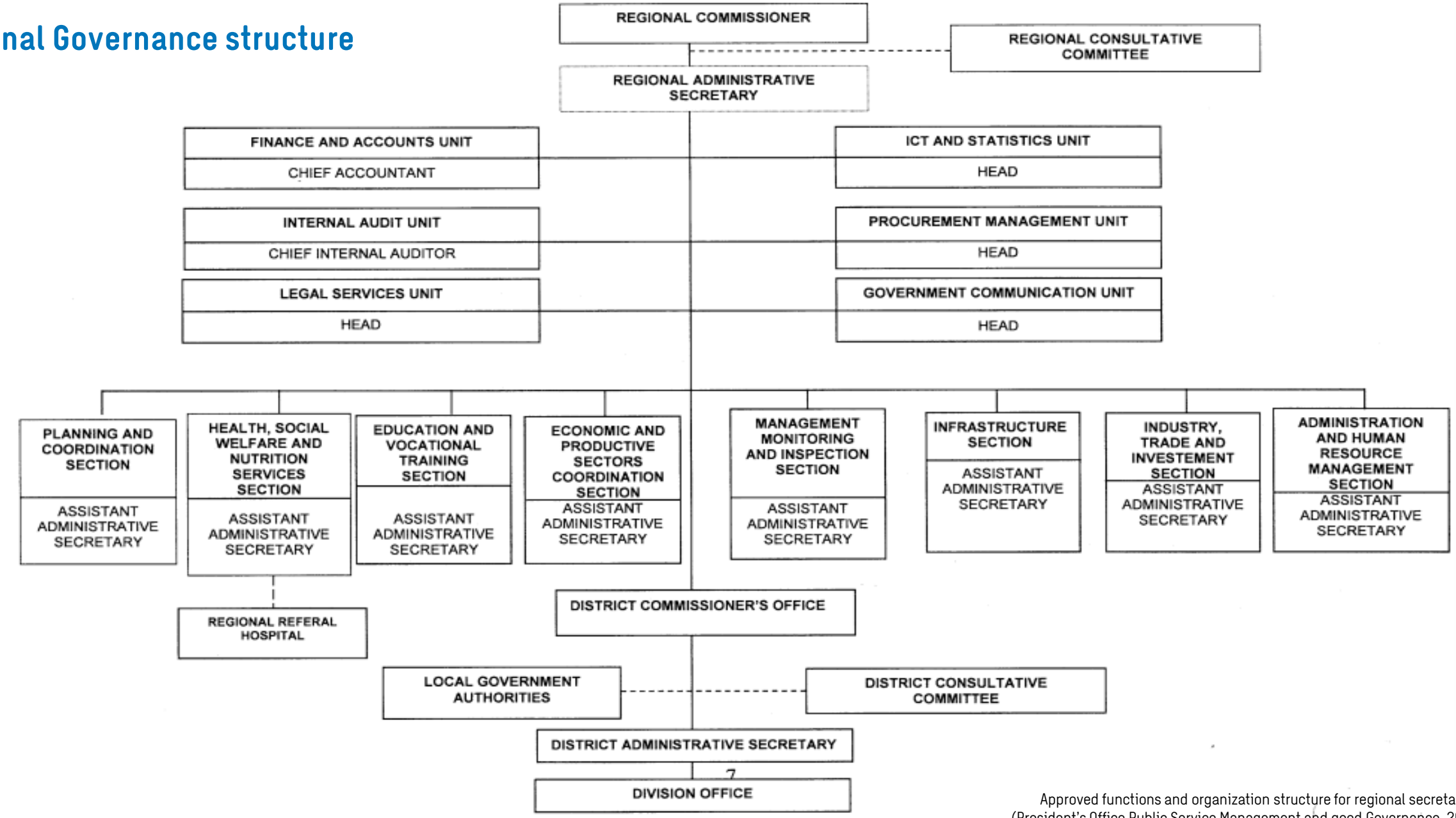
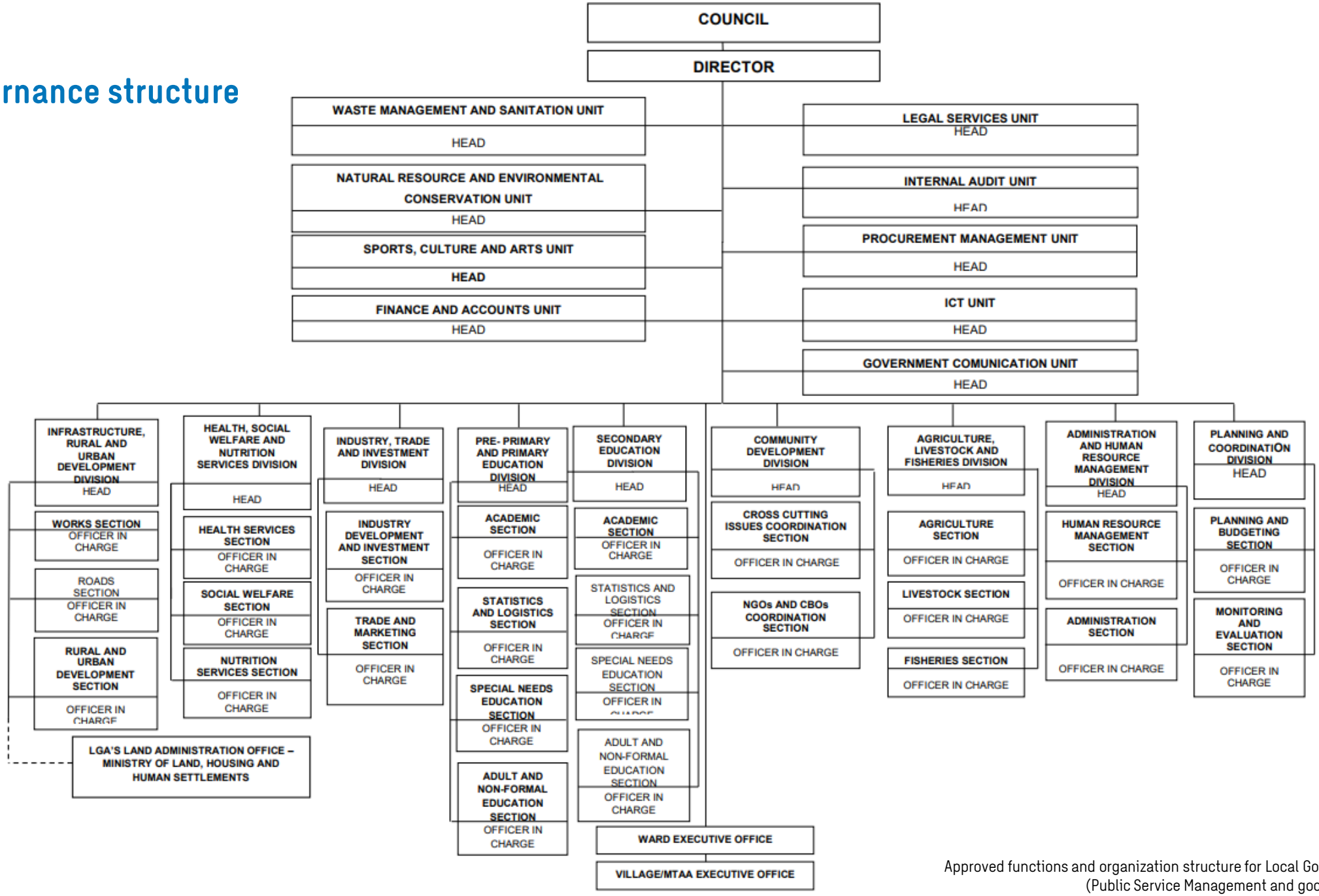
Regional Governance structure



Approved functions and organization structure for regional secretariats
(President's Office Public Service Management and good Governance, 2022)

Local Governance structure



Approved functions and organization structure for Local Government Authorities (Public Service Management and good Governance, 2022)

Organisational structure of Local Government Dodoma

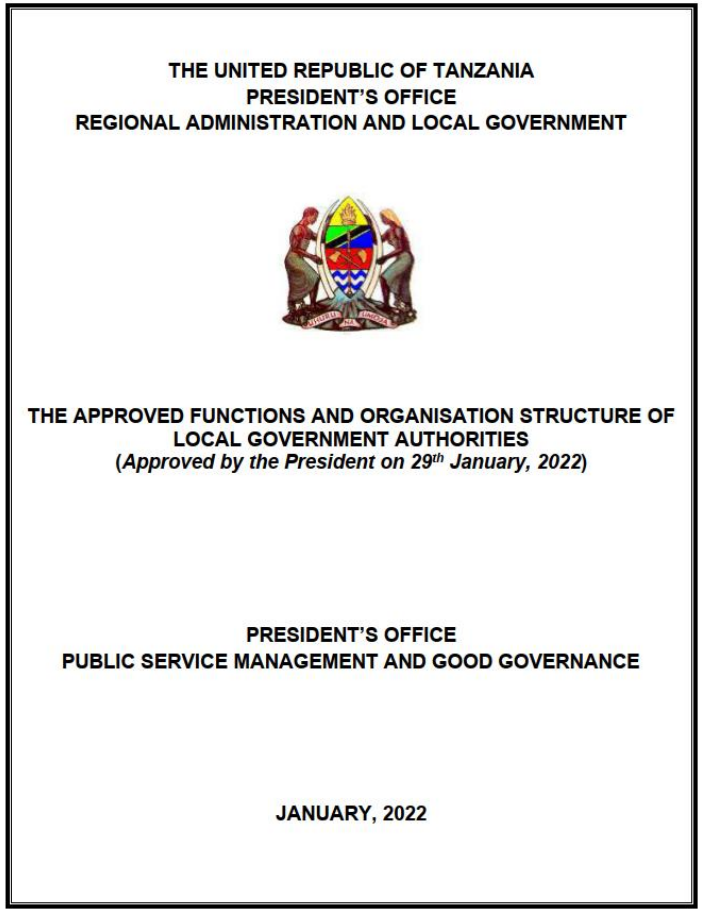
City level

In January 2022, the structure for the Local Government Authorities has changed to improve ***efficiency in service delivery*** and ***control of operations costs.***

The Dodoma Governance Structure follows a top-down structure with the ***City Council*** and ***City director*** on top, followed by:

- **9 Divisions.** Divisions are responsible for implementing the projects that are initiated by the regional and national government. The divisions report directly to the assistant administrative secretaries from the regional sections;
- **9 Units** that can be seen as the operational departments within a division;
- **2 Offices.** Ward Executive Office and Village Executive office. These offices are most engaged in community engagement and work together with offers in charge from the different divisions.

Dodoma abolished the water department and embedded all water supply and sewerage activities in **DUWASA:** the Dodoma Urban Water supply and Sewerage Authority. Duwasa is responsible for plans around the water and sewerage network. Duwasa also promotes public education on health aspects of water supply and wastewater.



THE UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

THE APPROVED FUNCTIONS AND ORGANISATION STRUCTURE OF LOCAL GOVERNMENT AUTHORITIES
(Approved by the President on 29th January, 2022)

PRESIDENT'S OFFICE
PUBLIC SERVICE MANAGEMENT AND GOOD GOVERNANCE

JANUARY, 2022

Tanzania (Climate) Governance structure

Climate Change Adaptation Budgeting

National Level

- Addressing climate change in Tanzania largely depends on financial support from the international community. Domestic funding from government budget, private sector, as well as individual contributions will complement this effort.
- The National Climate Change Strategy (2012) indicated that an integrated approach and coordinated working system is highly required to ensure that funds to address climate change are used to achieve the objectives presented in the Climate Change Strategy.
- To ensure resources availability, the National Climate Change strategy proposes the establishment of a National Climate Change Fund (NCF) and a special climate change window under Basket Fund to finance its implementation. No information is found on whether the NCF is currently set up.

At national level, resource mobilization, financial management and reporting is undertaken pursuant to the government's financial management guidelines and systems established under the ***Ministry of Finance.***

Source: National Governance on Environmental issues (National Climate Change Strategy , 2012)

Tanzania (Climate) Governance structure

Climate Change Adaptation Budgeting

Regional level

The ***Planning and Coordination Section*** is responsible for budgeting of the Regional Secretariats (see regional governance structure). The section needs to:

- Coordinate the translation of national strategies to the preparation of regional plans and corresponding budgets.

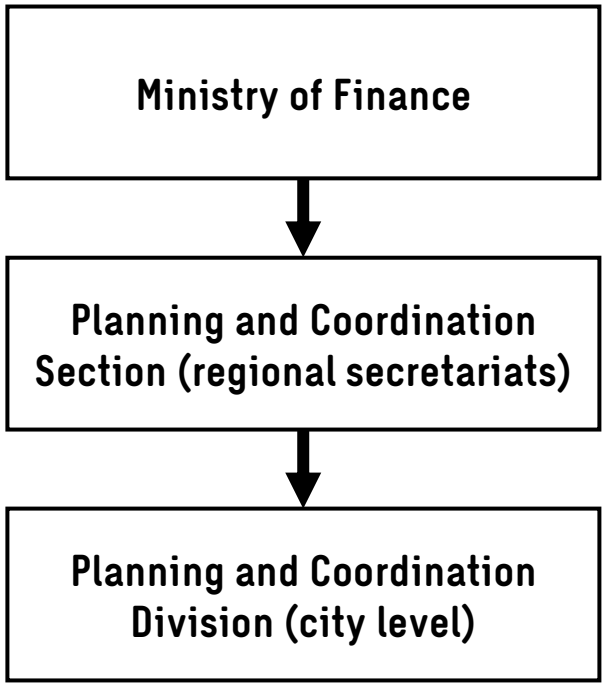
Source: Approved functions and organization structure for regional secretariats (President's Office Public Service Management and good Governance, 2022)

Local Level

At local level, the ***Planning and Coordination Division*** is responsible for budgeting (see local governance structure). The division needs to:

- Prepare mid- and long-term strategies and plans and the corresponding budgets;
- Monitor and evaluate implementation of strategies, plans and the respective budgets.

Source: Approved functions and organization structure for Local Government Authorities (Public Service Management and good Governance, 2022)



Impression of Climate Change Adaptation budget flows.
Note: this overview is not exhaustive

Organisational structure of Local Government Dodoma

City level

Responsible divisions and units on climate change adaptation

- The ***natural resources and environmental conversation unit*** is mostly in charge for managing climate risks.
- Additionally, the different ***divisions*** are responsible for the implementation of climate adaptation projects related to their topic. These divisions implement the (climate adaptation) projects that are initiated by the regional/national government.

Organisational structure of Local Government Dodoma

Community engagement & Participation

Offices and divisions responsible for involving ***non-governmental actors*** (including vulnerable groups) in decision-making:

Ward Executive Office

- Has the most important role in community engagement and participation in the city of Dodoma.

