



SAFE4ALL
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Understanding climate risk

June 4th, 2025

Welcome!



Funded by
the European Union

We will record this session





Avoid
distractions



Be
comfortable



Use the chat
for questions
or raise your
hand if you
want to speak

Who's in the room?

Name – Location – Job/expertise - One word that describes your mood today

Example: *"Sophie – The Netherlands – Climate expert at CAS - Excited!"*

Please answer in the chat

We have three special guests today!



Dr. Hasse Goosen



Emmanuel Ochola Matsaba



Ignacio Saldivia Gonzatti





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What are we going to do today?

Agenda



Welcome



Introduction to climate risk - Sophie



Comprehensive and Rapid Climate Risk assessments – Dr. Hasse Goosen



Climate risk assessment in Kenya – Emmanuel Ochola



Food security - Ignacio



Closing

Today's learning goal

Be able to explain the basics of climate risk and learn about different examples



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<https://mailchi.mp/c8b95dfbd95c/safe4all-africa>



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Introduction to climate risk

Poll: I know what climate risk is

Raise your hand if you would like to say something



**CLIMATE
RISK**

=

?





**CLIMATE
RISK**

=



**PROBABILITY OF A
HARMFUL CLIMATE
EVENT OR TREND**

×



IMPACT



**CLIMATE
RISK**

=



**PROBABILITY OF A
HARMFUL CLIMATE
EVENT OR TREND**

×



IMPACT

=

Hazard

×

Exposure

×

Vulnerability

=

*The threatening event
(including its
probability and
geographical extent)*

×

*The elements
(e.g., buildings,
humans, economic
values) present in
affected areas*

×

*The resistance or
lack of resistance of
the exposed
elements to the
hazard*

Example!



**CLIMATE
RISK**

=
?



Increasing droughts

*The threatening event
(including its
probability and
geographical extent)*



**CLIMATE
RISK**

=
?



Smallholder farmers

*The elements
(e.g., buildings,
humans, economic
values) present in
affected areas*



**CLIMATE
RISK**

=
?



High drought sensitivity
of crops

*The resistance or
lack of resistance of
the exposed
elements to the
hazard*



**CLIMATE
RISK**

=



**PROBABILITY OF A
HARMFUL CLIMATE
EVENT OR TREND**

×



IMPACT

=

Hazard

×

Exposure

×

Vulnerability

=

*The threatening event
(including its
probability and
geographical extent)*

×

*The elements
(e.g., buildings,
humans, economic
values) present in
affected areas*

×

*The resistance or
lack of resistance of
the exposed
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hazard*

Questions



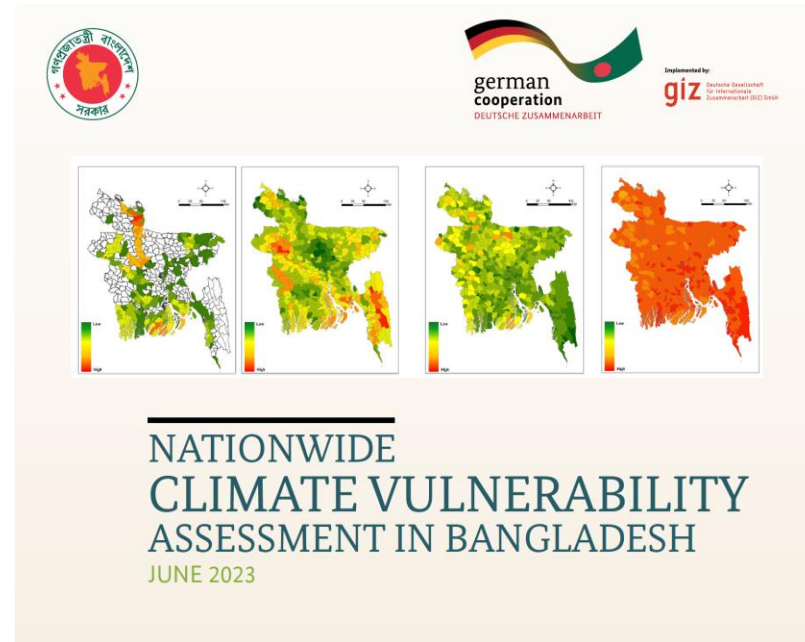


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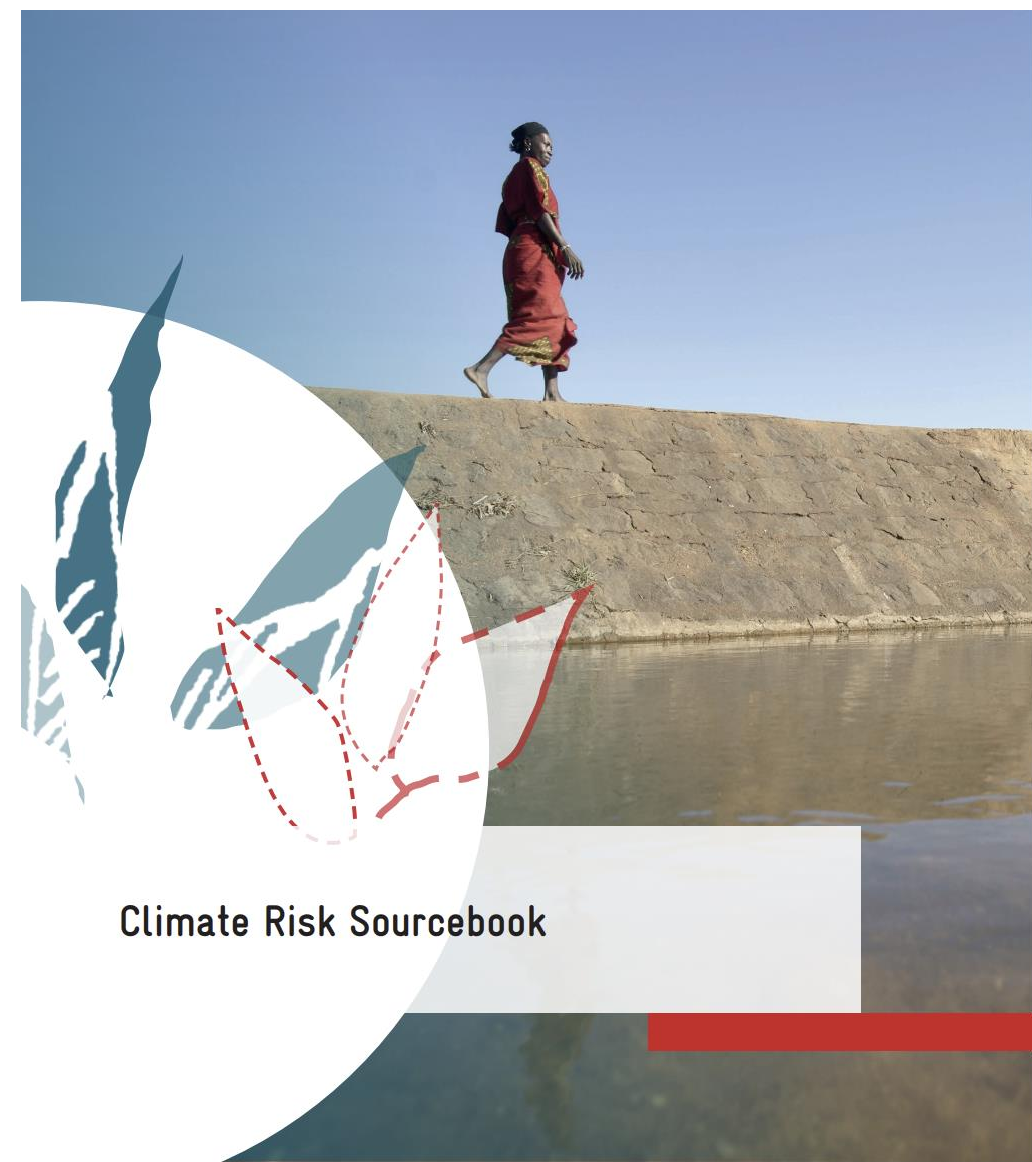
**Comprehensive and Rapid Climate Risk
assessments**