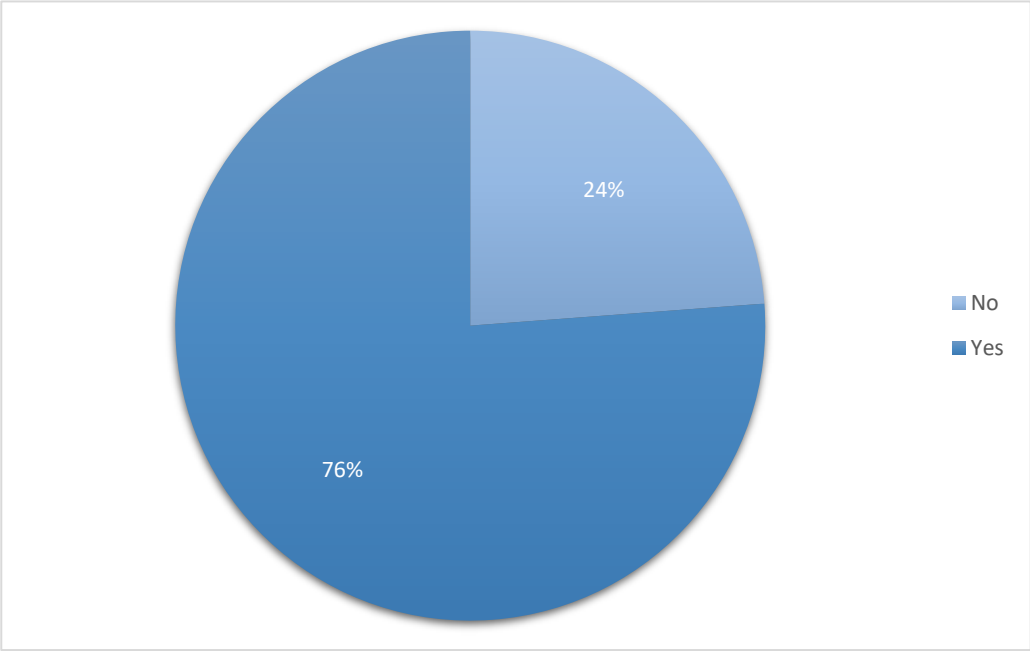
Community Development Division

- This division works on ***awareness creation*** and community participation and volunteerism in development projects;
- Also, ***citizen participation*** in planning, decision making, implementation and evaluation of spatial projects is part of their work.
- Additionally, this division coordinates and manages economic development activities for ***vulnerable groups*** as women, children and persons with disabilities
- They also coordinate the provision of training on poverty alleviation, AIDS, drugs and **gender equality.**

For an overview of citizen initiatives, see page 112.

Dodoma – Governance: city stakeholders' perception

Is Dodoma city considerate of regular people in its ambition to become Climate Adaptive and Resilient?



YES

- Citizens feel involved in some environmental projects such as the Green Dodoma Project;
- Also tree planting campaigns focus on the involvement of regular people;
- Some people feel supported by the city of Dodoma in terms of knowledge on how to stop environmental disruption;
- Some individuals indicate that they feel a strong need to conserve the environment and participate in that.

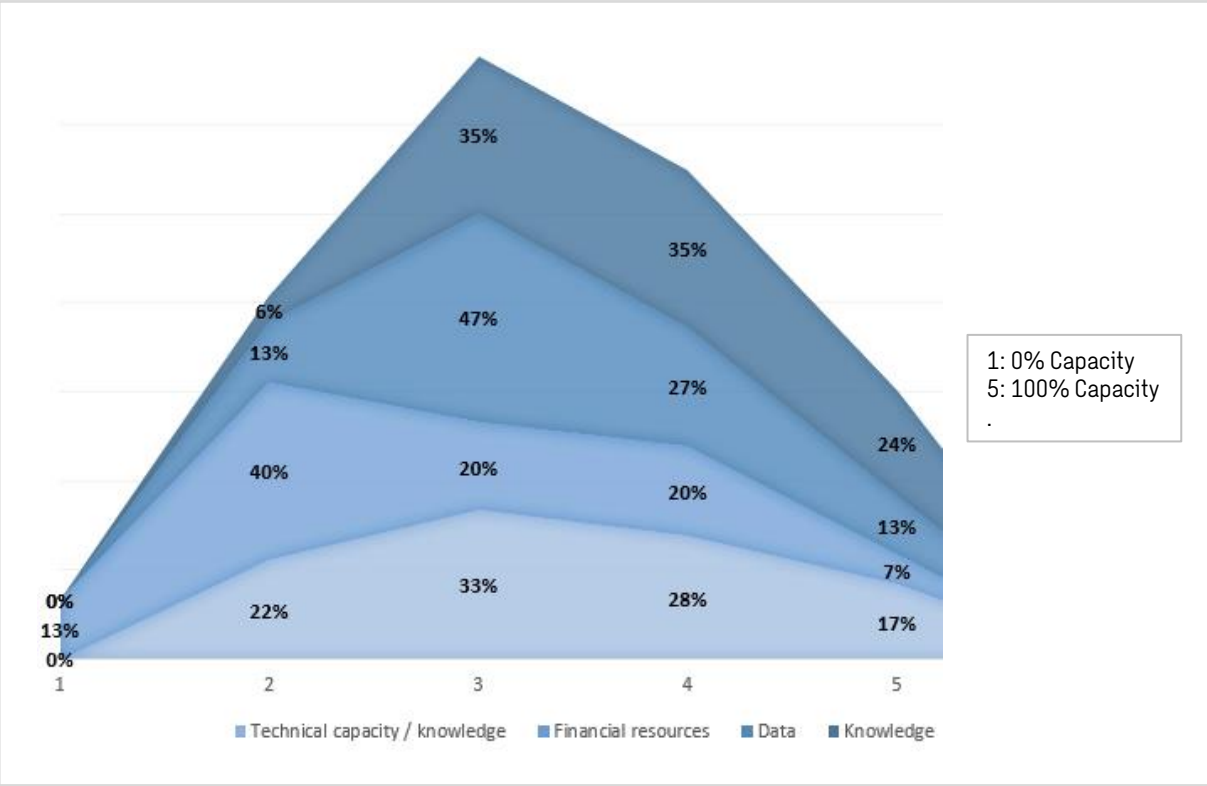
NO

- Individuals indicate that the rules and regulations regarding climate change adaptation are not followed. E.g. trees are planted during the wet season but there is no focus on maintenance of these trees during the dry season;
- City stakeholders indicate there is too little attention to educate people;
- There is no plan for climate adaptation measures.

Source: Questionnaire Dodoma CRA (2022)

Dodoma - Governance: city stakeholders' perception

Do you feel the city has the required capacity to make Dodoma climate resilient?



Local Government's Capacity to make Dodoma Climate Resilient

- According to the city stakeholders, Dodoma has quite good ***knowledge*** and ***technical capacity*** to make Dodoma Climate Resilient.
- ***Data availability*** and ***Financial resources*** are more limiting factors.

Source: Questionnaire Dodoma CRA (2022)

Hazard assessment

Impact assessment

Hazard and Impact Assessment

Introduction

Hazards & Impacts

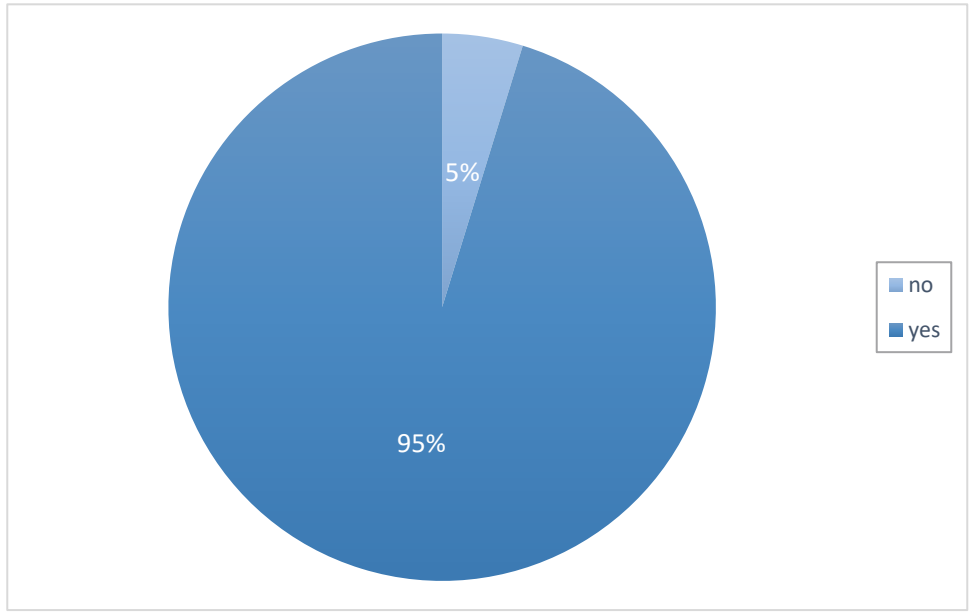
Based on an extensive literature study and stakeholder interviews, the hazard assessment determines the most important ***climate hazards*** for the themes heat, drought and floods & storms. These climate hazards are the ***physical climate effects*** that Dodoma is exposed to. For each of the climate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

Subsequently, the impact assessment focusses on the ***impacts*** of the climate hazards. These impacts were found in literature and were amplified by the city stakeholders.

Hazard: City stakeholders' perception

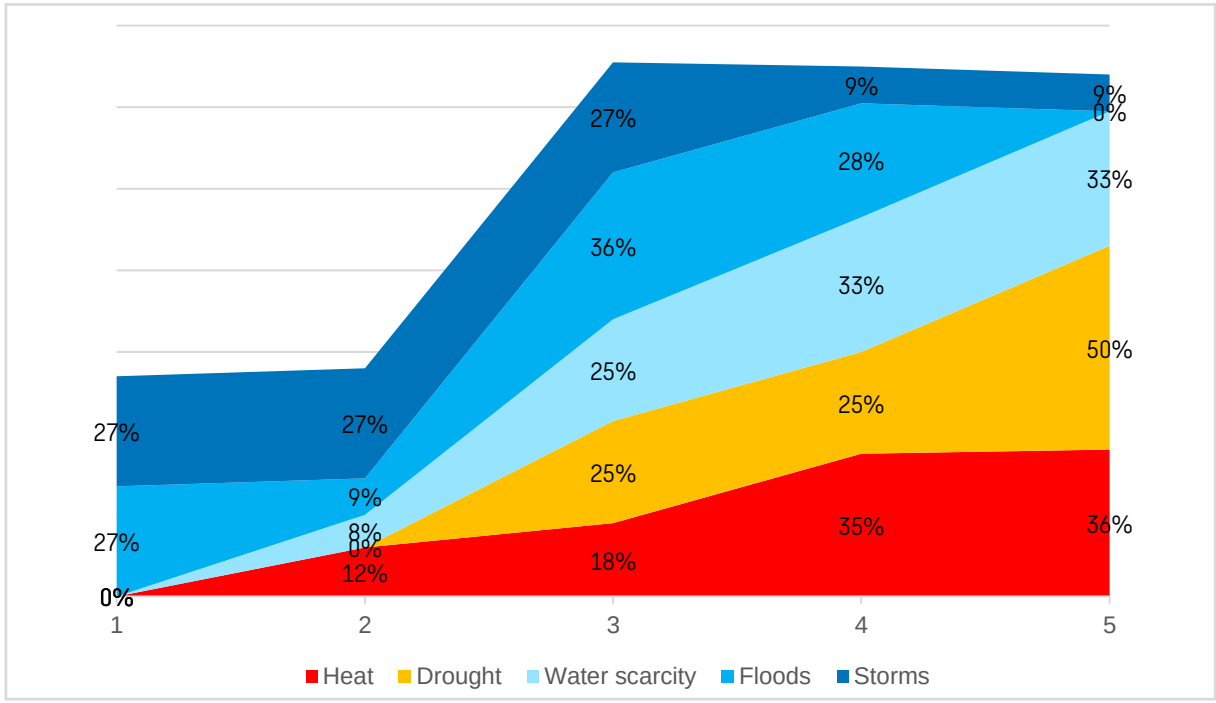
Awareness

Do you know what the effects of climate change are in Dodoma?



- City stakeholders seem to be very aware of the effects of climate change in Dodoma: **95%.**

Do you feel affected by the impacts of heat/drought/floods and storms?

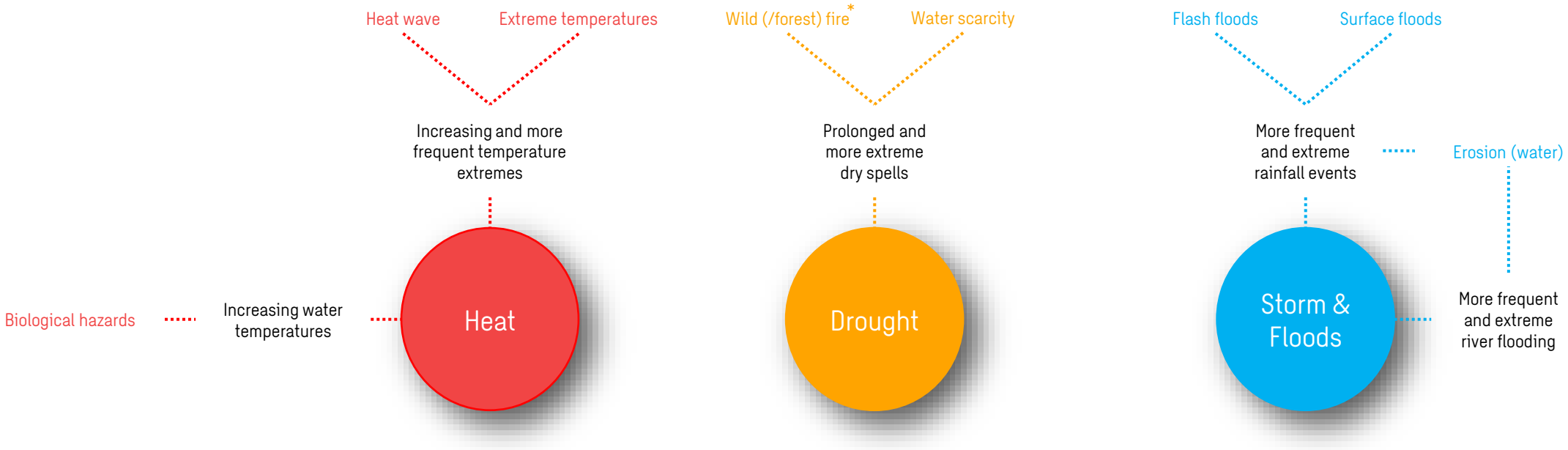


- City stakeholders indicate to be mainly affected by **heat**, **drought** and **water scarcity**. The same individuals indicate to be less affected by the effects of **floods** and **storms**.

Source: Questionnaire Dodoma CRA (2022)

Hazard Assessment

Hazards in Dodoma



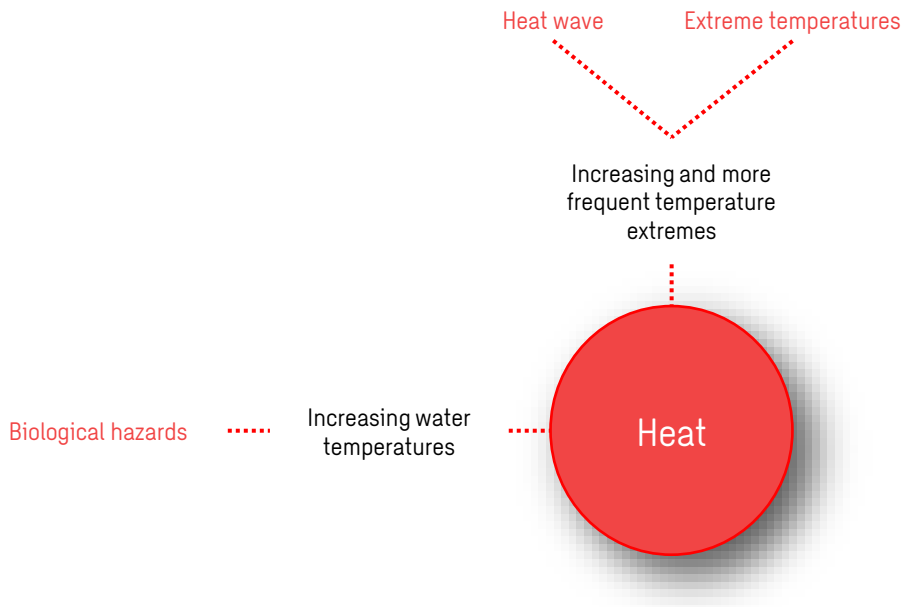
LEGEND

In black: Primary Climate Hazard

In colour: Secondary Climate Hazard

* The start of Wild/forest fires is generally caused by humans; due to drought these fires get more extreme and devastating

Heat in Dodoma



LEGEND

In black: Primary Climate Hazard

In red: Secondary Climate Hazard

What effects are visible now?