Hasse Goosen (CAS)

Example: National Level Climate Risk Assessment of Bangladesh



https://www.adaptationcommunity.net/wp-content/uploads/2023/10/giz_2023_Climate_Risk_Sourcebook.pdf





CLIMATE RISK

=



PROBABILITY OF A HARMFUL CLIMATE EVENT OR TREND

×



IMPACT

=



×

Exposure

×

Vulnerability

=

The threatening event (including its probability and geographical extent)

×

The elements (e.g., buildings, humans, economic values) present in affected areas

×

The resistance or lack of resistance of the exposed elements to the hazard

Poll: how many different hazards can you think of?

APPENDIX A: CLASSIFICATION OF CLIMATE-RELATED HAZARDS⁶⁶⁹

	Temperature-related	Wind-related	Water-related	Solid mass-related
Chronic	Changing temperature (air, freshwater, marine water)	Changing wind patterns	Changing precipitation patterns and types (rain, hail, snow/ice)	Coastal erosion
	Heat stress		Precipitation or hydrological variability	Soil degradation
	Temperature variability		Ocean acidification	Soil erosion
	Permafrost thawing		Saline intrusion	Solifluction
			Sea level rise	
			Water stress	
Acute	Heat wave	Cyclone, hurricane, typhoon	Drought	Avalanche
	Cold wave/frost	Storm (including blizzards, dust and sandstorms)	Heavy precipitation (rain, hail, snow/ice)	Landslide
	Wildfire	Tornado	Flood (coastal, fluvial, pluvial, ground water)	Subsidence
			Glacial lake outburst	



CLIMATE RISK

=



PROBABILITY OF A HARMFUL CLIMATE EVENT OR TREND

×



IMPACT

=

Hazard

×

Exposure

×

Vulnerability

=

The threatening event (including its probability and geographical extent)

×

The elements (e.g., buildings, humans, economic values) present in affected areas

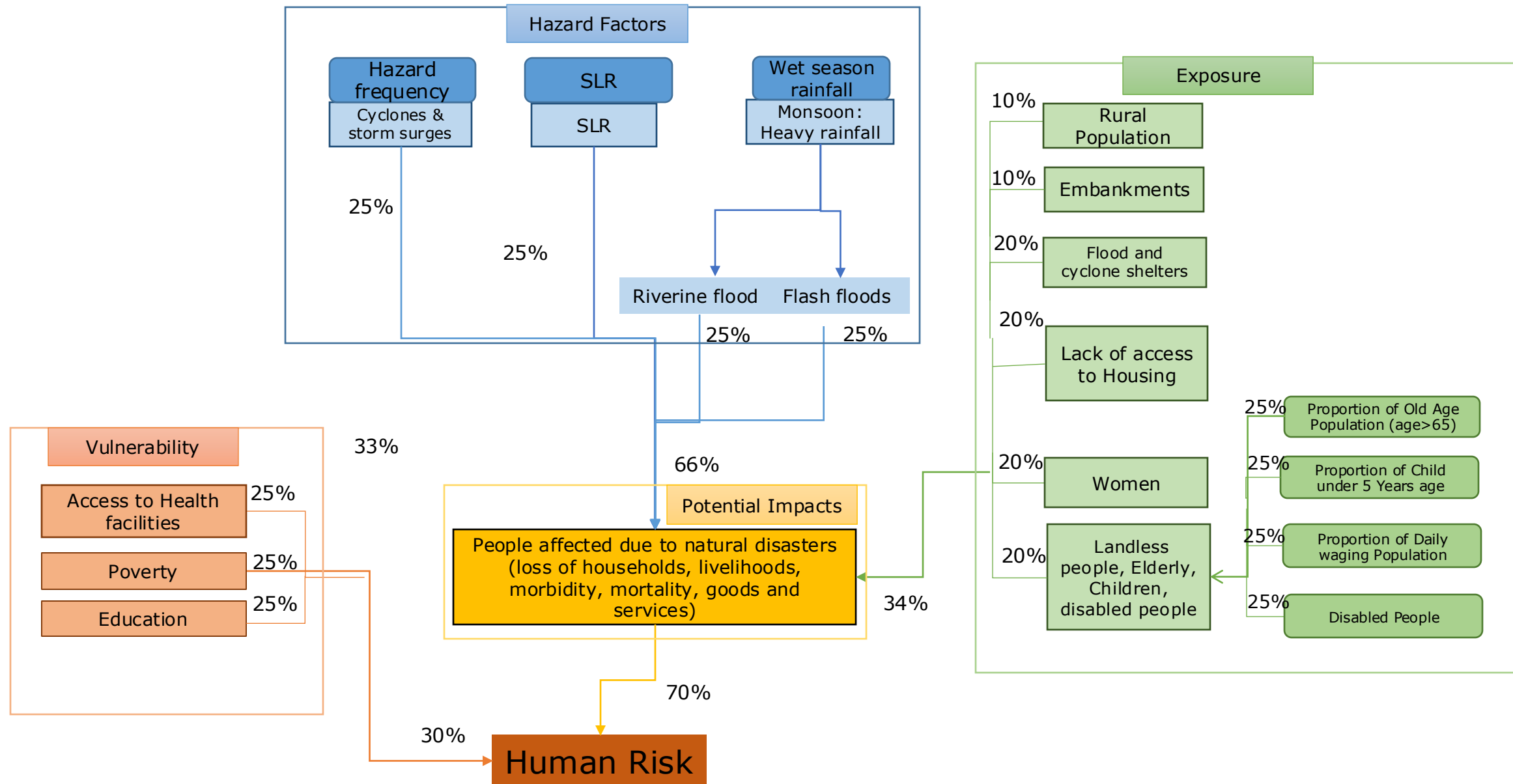
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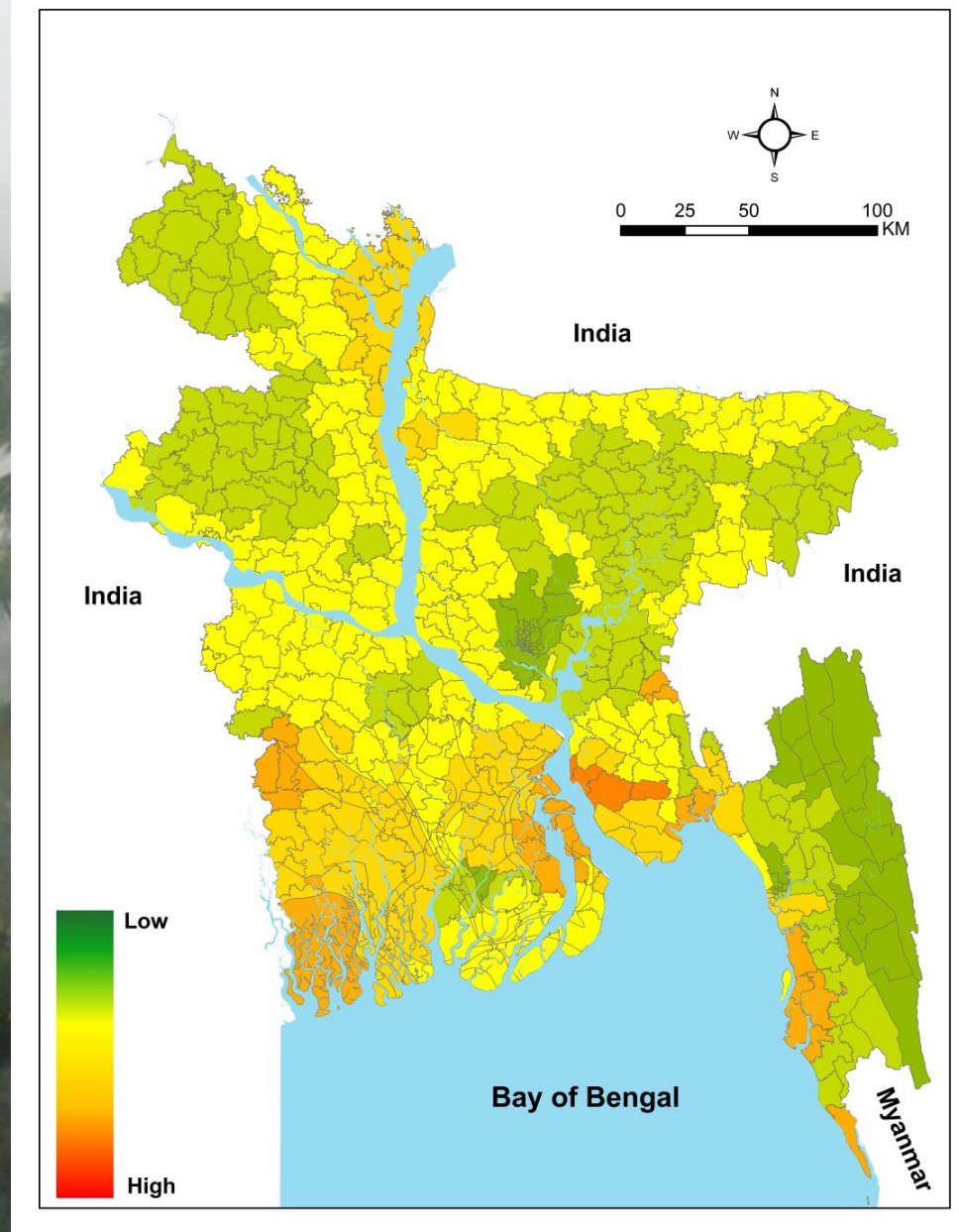
The resistance or lack of resistance of the exposed elements to the hazard

Impact Chains

	Sectors	Impact Chains
Human capital (people)	Human (people affected)	<ul style="list-style-type: none"> • Human Risk
	Health	<ul style="list-style-type: none"> • Heat stress • Water-borne diseases
Natural capital (planet)	Water resources	<ul style="list-style-type: none"> • Groundwater depletion and degradation • Surface Water
	Biodiversity & environment	<ul style="list-style-type: none"> • Mangrove forest degradation and loss
Production capital (profit)	Agriculture	<ul style="list-style-type: none"> • Land availability • Water availability • Agriculture Crop Yield Vulnerability
	Livestock	<ul style="list-style-type: none"> • Decrease in Livestock and Poultry Health • Land Availability for Livestock
	Fisheries	<ul style="list-style-type: none"> • Change in fish culture • Change in fish capture
	Navigation, Transport & Infrastructure	<ul style="list-style-type: none"> • River navigability • Road and rail network vulnerability

Impact Chain People Affected Due to Natural Disasters





People Affected Due to climate related Natural Disasters

Impact Chains

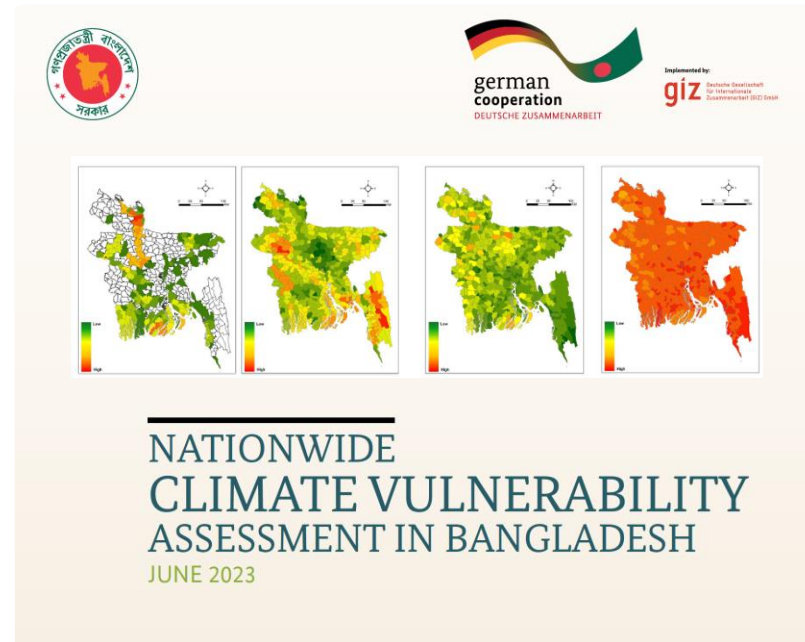
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Bangladesh risk & vulnerability assessment

- Complete picture of all risks covering all aspects of society
- 84 input data sets (hazard data, population census, topographic data)
- 15 risk indicators; 2 climate scenario's and reference period
- 300 page report
- > 200 GIS maps
- 2,5 year project



Example: National Level Climate Risk Assessment of Bangladesh



Questions



Rapid Climate Risk Assessment

- Less data intensive
- Using expert judgement and knowledge
- More engaging

Outline of this Rapid CRA – Steps

Steps



- 1.1. Determine the relevant climate **hazards** in a city
- 1.2. Select relevant **climate indicators** that provides evidence of how these hazards express themselves
- 1.3. Analyse **historical trends and events** for these hazards
- 1.4. Analyse **future projections** for these hazards, for different **scenarios & time horizons**