During the last years, the effects of increasing and **more frequent temperature extremes** have been clearly visible in Tanzania. Several news articles and stakeholders from the city of Dodoma underline this trend.

Additionally, stakeholders from the city of Dodoma identify **increasing water temperatures** as a visible effect of heat.

Heat setting off alarm bells in East Africa

21-04-2021 | Health | Article

News article (2021)

Climate change research to prevent sleeping sickness outbreaks in Tanzania

TDR news item
1 December 2015

An innovative research approach is underway in Tanzania that may help communities adapt to the devastating effects of climate change. Unexpected weather patterns, such as increasing temperatures, late rainfall onset and droughts are affecting livelihoods, food security and health.

According to WHO estimates, climate change is already causing tens of thousands of deaths every year - from shifting patterns of disease, from extreme weather events, such as heat waves and floods, and from the degradation of air quality, food and water supplies, and sanitation.

Source: News article (2021)

MABADILIKO YA TABIANCHI

Mabadiliko ya hali ya hewa yanasababisha ukosefu wa chakula, umaskini na kufurushwa makazi barani Afrika

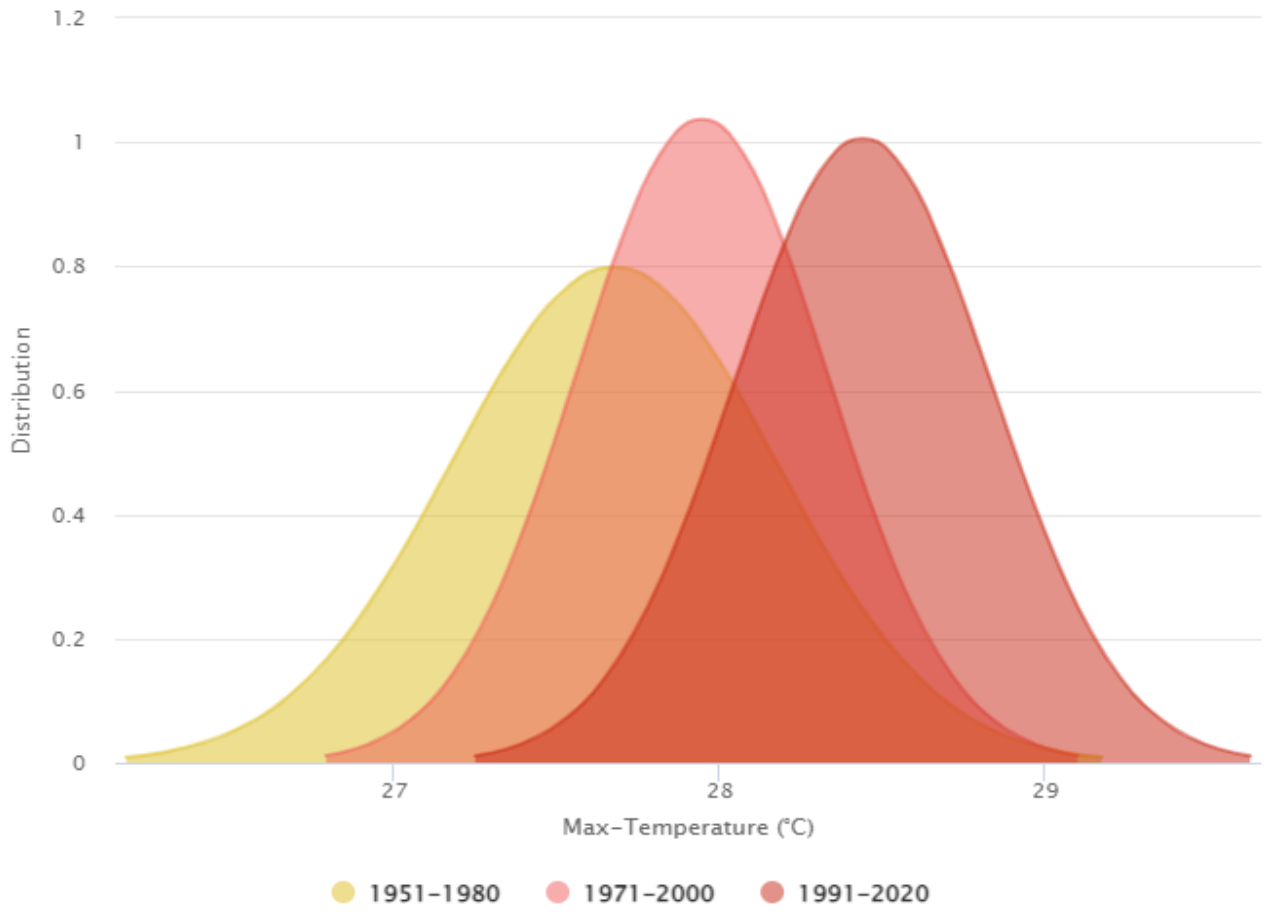
Kuyeyuka kwa barafu Afrika kunaashiria mabadiliko katika mfumo wa Dunia

Afrika Upya: Novemba 2021 | 19 October 2021
Na: WMO

Source: News article (2021)

Historical trends and future predictions

Historical observations provide evidence for the **rising temperature trend**. This figure shows that the maximum temperature in Dodoma has increased by about 1°C in the current climate compared to the climate between 1951-1980.

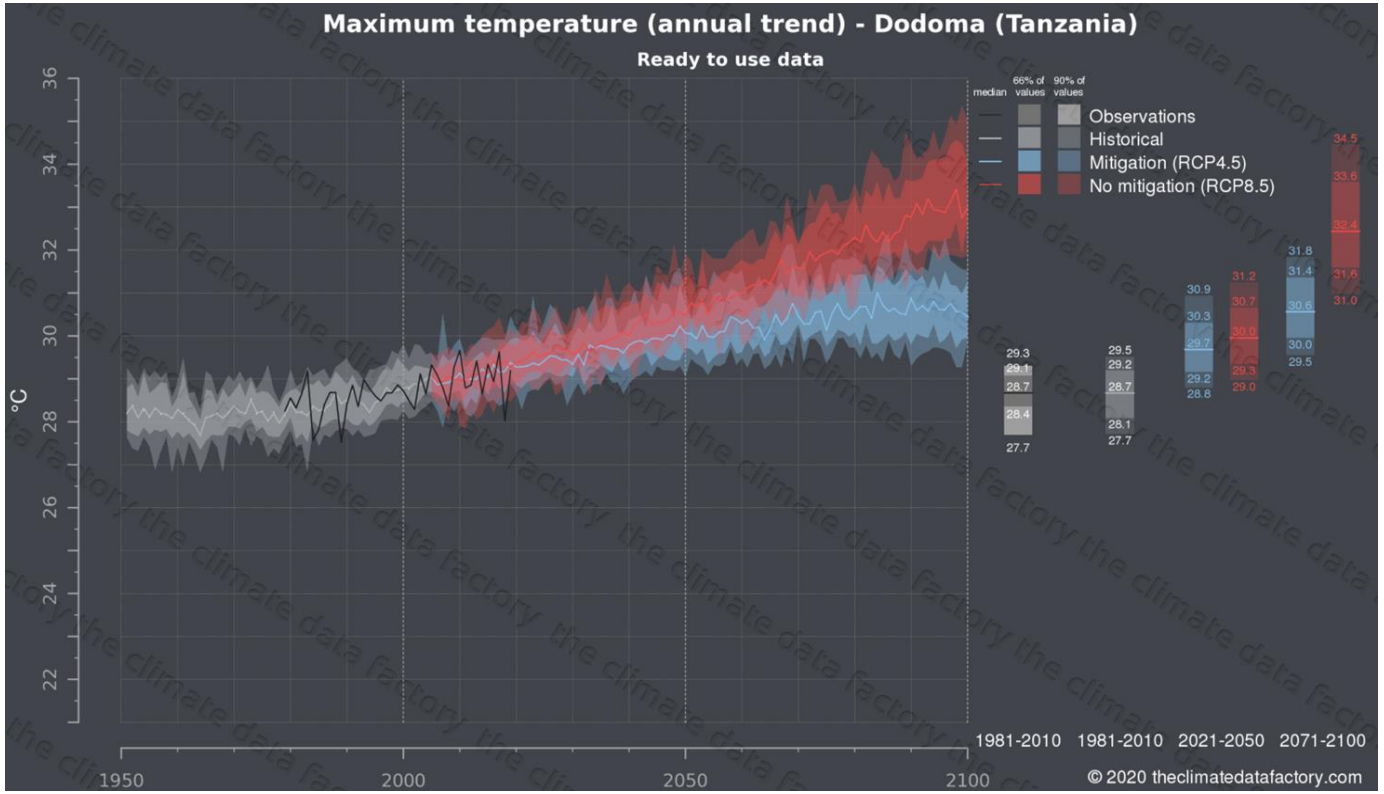


Change in distribution of Max-Temperature; Dodoma, Tanzania (Climateknowledgeportal Worldbank, 2022)

Historical trends and future predictions

The figure on this page also shows that since 1980 there is a clear **increase in average maximum temperature** in Dodoma.

Current trajectories predict an increase of 1.3 - 1.8 °C in average maximum temperatures in 2050, with an almost **ninefold increase in number of very hot days**. In 2100 average maximum temperatures are expected to have **increased to 30.5 - 33 °C**. These predictions are visualized in the infographics on the next pages.



Maximum Temperature (annual trend) – Dodoma, Tanzania (The Climate Data Factory, 2020)

Average Maximum Temperature in Dodoma (RCP4.5)

NOW	2050	2100
	+ 	+ 
28.7°C	30°C	30.5°C

Source: TheClimateDataFactory, (2020)

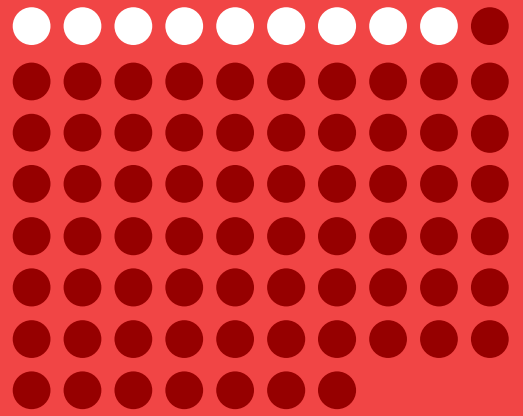
Average Maximum Temperature in Dodoma (RCP8.5)

NOW	2050	2100
	+ 	+ 
28.7°C	30.5°C	33°C

Source: TheClimateDataFactory (2020)

Number of very hot days (>35°C) (RCP 8.5)

NOW



2050

9 days

87 days

Source: World Bank Climate Change Knowledge Portal (2022)

Impact of heat on relevant city sectors

LIST OF SECTOR-BASED IMPACTS (HEAT)			
Hazard theme	**Capital**	**Division**	**Impacts**
HEAT	SOCIAL	*Health, Social Welfare and Nutrition services Division*	Increased and exacerbated heat stress to the population, leading to i.a. sleep problems and other health issues.
		Health, Social Welfare and Nutrition services Division; Agriculture, Livestock and Fisheries Division	Changes in the diet schedules and changes on food consuming ratios.
		Health, Social Welfare and Nutrition services Division	Skin sunburn
		Community Development Division/ Health, Social Welfare and Nutrition services Division	Enlarged gender inequality: women have greater roles in rural work and are therefore more affected by negative climate impacts on agriculture.
		Community Development Division/ Health, Social Welfare and Nutrition services Division	Enlarged inequalities for and among children: children are more vulnerable as there is less to no available food; less to no pasture for animals; drop out of school to look and work for water and food.
	NATURAL	*Planning and Coordination Division*	I.a. ecosystem shifts and changes to drier forests and ecosystems as a result of climate change.
		Agriculture, Livestock and Fisheries Division; Planning and Coordination Division	I.a. shifts and changes in the distribution of marine species.
		Agriculture, Livestock and Fisheries Division; Planning and Coordination Division	Loss of ecosystem services and natural capital in general to wild (/forest) fires.
	ECONOMIC	*Industry, Trade and Investment Division; Agriculture, Livestock and Fisheries Division*	Loss of productivity from labour.
		Industry, Trade and Investment Division	Increased energy demand for cooling purposes.
		Agriculture, Livestock and Fisheries Division	Loss of productivity and income from agriculture due to pests and diseases.

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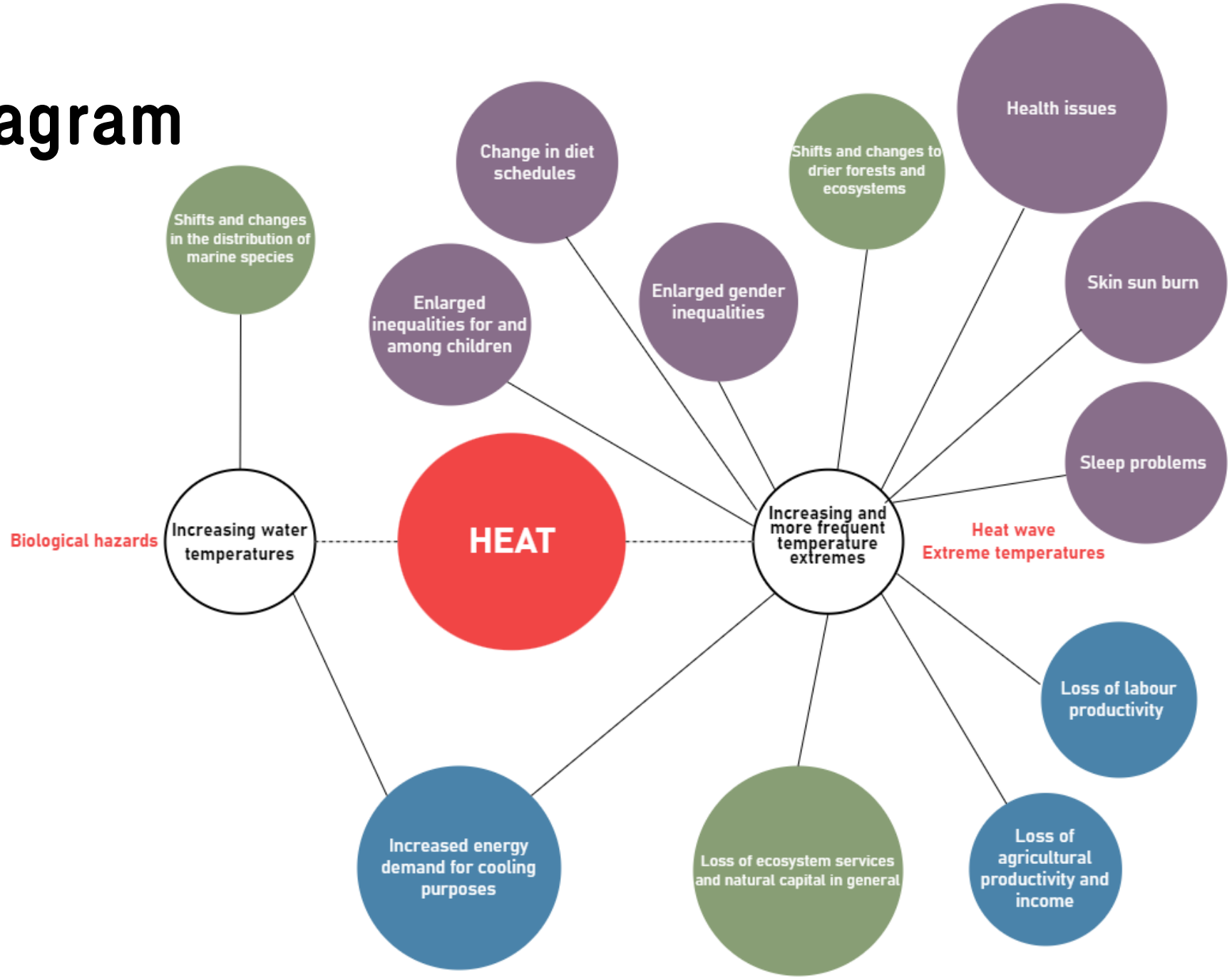
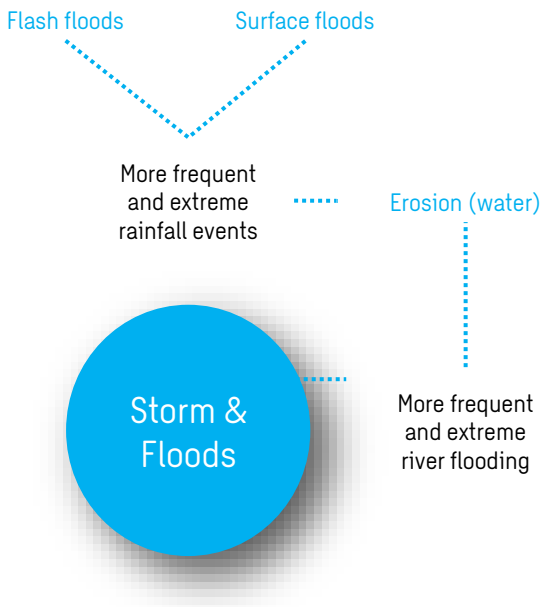
Impact Diagram



Floods and Storms in Dodoma



LEGEND

In black: Primary Climate Hazard

In blue: Secondary Climate Hazard

What effects are visible now?

Extreme precipitation events leading to **floods** is an established trend in Dodoma. Next to flash floods and surface floods, Dodoma also experiences (river) floods from seasonal gullies that overflow during wet periods.

Tanzania – 400 Displaced and 1 Dead After Floods in Mwanza and Dodoma – Further Flood Warnings Issued

21 JANUARY, 2016 BY RICHARD DAVIES IN AFRICA, NEWS

Source: News article (2016)

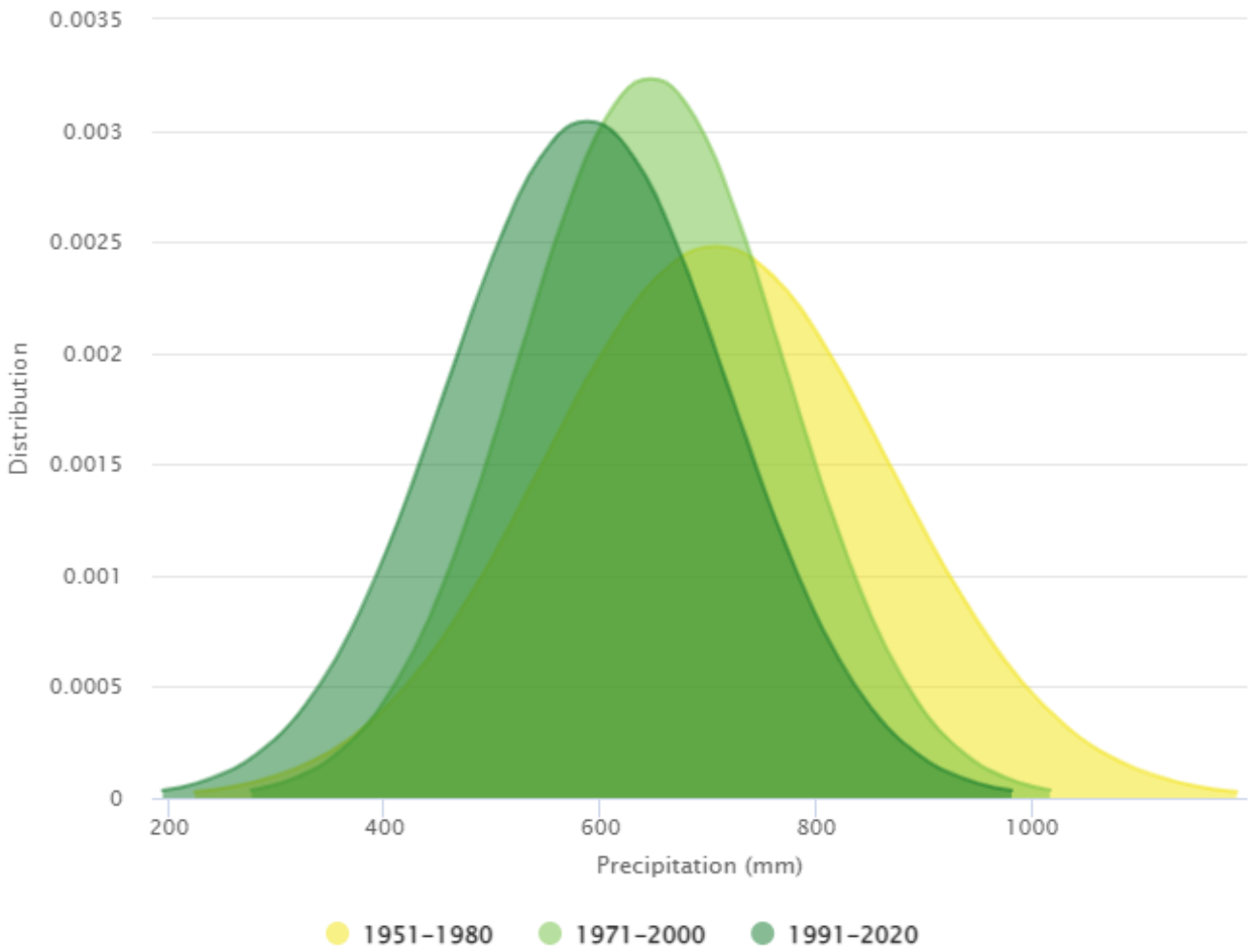
Dodoma flood victims now reach over 2,500

THURSDAY JANUARY 11 2018

Source: News article (2018)

Historical trends and future predictions

The current **yearly precipitation** in Dodoma is about 570 mm. 85% of this amount falls between November and April. Over the past decades, the total precipitation amount has significantly decreased from about 750 mm of precipitation per year in the period 1951 – 1980.

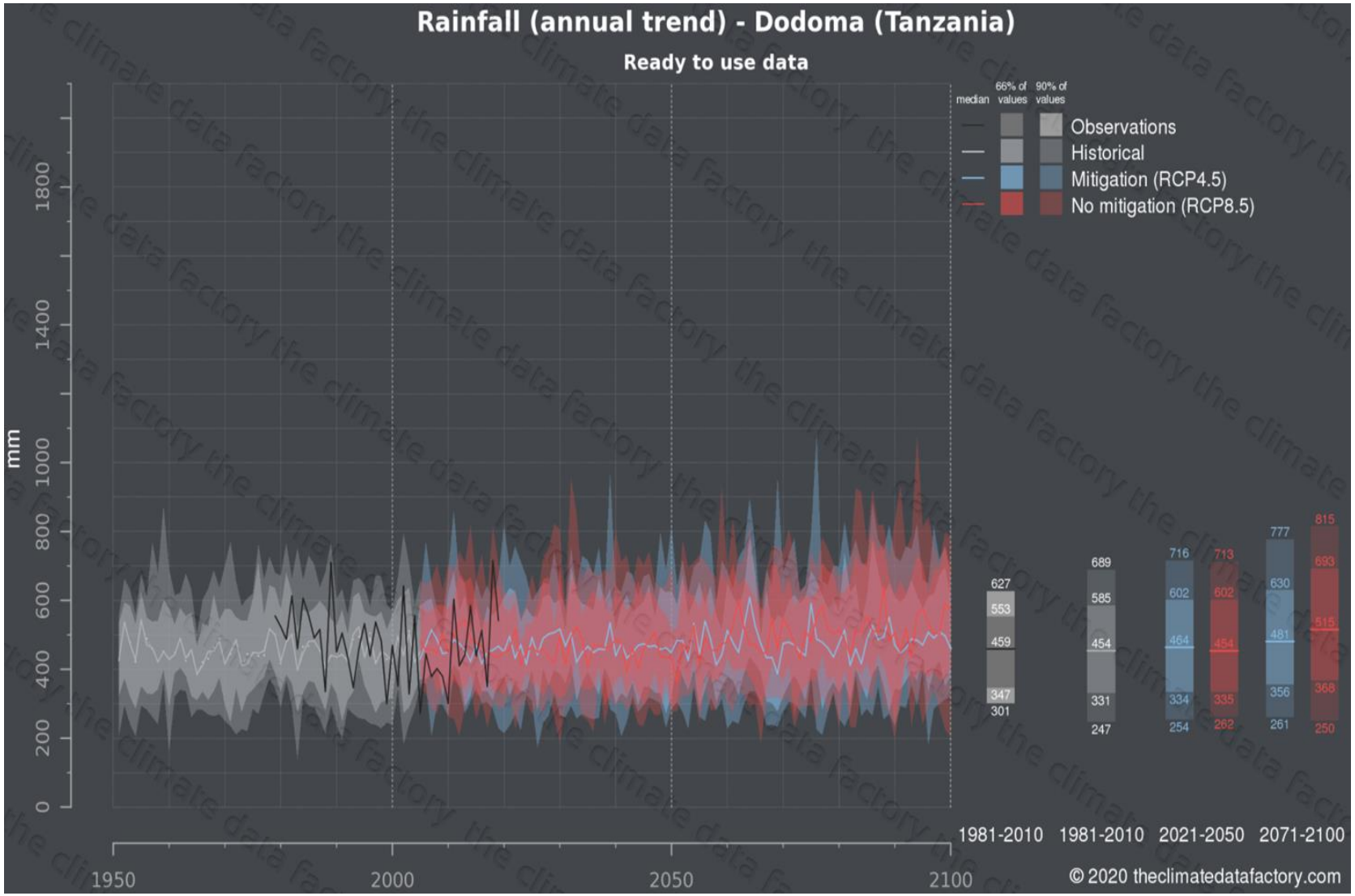


Change in Distribution of Precipitation; Dodoma, Tanzania (Climateknowledgeportal Worldbank, 2022)

Historical trends and future predictions

This figure also shows a slight **decline in annual rainfall** over the past 30 years (5 mm), whereas future projections for 2100 show a **slight increase in annual precipitation** of 60 mm (RCP8.5)

More relevant in terms of flood risk is that although the total annual precipitation amount will not experience big changes, rainfall events are predicted to become more **extreme and hazardous** in the future. The infographic on the next page underlines this trend.

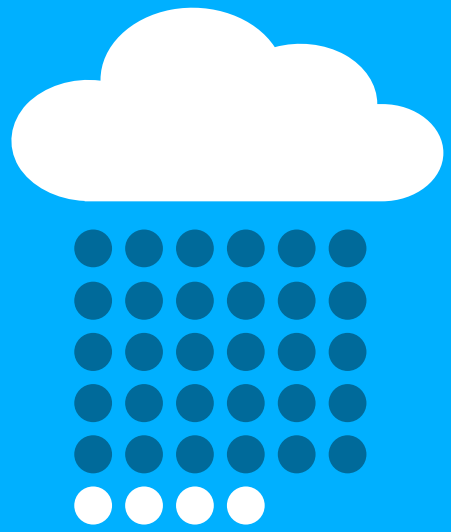


Yearly rainfall; Dodoma, Tanzania (The Climate Data Factory, 2020)

Average largest 1 day precipitation
(RCP 8.5)

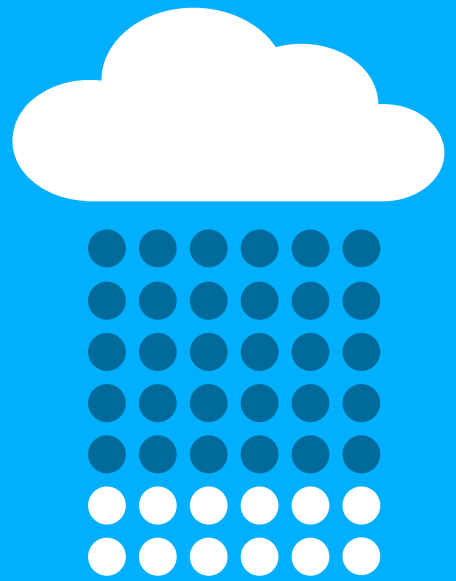
2020-2039 = 51,84 mm

2040-2059



+4 mm

2080-2099

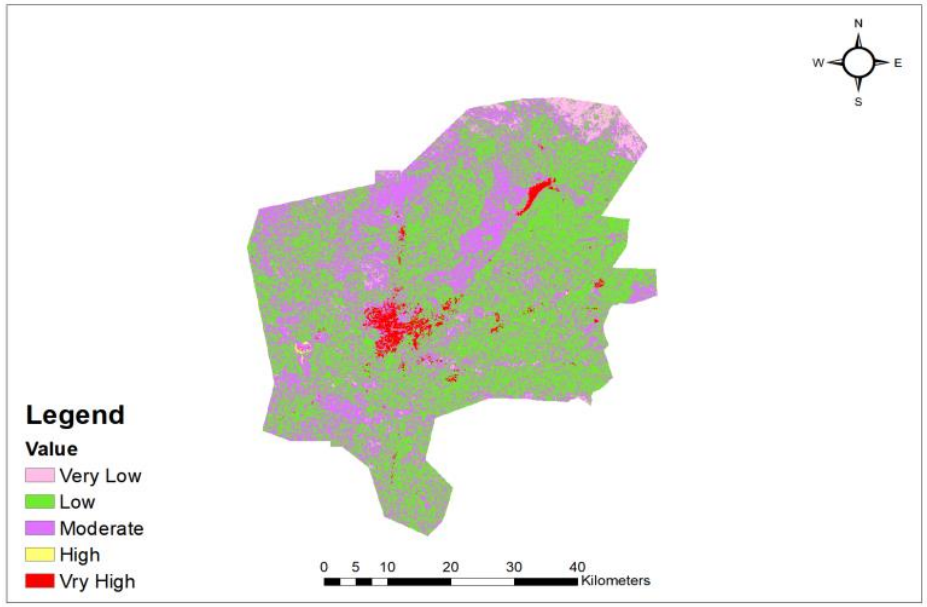


+12 mm

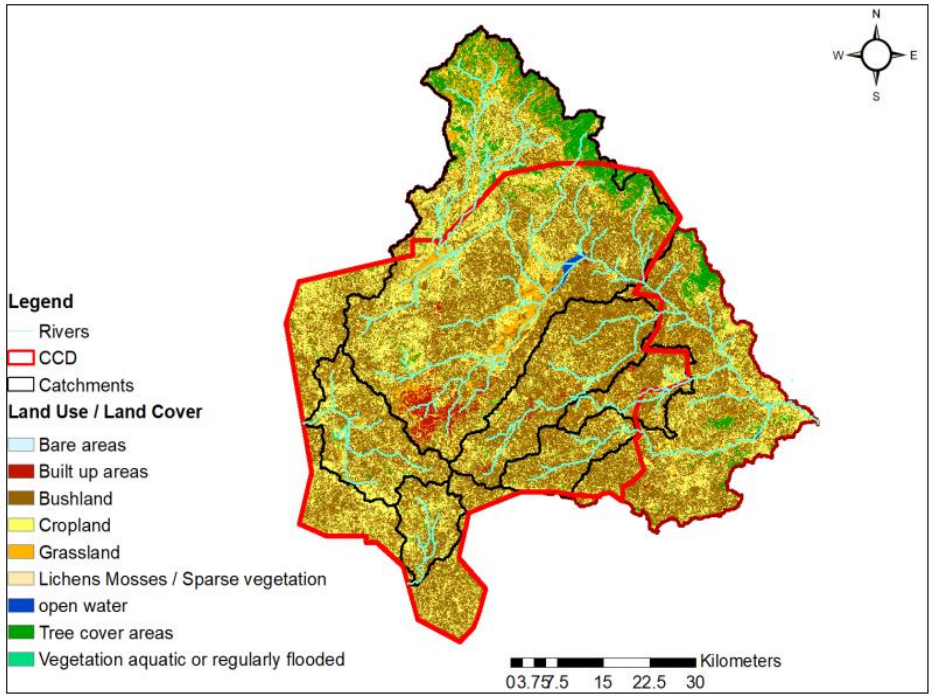
Source: World Bank Climate Change Knowledge Portal (2022)

Flood hazard maps

The upper map shows the **susceptibility to flooding** of the different areas in in the Dodoma Capital District. A comparison with the lower map which shows the **land cover map**, indicates that especially the **built-up areas are susceptible to flooding**.