- 2.1. Determine the relevant **city sectors**
- 2.2. Analyse **non-climatic trends**, e.g. demographic and socio-economic
- 2.3. Assess the different (spatial) **impacts** related to the hazards, positive or negative
- 2.4. **Prioritise** the identified impacts with city stakeholders

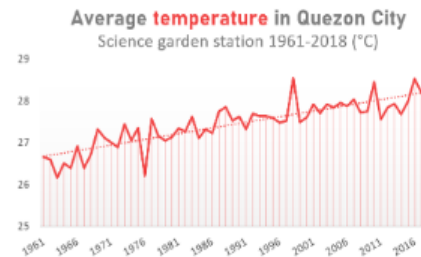


- 3.1. **Assess** risk, looking at severity and probability of impacts, with the city stakeholders
- 3.2. Summarise and communicate the **key risks**
- 3.3. Assess the **Adaptive capacity**

Determine relevant climate hazards – Desktop study

Quezon City is warming up **EXAMPLE**

One of the methods to identify climate hazards in the city is to perform desktop studies and scan news articles. For many cities, climate hazards are already a relevant topic.



Source: prepared by CADS/CAD/PAGASA, 2020

Over the past 65 years, temperatures have risen steadily in the Philippines, with an average of 0.1°C per decade (PAGASA, 2018). Quezon City is developing aggressively, and the effects of



Analyse future projections – Scenarios

<https://interactive-atlas.ipcc.ch>

<https://climateinformation.org/>

The screenshot shows the header of the IPCC Working Group I (WGI): Sixth Assessment Report. Below the header, the title "IPCC WGI Interactive Atlas" is displayed. The main text describes it as a novel tool for flexible spatial and temporal analyses of observed and projected climate change information. To the right, there is a globe with a temperature slider set to +2°C, and a list of temperature options: +1.5°C, +2°C, +3°C, and +4°C. A "Temperature" button is also visible.

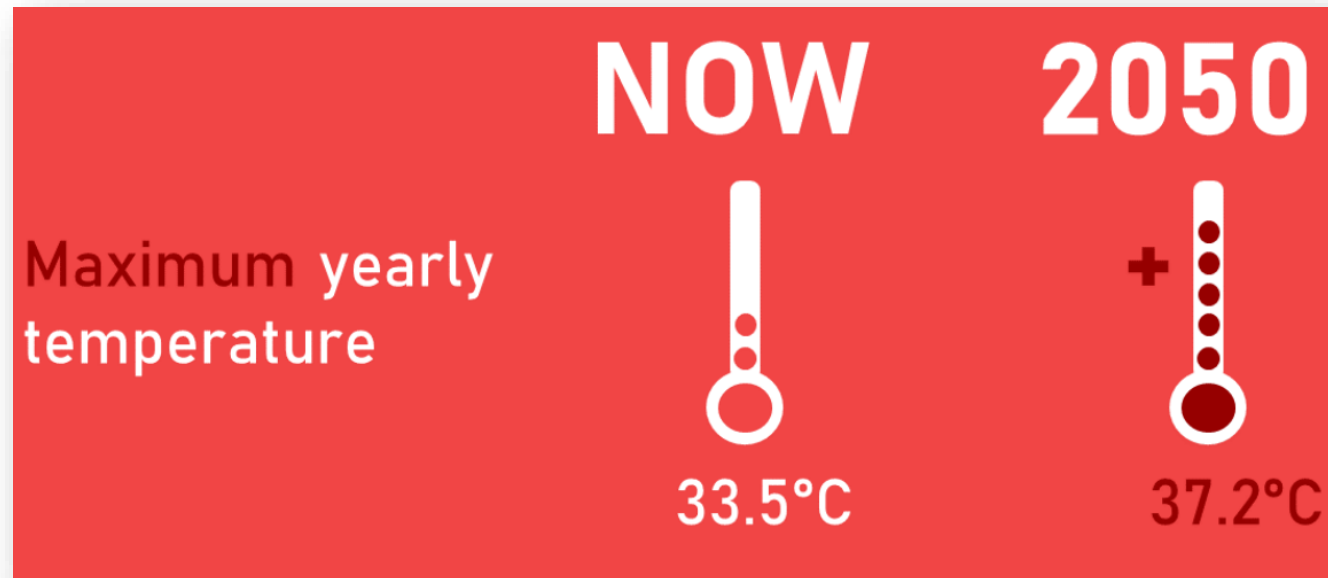
The screenshot shows the Climate Information Portal website. The navigation bar includes "News", "Feedback", and "FAQ". The main content area features three cards: "Site-specific report" (with a smartphone showing a map), "Data Access Platform" (with a laptop showing a globe), and "Knowledge Base" (with a key on a green background). Each card includes a brief description of the service.

Future projections visuals

The available climate indicators can be analysed for the selected scenarios and time horizon.

Whenever possible, try to relate the future situation to the current situation

Write down the expected future intensity or frequency of the hazard



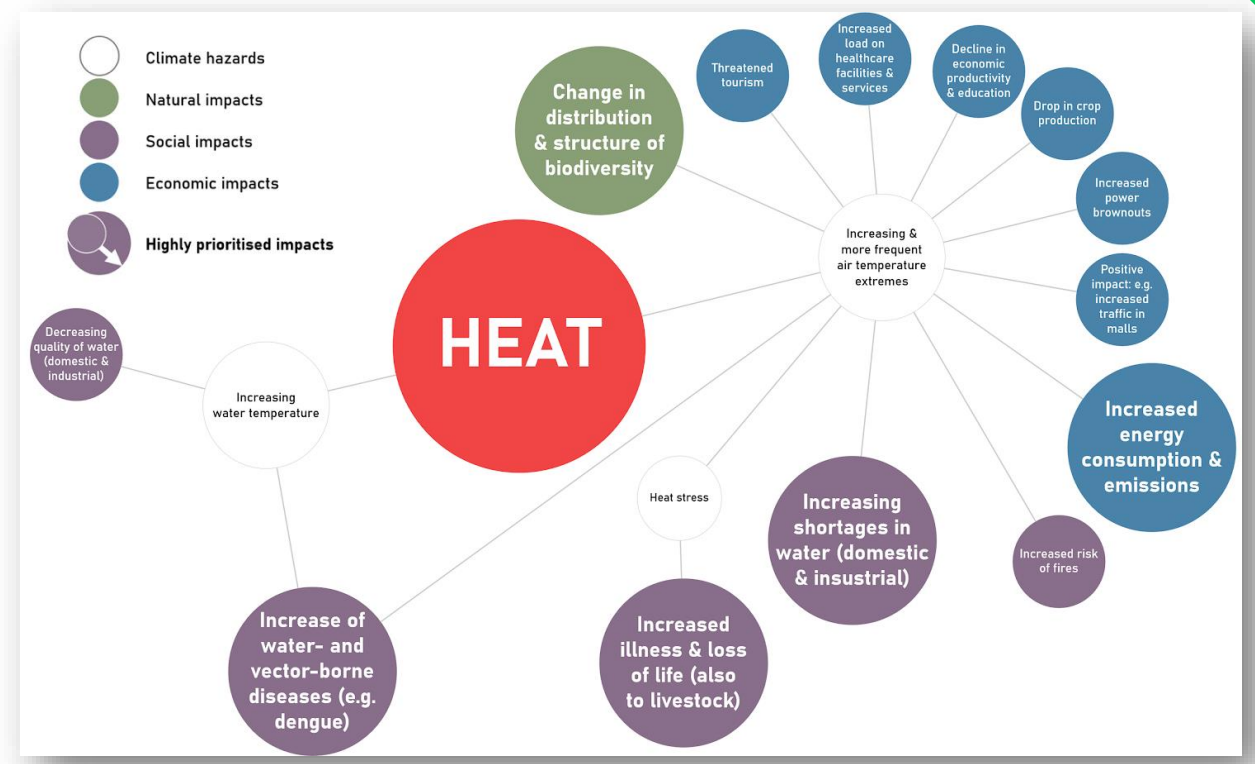
QCRA Kuala Lumpur showing an indicator for the current climate and RCP 8.5