Susceptibility to flooding map (Drainage and Sanitation Development Plan for Dodoma City, 2019);



Land cover map (Drainage and Sanitation Development Plan for Dodoma City, 2019);

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Impact of Floods & Storms on relevant city sectors

LIST OF SECTOR-BASED IMPACTS (FLOODS & STORMS)			
Hazard theme	**Capital**	**Sector (Division)**	**Impacts**
FLOODS & STORMS	SOCIAL	*Community Development Division/; Health, Social Welfare and Nutrition services Division*	Enlarged gender inequality: women have greater roles in rural work and are therefore more affected by negative climate impacts on agriculture.
		Health, Social Welfare and Nutrition services Division; Infrastructure, Rural and Urban Development Division	Displacement and loss of lives.
		Community Development Division	Conflicts among neighbors: downstream neighbors are affected by upstream neighbors.
		Health, Social Welfare and Nutrition services Division; Agriculture, Livestock and Fisheries Division	Food shortage or hunger due to crop failure.
		Health, Social Welfare and Nutrition services Division	Increased water-borne disease incidents. Disease outbreaks after floods as cholera are a recognized impact.
		Agriculture, Livestock and Fisheries Division	Loss of employment and income from agriculture and livestock due to unreliable rainfall and floods.
	NATURAL	*Agriculture, Livestock and Fisheries Division; Infrastructure, Rural and Urban Development Division*	Unpredictable rains and flash floods leading to soil erosion, destruction of farmland, and landscape disruption including **falling trees.**
	ECONOMIC	*Infrastructure, Rural and Urban Development Division; Planning and Coordination Division*	Damage to and loss of transport, communications and buildings due to increased rainfall and corresponding increased flooding.
		Agriculture, Livestock and Fisheries Division	Loss of productivity and income from agriculture (and livestock) due to soil erosion and destruction of farmland.
		Agriculture, Livestock and Fisheries Division	Loss of productivity and income from agriculture due to unreliable rainfall and floods.
		Industry, Trade and Investment Division; Infrastructure, Rural and Urban Development Division, Planning and Coordination Division	Destruction or damaging of (transport, storage and ICT) infrastructure.
		Infrastructure, Rural and Urban Development Division	Disruption of traffic and transit systems
		Infrastructure, Rural and Urban Development Division	Destruction of sewage systems
		Infrastructure, Rural and Urban Development Division; Industry, Trade and Investment Division	Damage to electricity services

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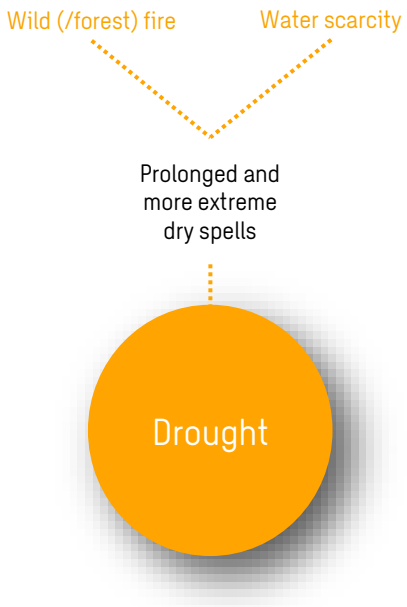
Impact diagram

Climate hazards
Natural impacts
Social impacts
Economic impacts
Highly prioritized impacts

Drought in Dodoma



LEGEND

In black: Primary Climate Hazard

In orange: Secondary Climate Hazard

What effects are visible now?

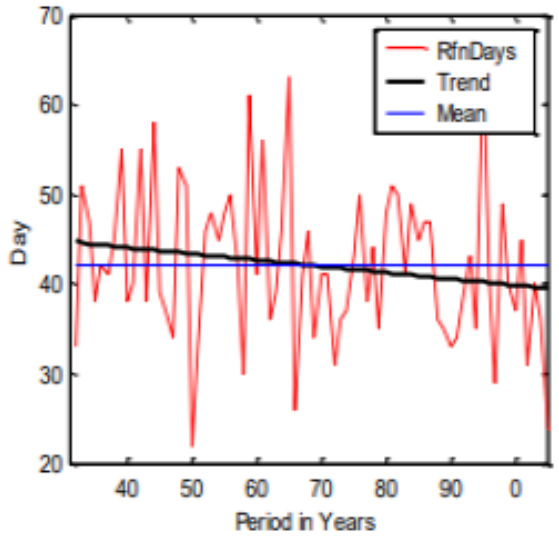
The effects of drought in Dodoma have increased over the past decades. City stakeholders as well as climatic data indicate an **increase of long dry periods** leading to problems in for example the agriculture sector due to water scarcity.

Historical trends and future predictions

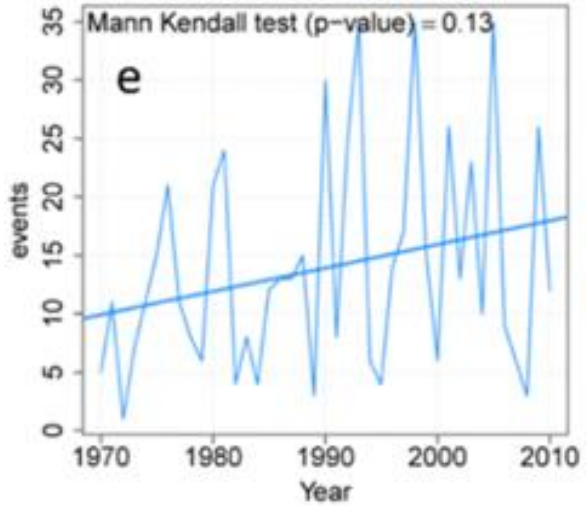
The graph on the left shows that the total number of rainy days in the rainy season has decreased with **about 10%** during the period 1932 – 2007. In addition, the number of dry spells with no precipitation for longer than 10 days during the rainy season has increased with about 15 days during the period 1970 -2010.

Source: News article (2021)

Source: News article (2021)



Total number of rain days in a OCT-MAY season (Drainage and Sanitation Development Plan for Dodoma City, 2019)

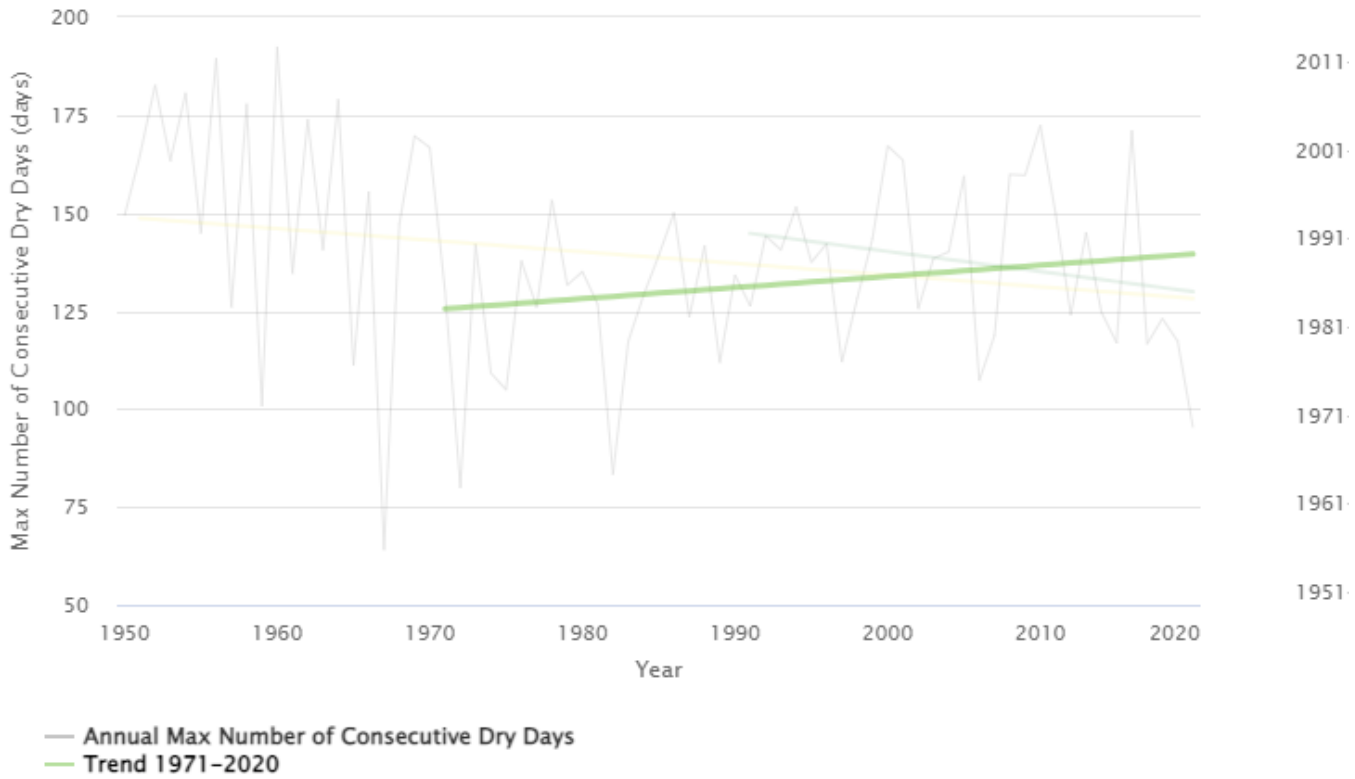


Dry spells (no precipitation) longer than 10 days in the rainy season (Brüssow et al., 2019)

Historical trends and future predictions

Next to a decrease in precipitation during the rainy season, also the length of dry spells during the dry season increased over the past 50 years. This figure shows that the maximum number of consecutive **dry days has increased with about 20 days** between 1971 and 2020.

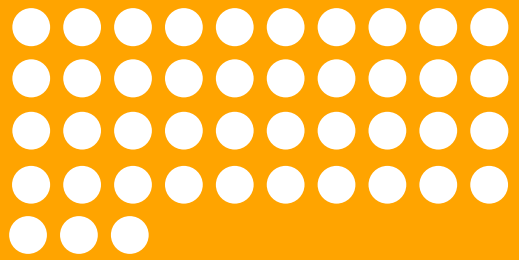
The length of dry spells during the dry season is expected to increase with about 4 days in the period 2080 – 2099.



Maximum number of consecutive Dry Days Annual Trend; Dodoma, Tanzania (Climate knowledge portal Worldbank, 2022)

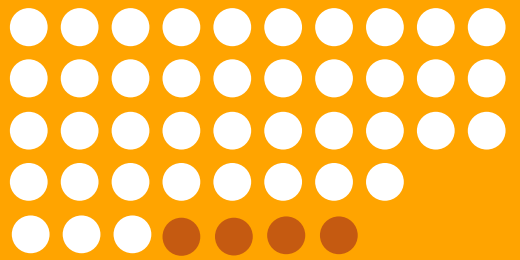
Longest dry spell
(RCP 8.5)Annually

2020-2039



185

2080-2099

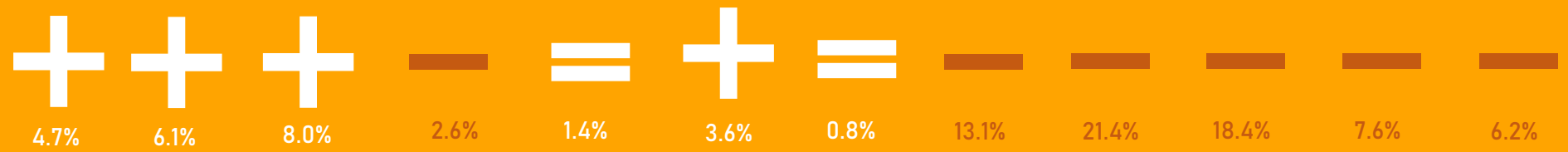


+4 days

Source: World Bank Climate Change Knowledge Portal

Projected change in effective precipitation (RCP 8.5)

Current situation to 2040-2059 average



Source: World Bank Climate Change Knowledge Portal

Impact of Drought on relevant city sectors

LIST OF SECTOR-BASED IMPACTS (DROUGHT)			
Hazard theme	**Capital**	**Division**	**Impacts**
DROUGHT	SOCIAL	*Community Development Division; Health, Social Welfare and Nutrition services Division*	Low water levels in the Makutupora basin (and other water basins resources) leading to an increased risk of domestic water shortages.
		Community Development Division	Enlarged gender inequality: women have greater roles in rural work and are therefore more affected by negative climate impacts on agriculture. Also gender issues due to the misuse of manpower on obtaining water or reaching water resources is reported.
		Health, Social Welfare and Nutrition services Division; Agriculture, Livestock and Fisheries Division.	Food insecurities and gender inequalities due to a shift towards cash crops.
		Health, Social Welfare and Nutrition services Division; Agriculture, Livestock and Fisheries Division.	Food shortage or hunger due to crop failure.
		Health, Social Welfare and Nutrition services Division; Agriculture, Livestock and Fisheries Division.	Increased epidemic disease incidences.
		Agriculture, Livestock and Fisheries Division	Loss of employment and income from agriculture and livestock due to drought.
		Community Development Division; Health, Social Welfare and Nutrition services Division; Agriculture, Livestock and Fisheries Division	Displacement of families due to food and water shortages.
	NATURAL	*Infrastructure, Rural and Urban Development Division*	Failed tree planting campaigns
		Agriculture, Livestock and Fisheries Division	Shifts and changes in plant species
		Infrastructure, Rural and Urban Development Division; Agriculture, Livestock and Fisheries Division	Loss of ecosystem services and natural capital in general to wild (/forest) fires.
		Infrastructure, Rural and Urban Development Division; Agriculture, Livestock and Fisheries Division	Loss of biodiversity
	ECONOMIC	*Agriculture, Livestock and Fisheries Division*	Loss of productivity and income from agriculture and livestock due to drought.
		Agriculture, Livestock and Fisheries Division	Loss of productivity and income from beekeeping.
		Industry, Trade and Investment Division	Lack of water for industrial uses due to low water levels in the Makutupora basin (and other water resources).

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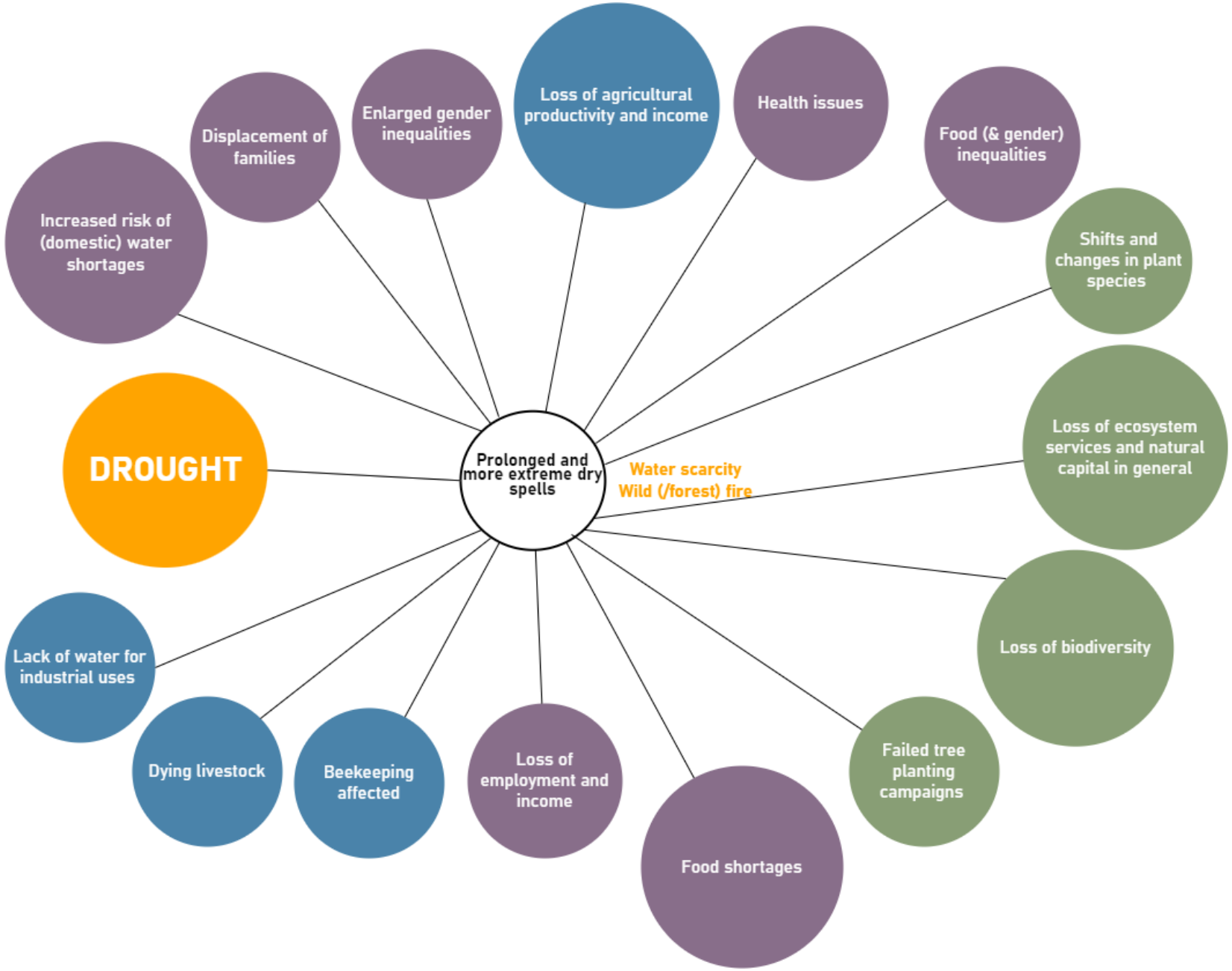
Impact diagram



- Climate hazards
- Natural impacts
- Social impacts
- Economic impacts
- **Highly prioritized impacts**

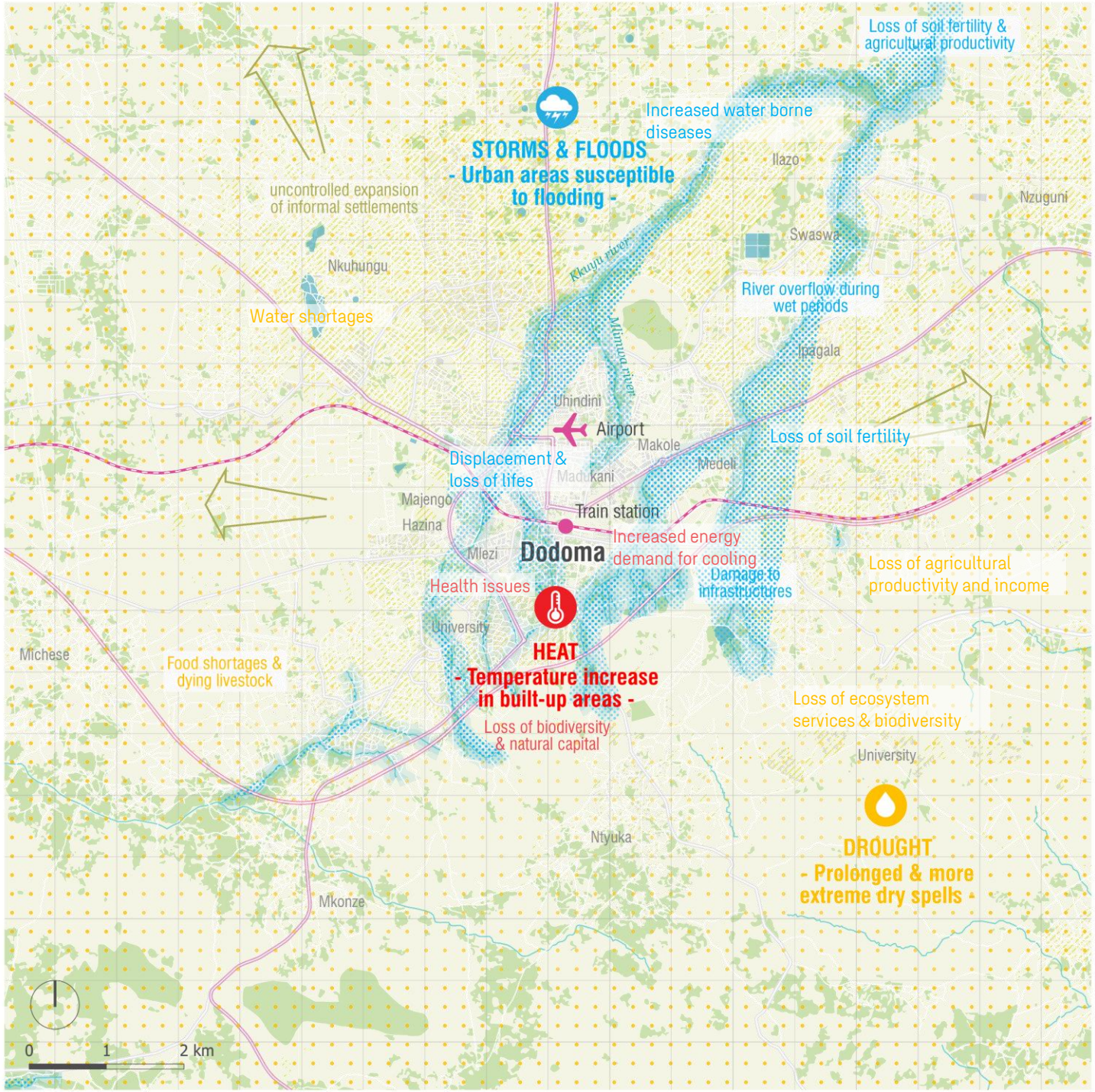
GLOBAL CENTER ON ADAPTATION

Dodoma

Spatial Diagnostic – Hotspot areas

The location of the ***hazard*** icons gives a first impression of where this hazard mostly takes place. Additionally, the spatial distribution of the priority impacts (page 74) has been added to the map. The eastern and western ***urban growth*** directions of Dodoma CCD are presented on the map, as well as the expansion of informal settlements, which are often located in vulnerable locations, thereby exasperating the living conditions for the occupants. Note that informal city development is present both centrally and in the periphery of the city.

The areas have been identified based upon literature study and stakeholder interviews and would require more in-depth, follow-up investigation at a later stage.



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

Dodoma

Spatial Diagnostic – Hotspot areas

	Affected areas - wards	Comment
Floods and storms	Chahwa, Chang'ombe Dodoma, Dodoma Makulu, Hazina, Hombolo Bwawani, Ipagala, Ipala, Iyumbu, Kikuyu Kaskazini, Kikuyu Kusini, Kilimani, Kiwanja cha ndege, Kizota, Madukani, Majengo, Makole, Makutupora, Miyuji, Mkonze, Mnadani, Msalato, Nkuhungu, Ntyuka, Nzuguni, Tambukareli, Uhuru, Viwandani	The hotspot areas of the hazards **flash floods** and **surface floods** due to more frequent and extreme rainfall events are located in the built-up areas of Dodoma City Center. Additionaly, the map shows the hotspot areas of **river floods.** This hotspot area has a high concentration of informal settlements.
Heat	Chamwino, Chang'ombe Dodoma, Dodoma Makulu, Hazina, Ipagala, Iyumbu, Kikuyu Kaskazini, Kikuyu Kusini, Kilimani, Kiwanja cha ndege, Kizota, Madukani, Majengo, Makole, Miyuji, Mkonze, Mnadani, Msalato, Nkuhungu, Ntyuka, Nzuguni, Tambukareli, Uhuru, Viwandani	The most **extreme temperatures** occur in Dodoma City Center. Especially during the night, these built-up areas suffer mostly from the urban heat island effect. Especially poor people in informal settlements are affected by these hot nights as they have no financial resources available to buy cooling equipment for their houses.
Drought	Chahwa, Chamwino, Chigongwe, Chihanga, Hombolo, Hombolo Bwawani, Ihumwa, Iyumbu, Kikombo, Makutupora, Matumbulu, Mbabala, Mbalawala, Mkonze, Mpunguzi, Msalato, Mtumba, Nala, Ngh'ongh'onha, Nzuguni, Zuzu	The complete Dodoma CCD is exposed in a similar way to the hazard **prolonged and more extreme dry spells**. However, the agricultural areas and people who work in agriculture for their living are mostly affected as agricultural production decreases during dry periods.

Dodoma

Spatial Diagnostic – Hotspot areas

Further investigation

Please note that this spatial diagnostic map only gives a first impression of the hotspot areas. Further investigation is required to get a more extensive overview. More detailed hazard maps in combination with more specific maps of locations with vulnerable people will lead to a more precise understanding of the hotspot areas. In addition, the selection of affected ward areas is based on a rough estimation and require further in-depth research.

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.***

Based on the input from the same city stakeholders, the impacts were plotted in a ***Risk Matrix***. The impacts in the right top corner (next page) can be seen as the ***key climate risks*** for the city of Dodoma.

Priority impacts[1]

Floods & Storms

1. Loss of soil fertility
2. Damage to infrastructure
3. Loss of agricultural productivity and income
4. Displacement and loss of lives
5. Increased water borne diseases

Heat

1. Health issues (sleeping problems, dehydration, physiological stress)
2. Loss of ecosystem services and natural capital in general
3. Increased energy demand for cooling purposes

Drought

1. Loss of agricultural productivity and income
2. Food shortages
3. Increased risk of water shortages
4. Loss of ecosystem services (biodiversity) and natural capital in general
5. Dying livestock because of loss of pasture

[1] The impacts were prioritized by the city stakeholders and the city advisor
An expert validation by the Dodoma City Advisor resulted in some minor changes to the priority impacts in comparison to the questionnaire results.

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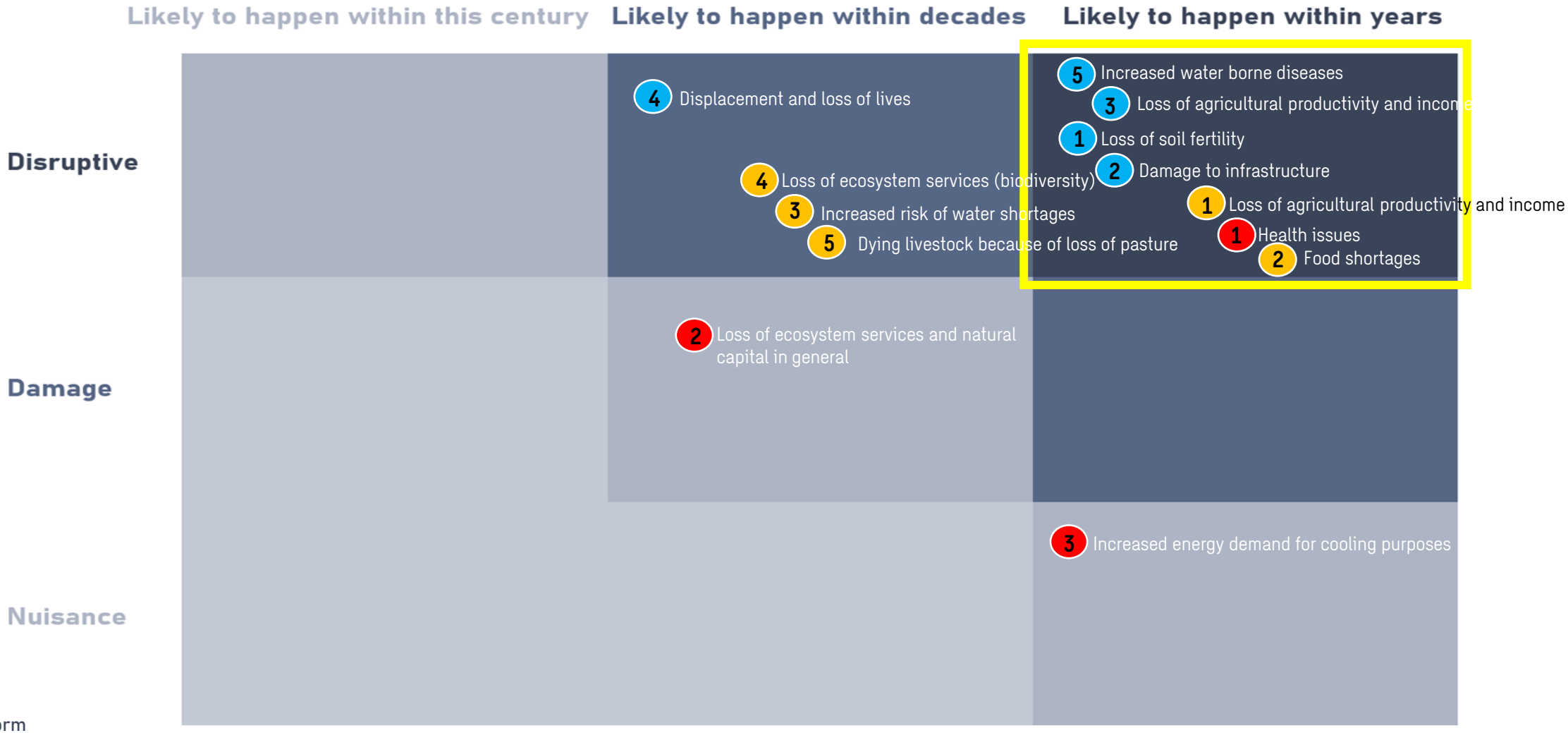
Risk Matrix[1]

Key climate risks



[1] The time series projections of the prioritized impacts in this Risk Matrix is done by the Dodoma City Advisor based on the questionnaire input from the city stakeholders.