Impact assessment



Assess the different impacts of the climate hazards

Based on the sector-based impacts table described above, **draft impact diagrams** can be set up. These diagrams present a simplified, visual summary of current scientific knowledge of climate effects and climate consequences in a city.



Prioritise the identified impacts with city stakeholders

Using stickers, impacts can be intuitively prioritised. For example: stakeholders receives three stickers for each climate impact diagram poster and one 'master sticker' which can be placed on any climate impact diagram poster.

The resulting overview provides insights in, for example, the top-5 or top-10 climate impacts for each relevant climate theme (floods, drought, heat, etc).



Risk assessment

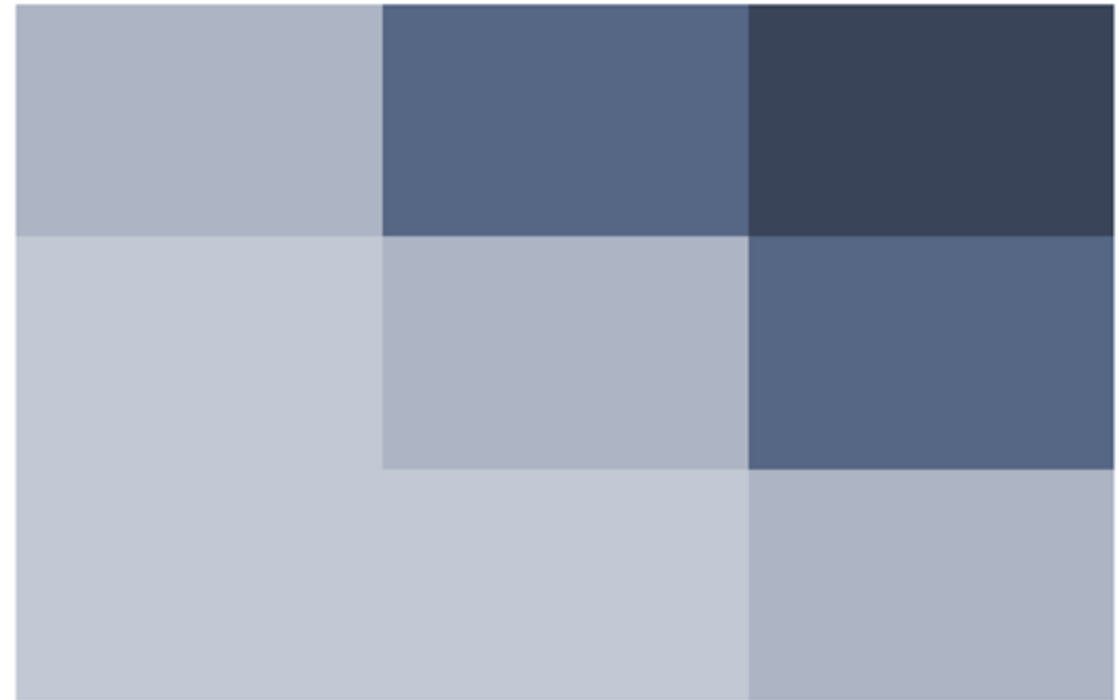


Identify key climate risks – Risk matrix

In order to identify the key climate risks, cities can use a **risk matrix** like the one on the right to assess severity and probability of the priority **impacts** from the previous exercise.