Key Climate Risks

Loss of agricultural productivity and income
Extreme rainfall and floods but also long periods of drought result in loss of agricultural productivity. For many people this means a loss of income.

Floods | Drought

Loss of Soil Fertility
Extreme rainfall and floods lead to soil erosion that causes a loss of soil fertility.

Floods

Displacement and loss of lives
Extreme rainfall and floods destroy houses and bring a risk of drowning

Floods

Increased water borne diseases
Disease outbreaks after floods as cholera are an important risk

Floods

Health problems
Extreme heat brings health risks related to sleeping problems, dehydration and severe physiological stress

Heat

Food shortages
Long period of drought leads to a loss of agricultural production leading to food shortages in the city of Dodoma

Drought

No regret measures

No regret measures

Introduction

Adaptive capacity

For each of the key risks, ***3 supporting and 3 challenging factors*** were identified in order to get a first impression of the adaptive capacity of the city in relation to the key risks. For each key risk, one or multiple no regret measures apply that could reduce the impact of these key risks.

No regret measures

No regret measures are measures worth implementing no matter which event actually happens whenever consequences are uncertain. No regret measures have been identified through literature and data review or during interviews for each of the key climate risks in the city, a fitting no regret measure is presented. These are examples of what can be done to help adapt the city to a changing climate and the hazards that result from it.

While the city's geographical location is set, there are things that can be done to make the city and its population (especially the most vulnerable) more resilient and climate adaptive.

No Regret measures – City stakeholders' perception

According to city stakeholders, the city of Dodoma could do the following to **enable the community** to become more climate adaptive and resilient:

+++ **Create awareness**

Create climate change awareness among the community

Promote how citizens can take climate action

Provide education on climate change

Increase knowledge on climate change and adaptation

+++ **Make Dodoma green**

Make Dodoma and its infrastructures green

Tree planting campaigns

+++ **Water management**

Invest in dams to increase availability of drinking water

+++ **Law enforcement**

Enforcing rules and regulations on climate adaptation

Implement bylaws

Implement environmental policy

+++ **Waste management**

Environmental pollution control

Source: Questionnaire Dodoma CRA (2022)

No Regret measures – City stakeholders' perception

According to the city stakeholders, Dodoma's priority when it comes to making the city more climate resilient and adaptive, should be:

+++ **Flood prevention**

Construct storm water drains

Construct infrastructure systems against floods

Improve storm water drainage

+++ **Drinking water management**

Improve existing water sources

Ensure water availability for domestic and industrial use

Establish irrigation scheme for farmers

+++ **Greening of Dodoma**

Make Dodoma and its infrastructures green

Tree planting campaign

Enable communities to plant more trees and flowers

+++ **Create awareness**

Create awareness on climate change adaptation

Providing education on the impacts of climate change adaptation

+++ **Infrastructure**

Improve infrastructure (mainly roads)

+++ **Waste management**

Improve waste management

+++ **Law enforcement**

Enforcing rules and regulations on climate adaptation

More restrictions on environmental pollution

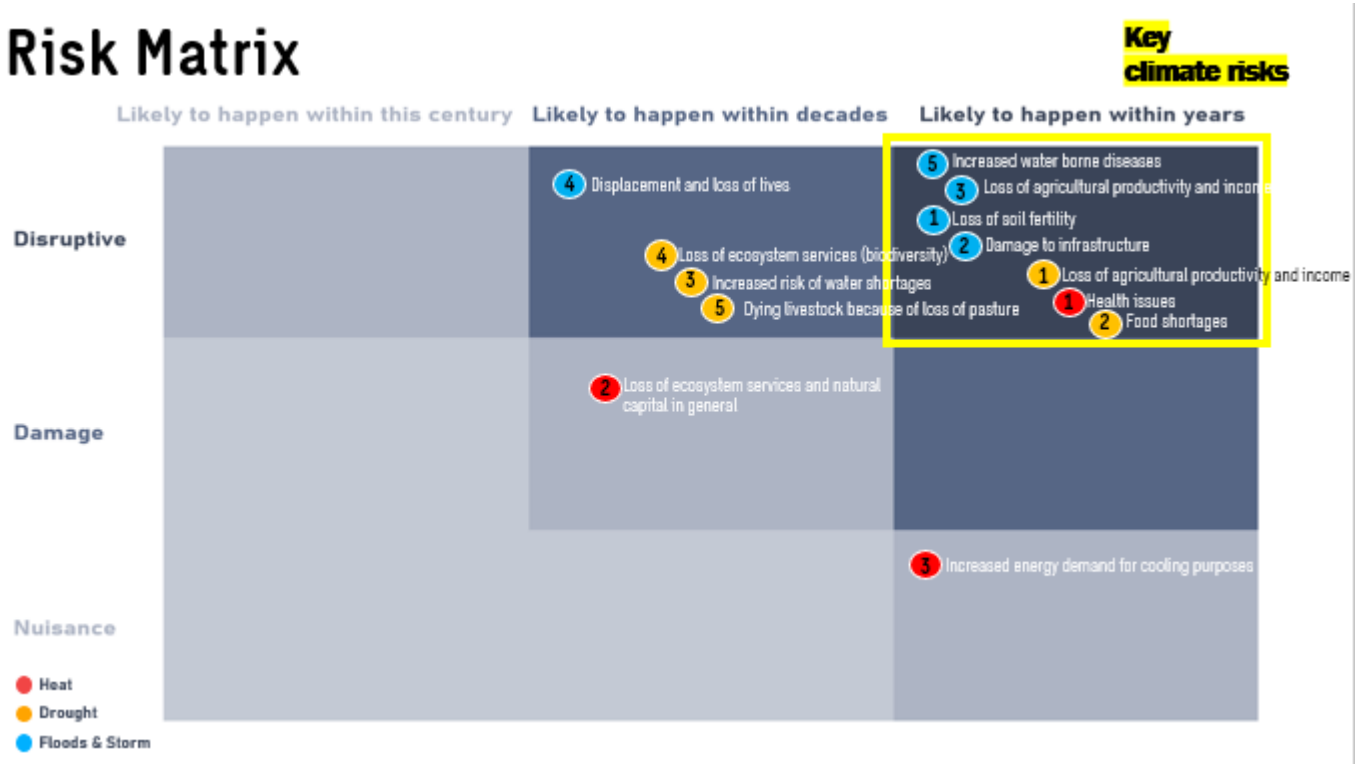
Source: Questionnaire Dodoma CRA (2022)

No regret measures

Based on the results of the interviews with city stakeholders, field interviews,the questionnaire results and key documents, the following no regret measures were identified for Dodoma:

- Sustainable farming
- Drinking water management
- Waste management
- Law enforcement
- Make Dodoma green
- Create awareness on climate change
- Climate resilient infrastructure
- Flood prevention

These no regret measures are linked to the key climate risks for Dodoma CCD in the Risk Matrix. The key climate risks present the impacts that are disruptive and likely to happen within years.



Adaptive Capacity

KEY RISK:

1 3 Loss of agricultural productivity and income

+

1 Loss of soil fertility

Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Economic diversity	A high economic diversity will help people to be ensured of income, also when floods or droughts destroy the agricultural productivity	High
2. Proper land use management	Proper land use and its management helps to create a more resilient agricultural productivity	High
3. High governance focus on this topic	The city governance has a good focus on assuring good agricultural productivity	High

Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Poverty	Poverty reduces peoples' ability to deal with shocks and stresses related to loss of agricultural productivity and income	High
2. Rapid urbanization	Due to rapid urbanization the pressure on farmlands that are still available increases	High
3. Environmental condition	Naturally, there are poor environmental conditions for having productive agriculture	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.

Sustainable farming

Explanation of no regret measure

Central Tanzania has many farming communities, depending on rainfed agriculture, communal grazing and shared natural resources for their livelihoods. The agricultural sector is the main driving force of economic activities in Dodoma CCD. The area is highly affected by climate change, especially drought.

Sustainable farming can increase crop productivity by the adoption of improved modern and climate resilient seed varieties and technologies. If modern crop production is applied, Dodoma CCD could increase production of food and cash crops tremendously.

Benefits of no regret measure

+ Agricultural productivity increase

+ Food security for vulnerable communities

+ Generate **income**

Additional information

The ECO-ACT project is an example of supporting poor and vulnerable smallholder farmers to adopt climate change mitigation and adaptation strategies.

Link to key risk:

FLOOD & STORMS

- Loss of agricultural productivity and income

DROUGHT

- Loss of agricultural productivity and income
- Food shortages

Source: Dodoma City Diagnostic (2021) & The Ecovillage adaptation to climate change in central Tanzania (ECO-ACT) project (2019)

Adaptive Capacity

KEY RISK:
2 food shortages

Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Public education / communication	Planting of drought resistant crops and adoption of climate resilient seed varieties and technologies	High
2. Community engagement	Engage communities on the measures of climate change adaptation and mitigation measures. Thereby addressing immediate household livelihood related climate change issues	High
3. Government attention	The national- and city government put quite some attention on reducing food shortages	High

Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Poverty	People cannot afford cooling devices	High
2. Big amounts of livestocks	Big amounts of livestock increase the risk on depletion of the land, leading to food shortages	High
3. Inequality	The most affected are the poor people	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.

Drinking water management

Explanation of no regret measure

The drinking water system of Dodoma CCD is highly dependent on groundwater resources from the Makutapora well-field, by which 61 million liters of water per day are used for drinking water, agriculture and industrial uses.

Investing in the construction of dams can improve drinking water availability and ensure water availability for domestic, agricultural and industrial uses. In addition, irrigation schemes for farmers could provide sufficient water usages in times of drought.

Benefits of no regret measure

+ Ensure **water availability** for domestic, agriculture and industrial uses

+ Maintain **agricultural productivity**

Additional information

The construction of the Farkwa water dam is planned to be constructed in order to limit the water deficit.

Link to key risk:

- Loss of agricultural productivity and income
- Food shortages

Source: Drainage and Sanitation Development Plan for Dodoma City (2019) & Survey

Adaptive Capacity

KEY RISK:

5 Increased water borne diseases

Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Public Health Education	Education on proper sanitation is a very important supporting factor	High
2. Investment in waste water infrastructures	Wastewater infrastructure investments lead to a reduction of polluted water stagnation that can lead to disease outbreaks	High
3. Investment in proper solid waste management facilities	Proper solid waste management facilities reduce the amount of pollution sources.	Moderate

Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Badconditions of infrastructure	Currently the drainage and waste water infrastructures are in a poor condition	High
2. Bad maintenance on drainage and waste water infrastructures	Due to bad maintenaince, the drainage and wastewater infrastructures are in a poor condition.	High
3. Rapid urbanization	Rabid urbanization might lead to inproper planning and construction of good drainage systems	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 stakeholder.

Waste management

Explanation of no regret measure

In Dodoma CCD solid waste management collection services is done in 24 wards of the city. The low level of service and reliability of the service cause the residents to burn waste and disposing it in storm water channels. Solid waste disposal affects the capacity of the drainage system.

Waste management can be improved by extending the waste collection service to all areas of the city, include household awareness and compliance with source separation of waste. In addition, environmental pollution control could contribute to waste management.

Benefits of no regret measure

+ Reduce environmental pollution

+ Reduce water borne diseases

+ Improve capacity of the **drainage system**

+ Improve **livability**

Additional information

In the construction of Chidaya Sanitary Landfill project, possibilities of organic solid waste for fertilizer/manure were explored to enhance waste management.

Link to key risk:

- Increased water borne diseases

Source: Drainage and Sanitation Development Plan for Dodoma City (2019) & Survey

Law enforcement

Explanation of no regret measure

Relevant authorities could integrate climate change further into policies and laws. City stakeholders mentioned that enforcing rules and regulations on climate adaptation, implementing bylaws and restrictions on environmental pollution could make Dodoma CCD more climate resilient and adaptive.

Benefits of no regret measure

+ Integrating climate change in policies and law

+ Reduce environmental pollution

Link to key risk:

HEAT
- Health issues (sleeping problems, dehydration, physiological stress)

FLOOD & STORMS
- Loss of soil fertility
- Damage to infrastructure
- Loss of agricultural productivity and income
- Increased water borne diseases

DROUGHT
- Loss of agricultural productivity and income
- Food shortages

Source: Dodoma City Diagnostic & Survey

Adaptive Capacity

KEY RISK:
1 Health issues

Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Public education	Public education on water consumption during warm periods	High
2. Adapting building codes	Build houses with good ventilation options	High
3. Tree planting campaigns	The city currently invests in a tree planting campaign in order to reduce heat stress	High

Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Poverty	People cannot affort to buy cooling devices in their houses	High
2. Resource availability	Maintenance budget for the planted trees is quite low	High
3. Rapid urbanization	Costs of delaying construction works during heat waves is high	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 stakeholder.

Make Dodoma green

Explanation of no regret measure

Dodoma CCD follows the Garden City model of a town set amongst a garden with green belts. A green network in the city is important for ecosystem services and achieving a sustainable, resilient, livable city.

However, some of the planned green belts in Dodoma CCD have been invaded by informal and formal development over time. The green in Dodoma CCD requires landscape management to enhance their ecological value and value for climate adaptation.

Benefits of no regret measure

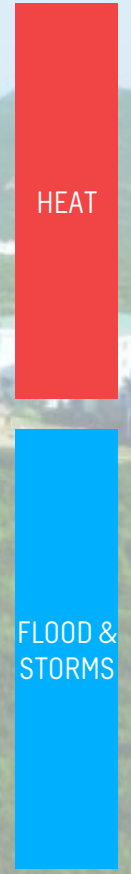
+ Improve **livability**
+ Enhance **ecosystem functions**
+ Improve **drainage and storage** of rainwater
+ **Filter air**
+ **Stabilize soil**
+ Provide economic potential of **bee keeping**

Additional information

As part of making Dodoma green, the Greening of Dodoma program was introduced in Dodoma CCD to make Dodoma green in the twenty and fifty years to come.

Source: Dodoma City Diagnostic (2021) & Survey

Link to key risk:



- Health issues (sleeping problems, dehydration, physiological stress)
- Loss of soil fertility
- Damage to infrastructure

Create awareness on climate change

Explanation of no regret measure

The link between climate change and environmental impacts can be unknown among communities. In order to spread knowledge on climate change and adaptation measures, creating awareness is essential.

Awareness on climate change can be improved by raising awareness campaigns, provide education on climate change and its impacts and promote how citizens can take climate action (e.g. via radio programs).

Benefits of no regret measure

+ **Increase knowledge** on climate change and adaptation measures

+ Citizens gain insight on how they can take **climate action**

Additional information

An example of creating awareness is the tree planting campaign. The community is encouraged to plant trees and provide shade during extreme temperatures.

Link to key risk:

- HEAT
  - Health issues (sleeping problems, dehydration, physiological stress)
- FLOOD & STORMS
  - Loss of soil fertility
  - Damage to infrastructure
  - Loss of agricultural productivity and income
  - Increased water borne diseases
- DROUGHT
  - Loss of agricultural productivity and income
  - Food shortages

Source: Field interview & Survey

Adaptive Capacity

KEY RISK:

2 Damage to infrastructure

Top 3 Supporting factors

Factor	Short description	Supporting degree*
1. Drainage system investment	The drainage investments that are currently done by the city of Dodoma reduce the damage to infrastructure	High
2. Good buidlings codes and standerds	Good building codes and standards increase the capacity of the infrastructure to deal with floods	Moderate
3. Proper land use planning	By not planning the construction of new infrastructure in flood prone areas, damage to infrastructure due to floods can be prevented	Moderate

Top 3 Challenging factors

Factor	Short description	Challenging degree*
1. Limited financial capacity	The city of Dodoma and city individuals have limited financial resources to build good drainage and flood resilient infrastructure	Moderate
2. Limited political motivation	The political motivation to really reduce the effects of floods is too limited	High
3. Rapid urbanization	Due to rapid urbanization, problems with proper land planning occur.	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.

Climate reslient infrastructure

Explanation of no regret measure

Dodoma CCD will benefit from major recent and planned infrastructure investments. Such as development of middle and outer Ring roads, new bus terminal, Dodoma Airport etc.

Ensuring that infrastructure is climate resilient will help to reduce direct losses and reduce the indirect costs of disruption. New infrastructure assets should be prioritized, planned, designed, built and operated to account for climate changes. Existing infrastructure may need to be retrofitted with for example nature-based solutions (e.g. infiltration basins with green infrastructure).

Benefits of no regret measure

+ Increased **reliability of infrastructure**
+ Increased **asset life**
+ Co-benefit of creating **green infrastructure**

Link to key risk:

HEAT

- Health issues (sleeping problems, dehydration, physiological stress)

FLOOD & STORMS

- Damage to infrastructure

Source: Drainage and Sanitation Development Plan for Dodoma City (2019)& Climate-resilient Infrastructure (2018) & Survey

Flood prevention

Explanation of no regret measure

Dodoma CCD has areas which are vulnerable to seasonal flooding and increased rainfall due to climate change. In addition, Dodoma CCD is growing and urbanizing which leads to an increase in water demand and wastewater flow.

Flood prevention is essential to protect the community. This can be done by constructing new storm water drains, maintaining storm water drains, improve the infrastructural drainage and do gully controls from waste discharges.

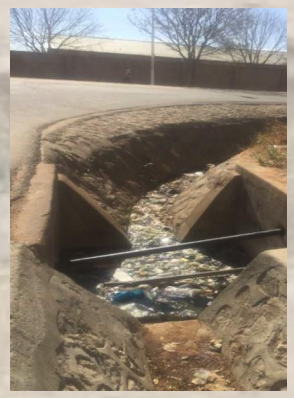
Benefits of no regret measure

+ Reduce the impact of flooding and its damage to infrastructures

+ Protect the community of Dodoma CCD

+ Reduce loss of soil fertility

+ Reduce water borne diseases



Additional information

An example of flood prevention is the Drainage & Sanitation Development Plan (DSDP) which substantially expands the sewer and drainage system of Dodoma CCD.

Link to key risk:

FLOOD & STORMS

- Loss of soil fertility
- Damage to infrastructure
- Loss of agricultural productivity and income
- Increased water borne diseases

Source: Drainage and Sanitation Development Plan (2019) & Survey

Past & planned investments

Passed and Planned Investments

Introduction

Past and Planned Investments

In this section we have made a selection of what we consider the 10 most relevant past (since 2016) and planned investments relating to climate adaptation and resilience building.

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

Past investments

13 CLIMATE ACTION

1. THE ECOVILLAGE ADAPTATION TO CLIMATE CHANGE IN CENTRAL TANZANIA - DODOMA

Enhanced nature-based water resources management for more equitable access to ecosystem benefits

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Integrated eco-village approach extended across two wards with innovations in agriculture, water, energy and forestry. And enhancing climate change knowledge	Positive changes to beneficiaries and ecosystems that can be attributed to ECO-ACT project in the field of agriculture, livestock, water management, environment protection and energy	Over 2,2 million $ Funding: Global Climate Change Alliance (GCCA) launched by the European Commission	2015 to 2019

Source: The Ecovillage Adaptation To Climate Change in Central Tanzania (ECO-ACT) Project (2019)

13 CLIMATE ACTION

1. THE ECOVILLAGE ADAPTATION TO CLIMATE CHANGE IN CENTRAL TANZANIA - DODOMA

Enhanced nature-based water resources management for more equitable access to ecosystem benefits

ACTORS INVOLVED & **IMPLEMENTING AGENCIES**	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
Institute of Rural Development Planning (IRDP)	1) Focusing on the priority needs of the beneficiaries improves livelihood, 2)Operationalization depends on the capacity of community-based institutions, 3) Aligning project interventions to national policies and strategies is crucial	ECO-ACT project interventions and innovations were highly appreciated by both beneficiaries and other stakeholders as they addressed immediate household livelihood related issues and actualization of climate change adaptation and mitigation strategies at community level	Increase the capacity of vulnerable semi-arid rural Tanzanian communicates to adapt to the adverse effects of climate change and reduce poverty

Source: The Ecovillage Adaptation To Climate Change in Central Tanzania (ECO-ACT) Project (2019)

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CLIMATE HAZARD

SWECO

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

2. CONSTRUCTION OF CHIDAYA SANITARY LANDFILL - DODOMA

Enhanced quality of drinking water and solid waste management services

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Improve management of solid waste, thereby preventing residents to burn waste and disposing it in storm water channels	Disposal of solid waste in the right way	Over 2,5 million $ Funding: The World bank under the Tanzania Strategic Cities Project (TSCP)	2010 - 2020

Source: Dodoma Masterplan (2019) & Dodoma City Diagnostic (2021)

GLOBAL CENTER ON ADAPTATION

CLIMATE HAZARD

SWECO

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

2. CONSTRUCTION OF CHIDAYA SANITARY LANDFILL - DODOMA

Enhanced quality of drinking water and solid waste management services

ACTORS INVOLVED & **IMPLEMENTING AGENCIES**	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
President office Regional administration and local Government (TAMISEMI), VPO - Environment, Ministry of Infrastructure, Water Energy	Possibilities of using solid waste as fertilizer or generate electricity from the waste	Within project enabling of community to dispose solid waste properly. Further detailed information on community engagement not known	Farmers benefit from the manure

Source: Dodoma Masterplan (2019) & Dodoma City Diagnostic (2021)

13 CLIMATE ACTION

3. CONSTRUCTION OF ILAZO IPAGALA STORM WATER DRAIN AND THREE FOOT BRIDGES - DODOMA

Strengthened flood and drought risk management in urban areas and at the basin-level

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Improving stormwater drainage infrastructure, by constructing 6.5km stormwater drain and three-foot bridges	Reduced flooding problem and some of the areas eradicated the problem	2,3 million $ Funding: Central Government through World Bank loan (TSCP Additional financing 2)	2018 to 2020

Source: Local consultant

13 CLIMATE ACTION

3. CONSTRUCTION OF ILAZO IPAGALA STORM WATER DRAIN AND THREE FOOT BRIDGES - DODOMA

Strengthened flood and drought risk management in urban areas and at the basin-level

ACTORS INVOLVED & **IMPLEMENTING AGENCIES**	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
CCD, DUWASA	There is need for storm water drains to eradicate flooding problems	Ipagala Community was involved in the construction. Further detailed information on community engagement not known	*Not clear*

Source: Local consultant

Planned investments

GLOBAL CENTER ON ADAPTATION

CLIMATE HAZARD

SWECO

13 CLIMATE ACTION

4. DRAINAGE & SANITATION DEVELOPMENT PLAN (DSDP) - DODOMA

Strengthened flood and drought risk management in urban areas and at the basin-level

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Substantial expansion of the current sewer system and storm water drainage construction to control flooding	A flood free Dodoma and enhancement of safety to vulnerable community groups	Over 8,6 million $* for Dodoma of total 130 million $ for total project via AF2 funds (second additional financing by TSCP) *note: this is an estimated amount for Dodoma, based on information from the local consultant. Funding: The World bank under the Tanzania Strategic Cities Project (TSCP)	2016 - 2020

Source: Master plan, Dodoma City Diagnostic, Drainage and Sanitation Development Plan for Dodoma City & local consultant

GLOBAL CENTER ON ADAPTATION

CLIMATE HAZARD

SWECO

13 CLIMATE ACTION

4. DRAINAGE & SANITATION DEVELOPMENT PLAN (DSDP) - DODOMA

Strengthened flood and drought risk management in urban areas and at the basin-level

ACTORS INVOLVED & **IMPLEMENTING AGENCIES**	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
President office Regional administration and local Government (TAMISEMI), VPO - Environment, Ministry of Infrastructure, Water Energy	Community engagement seems to work on community ownership	Community engagement enhances the sense of ownership by the city of Dodoma. Further detailed information on community engagement not known	Community/children walking free from flooding and without fear to school via the allocated footbridge

Source: Master plan, Dodoma City Diagnostic, Drainage and Sanitation Development Plan for Dodoma City & local consultant

15 LIFE ON LAND

5. MAKE DODOMA GREEN - DODOMA

Improved urban livability and public health from climate risks stemming from heat waves

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
To promote improved landscape characteristics and beauty of Dodoma as a National Capital City in twenty and fifty years to come	Improve livability, prevent desertification, decrease flood risk, filter air, increase humidity and moisture, stabilize soil, enhance ecosystem functions	*Not clear* Funding: City of Dodoma. Tanzania First Service Agency (central governance agency responsible for tree planting)	From 2017 onward

Source: Dodoma Masterplan (2019) & Drainage and Sanitation Development Plan for Dodoma City (2019)

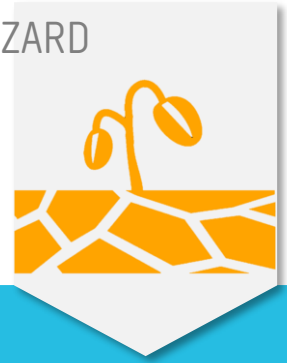
15 LIFE ON LAND

5. MAKE DODOMA GREEN - DODOMA

Improved urban livability and public health from climate risks stemming from heat waves

ACTORS INVOLVED & **IMPLEMENTING AGENCIES**	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
International Planning Non-Governmental Organization (ICLEI)	Community encouragement on the habit of tree planting and protect them	Community engagement by organizing public meetings before the planting of trees. Inform the public on the importance of public trees to overcome challenges like grazing problems, fires, agricultural activities	Reduction of temperatures to protect vulnerable people from extreme temperatures

Source: Dodoma Masterplan (2019) & Drainage and Sanitation Development Plan for Dodoma City (2019)



6 CLEAN WATER AND SANITATION

6. CONSTRUCTION OF FARKWA WATER DAM AT FARKWA IN KONDOA/CHEMBA - DODOMA

Enhanced nature-based water resources management for more equitable access to ecosystem benefits

ACTIONS	EXPECTED RESULT	BUDGET	YEAR
Improve water supply for Dodoma City by constructing water dam	Supply of 120.000m3 water per day for Dodoma City	*Not clear* Funding: AFDB, Ministry of Water	Planned to be constructed

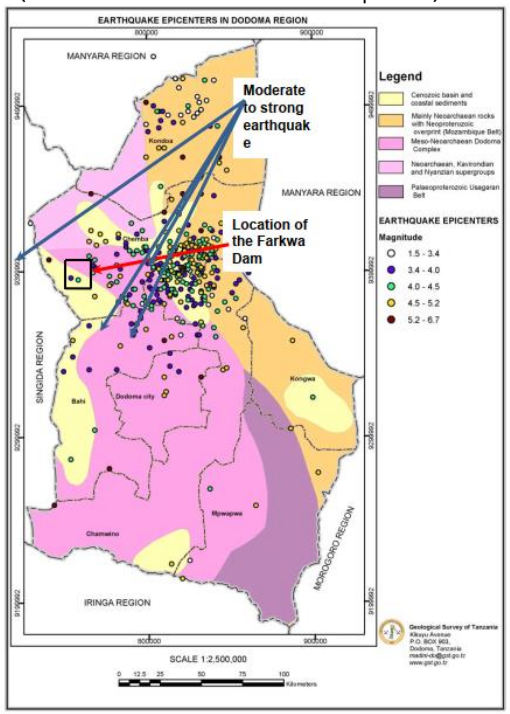
Source: Dodoma Masterplan (2019)

6 CLEAN WATER AND SANITATION

6. CONSTRUCTION OF FARKWA WATER DAM AT FARKWA IN KONDOA/CHEMBA - DODOMA

Enhanced nature-based water resources management for more equitable access to ecosystem benefits

ACTORS INVOLVED & **IMPLEMENTING AGENCIES**	LESSONS LEARNED	COMMUNITY ENGAGEMENT	SUPPORT TO VULNERABLE GROUPS
Ministry of Water, DUWASA	*To be determined*	*To be determined*	*To be determined* (note: area is sensitive to earthquakes)



Location of Farkwa Dam in Relation to Earthquake Epicenters in de Dodoma Region (Dodoma Masterplan, 2019)

Source: Dodoma Masterplan (2019)

Past and planned investments– Citizens

Are you aware of any citizen initiatives in Dodoma that help to reduce climate risks?

29% NO

Most of the respondents answered positively when asked if they knew any citizen initiatives in Dodoma to make the city more climate resilient.

Among the projects mentioned by the interviewees with knowledge on citizen initiatives, the **tree planting campaign** as part of Making Dodoma Green was widely mentioned.

- These findings suggest that Dodoma CCD is putting forth effort in citizen initiatives, particularly when it comes to tree-planting campaigns.

Source: Questionnaire Dodoma CRA (2022)

Past and planned investments– Citizens

Are you aware of any citizen initiatives in Dodoma that help to reduce climate risks?

71% YES

“ Citizen initiatives that help to reduce climate risk:

- Each year during the rainy season civil servants participate in **tree planting campaigns** with the aim of at least having several trees grown per year. The government provides trees to the community to plant at their places.
- In **building permits**, plot owners are advised to plant a minimum of five trees per plot depending on plot size.
- There are **Community environmental** groups that focus on conserving the environment in order to reduce the impacts of climate risks.
- Collection of **plastic bottles** by hawkers.
- Harvesting of groundwater by the **construction of borehole wells** by individuals themselves. ”

Source: Questionnaire Dodoma CRA (2022)

Acknowledge-ments

Acknowledgements

City Advisor

For this mission we would like to thank our city advisor Ally Mfinanga for all the great input during the regular calls and interiews.

- Ally S. Mfinanga amfinanga@hotmail.com

Local consultants from Apex

We would also like to thank our Tanzanian based consultants for their local support.

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Annexes

Annexes

Annex 1: Dodoma – Climate Hazard Identification.xlsx

Annex 2: Dodoma – Climate Sector Impact Identification.xlsx

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

Annex 4: Dodoma – Questionnaire results.xlsx

Annex 5: Dodoma – Interview minutes

Annex 6: Dodoma – Key documents