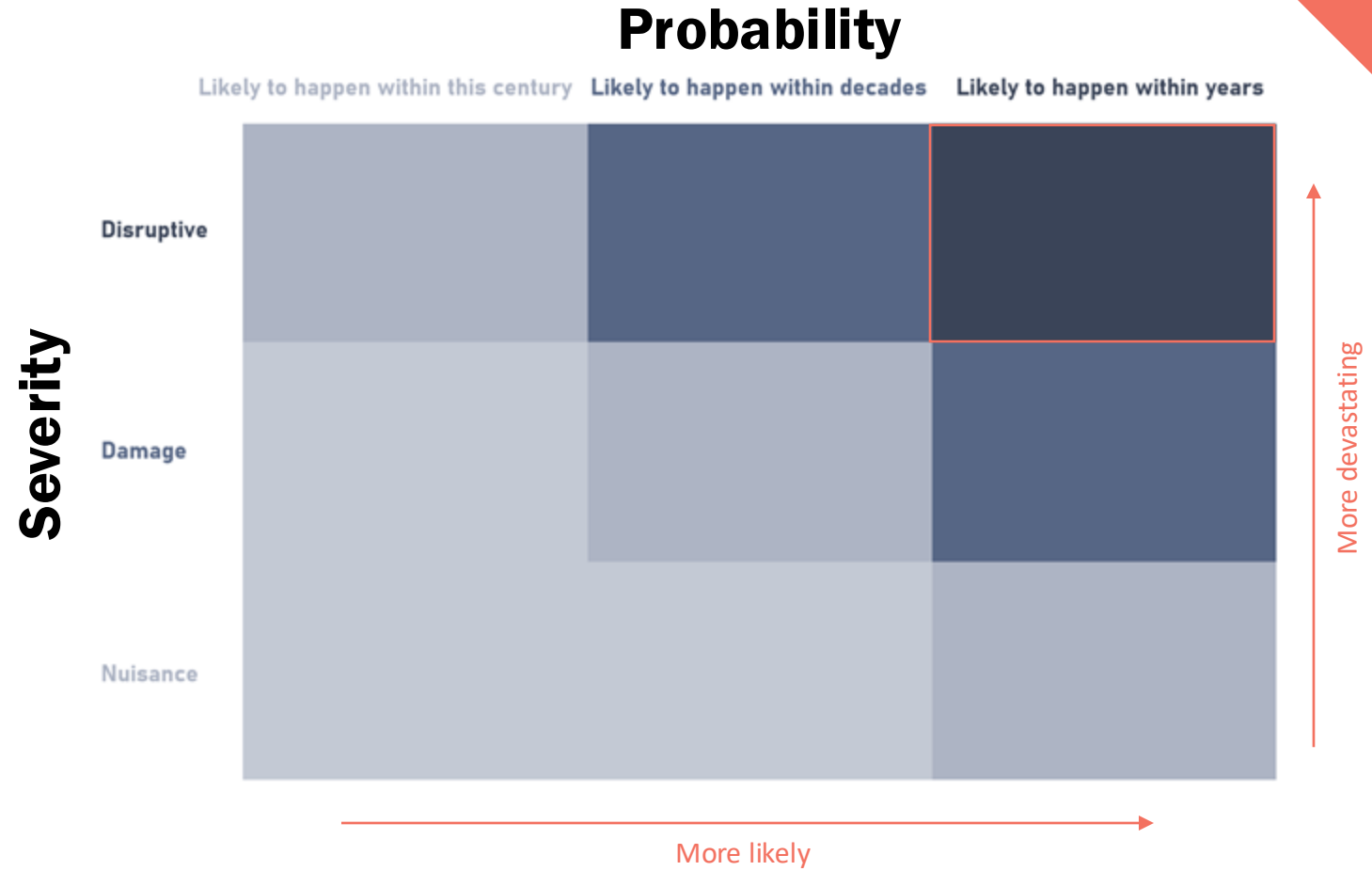
Severity

Probability

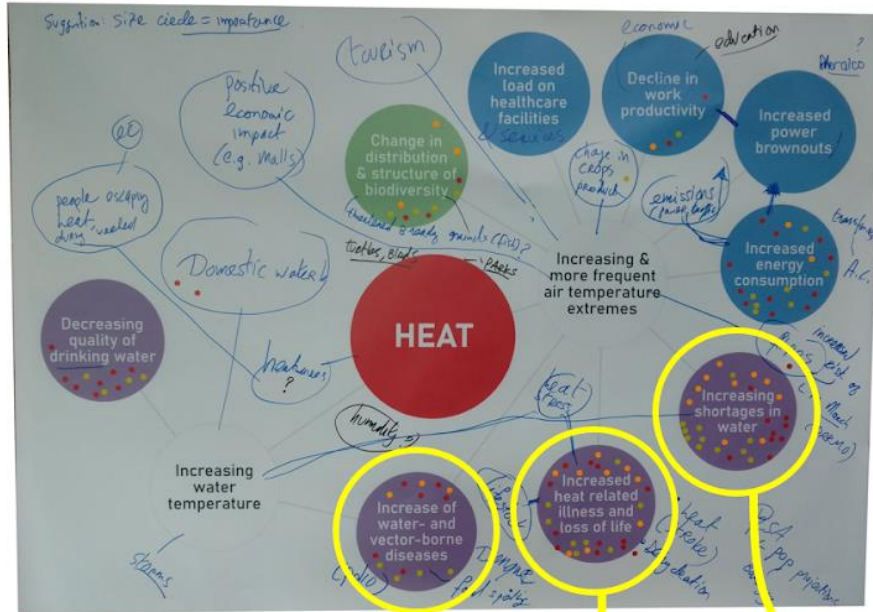


Identify key climate risks – Risk matrix

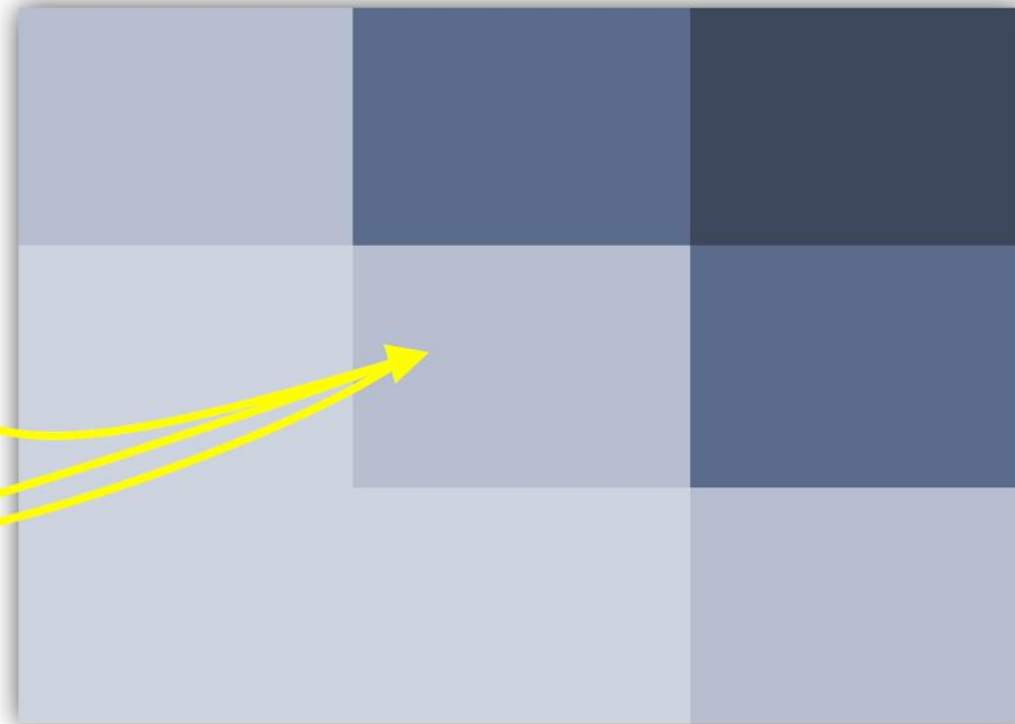
Impacts that fall in the **top right quadrant** present the highest climate risks to the city as these impacts are the most likely to happen, and the most devastating when they do happen.



Identify key climate risks - Example



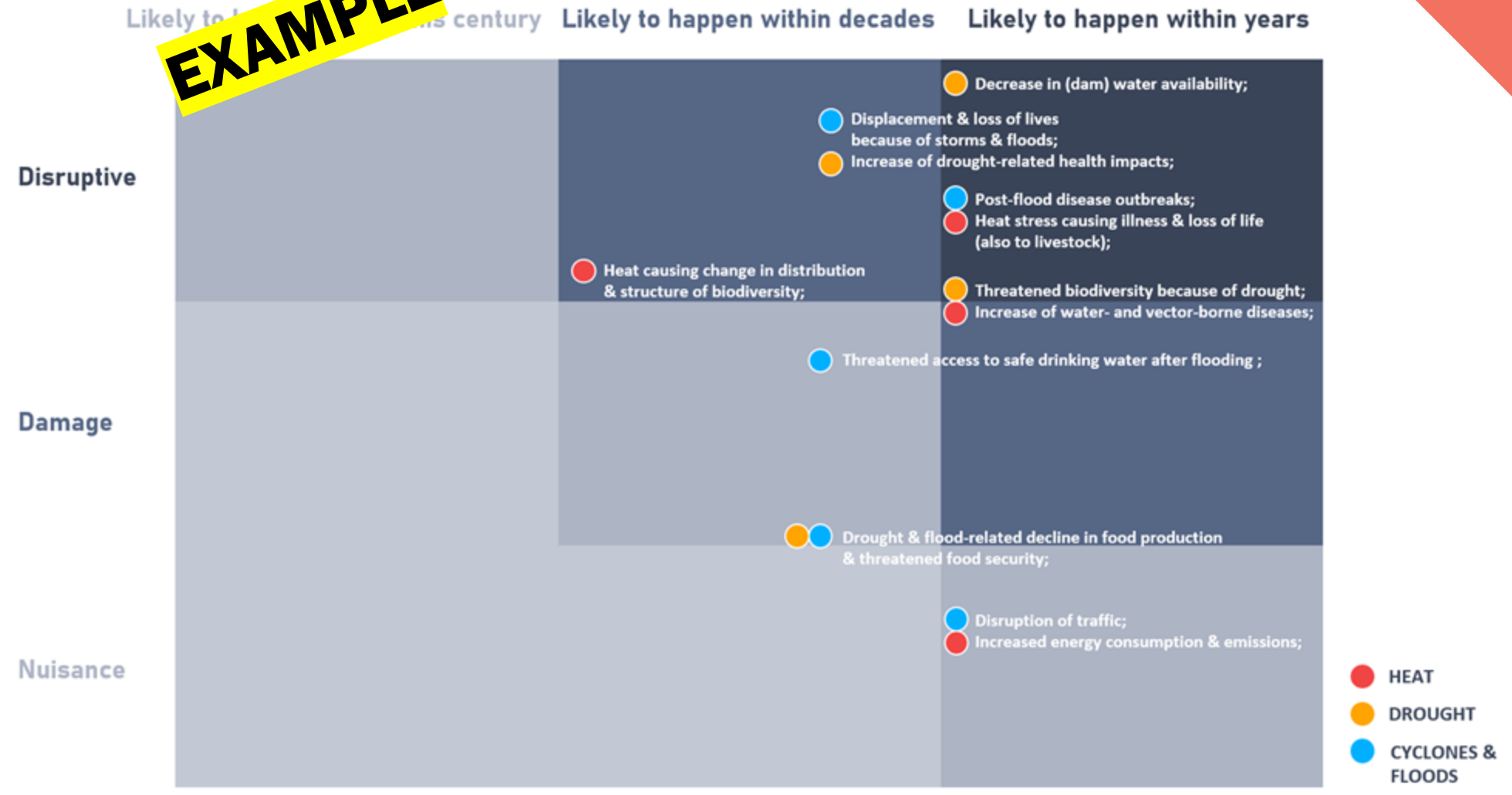
City stakeholders were asked to place the highly prioritised **impacts** for heat, drought and cyclones & floods within this matrix.



Identify key climate risks - Example

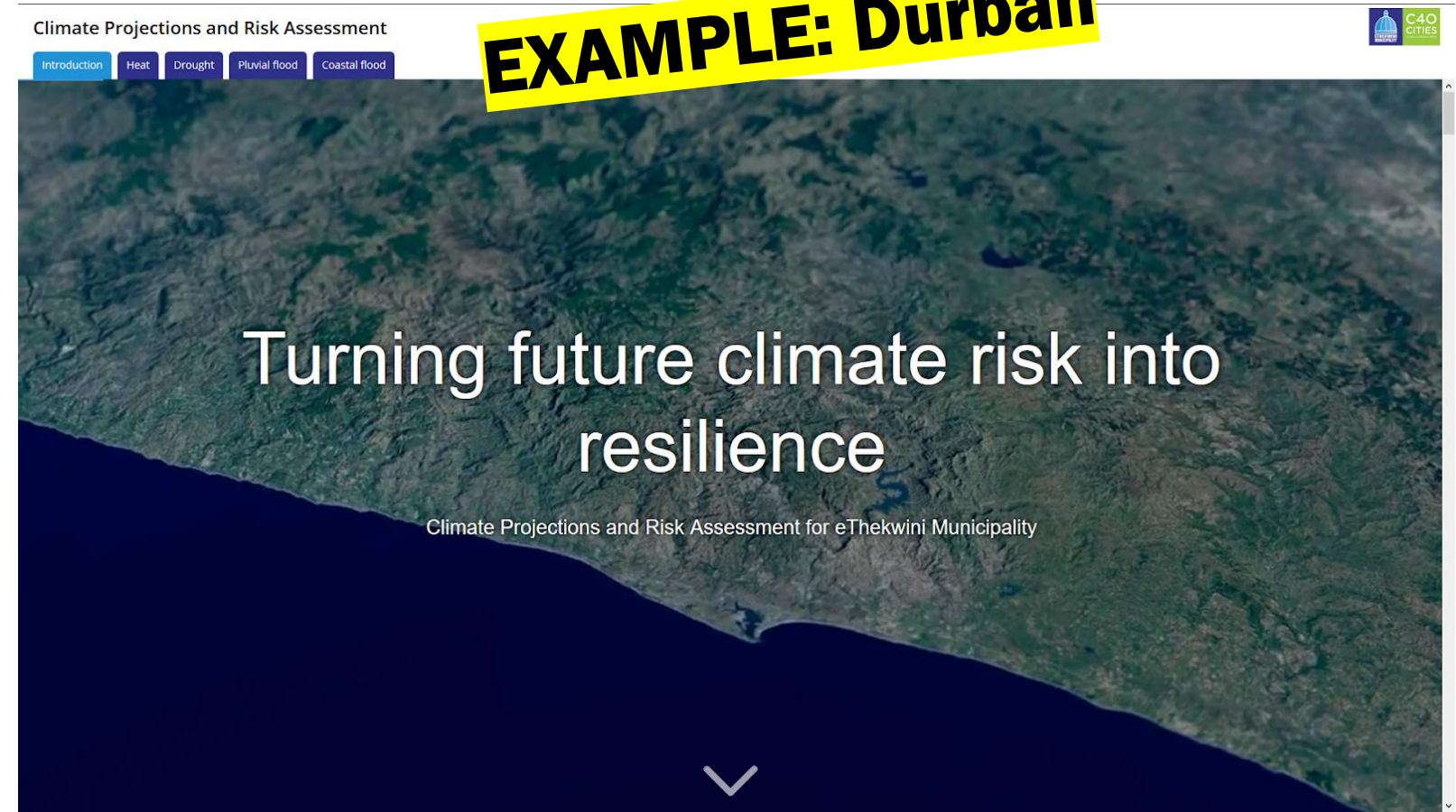
The final result may look like this, ready to be used as input for the **Climate Action Plan**.

EXAMPLE



Summarise and communicate key climate risks

EXAMPLE: Durban



<https://ethekwini.maps.arcgis.com/apps/MapSeries/index.html?appid=4c59620219d343a1aec468b87aa0ffc5>

Summarise and communicate key climate risks

EXAMPLE: Durban

Climate Projections and Risk Assessment

- Introduction
- Heat
- Drought
- Pluvial flood
- Coastal flood

Heat

Temperatures have risen significantly: Durban average annual temperature increased from 19.8 to 21.4 °C in 20 years

In South Africa, mean annual temperatures for the past five decades have increased by at least 1.5 times the observed global average of 0.65°C. Maximum and minimum daily temperatures have been increasing annually, and in almost all seasons.

Annual mean air temperature in Durban



Of all areas in South Africa, KwaZulu-Natal is among the warmest. As you can see in the graph above, Durban's annual mean air temperature has been on a constant rise during the past 20 years.

Breaking News. First
LAST UPDATED: 2014-05-16, 13:41

News - Voices - Business - Sport - Water Crisis - #GuptaLeaks - Lifestyle - Video

Fatal veldfire havoc in KZN

2014-05-16 21:13

Durban - About seven people have died in runaway veld fires fanned by gale force winds in KwaZulu-Natal, the department of co-operative governance and traditional affairs (Cogta) said on Monday.

"Runaway veld fires, propelled by gale force winds, left a trail of destruction resulting in the loss of lives and the destruction of property," Cogta spokesperson Lennox Mabaso said in a statement.

He said the number of deaths caused by the veld fires in the province, were unconfirmed as processes of certification still had to be confirmed and the next of kin had to be informed.

However, the department would visit the area and conduct preliminary findings.

SABC radio news placed the death toll at seven. Mabaso said KwaZulu-Natal Cogta MEC Nomusa Dube-Ncube had dispatched disaster relief teams to parts of the province, including KwaMnyathi, Kokstad and some parts of the uGu district.

High temperatures recorded in KZN



DURBAN: ZAZI Lwandle Ntshande looking at the Durban beach front's swimming pools. PICTURE: GCNA NOW/ALAN

Durban - If you thought it was hot where you were on Christmas Day, spare a thought for the North Coast.

Comments

...a province, reaching a sweltering 43.7°C, Sardiwalla, said on Sunday.

...nd, which recorded a maximum

hottest at 43.2°C and then Mtunzini,

Day 4 of a heatwave set to break more temperature records.

WEATHER Thursday 7 January 2016 - 8:01am Contributors: Annette Verter



KZN farms destroyed in veld fire

SOUTH AFRICA Wednesday 18 June 2014 - 5:13am



news24

Breaking News. First

LAST UPDATED: 2014-05-16, 13:38

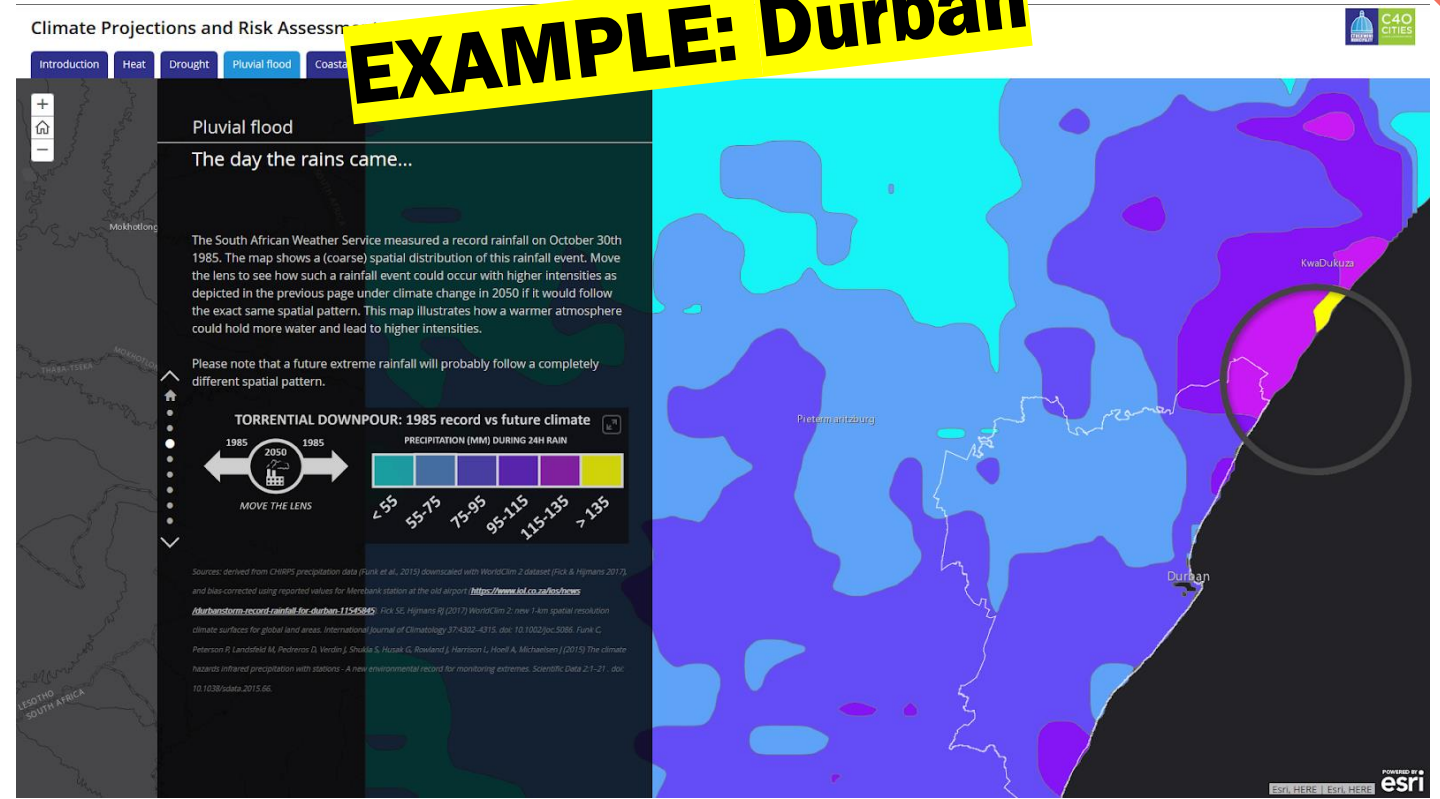
News - Voices - Business - Sport - Water Crisis - #GuptaLeaks - Lifestyle - Video

PODCAST | Mahumapelo: end of the 2nd coming? This week on POLOTHI, we take a look at the embattled fourth Vred premier, Supra Mahumapelo. Is he going or is he staying? Listen

KZN residents told to drink lots of water as heatwave hits the 40s

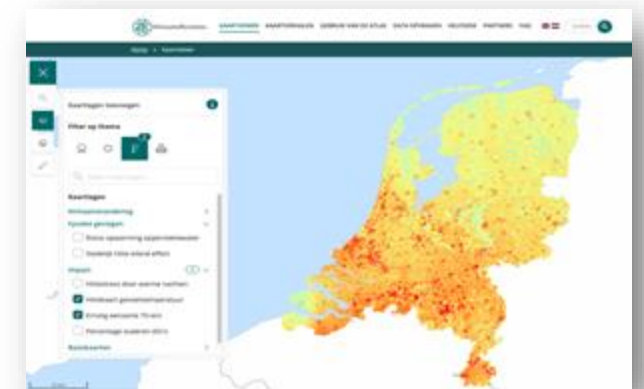
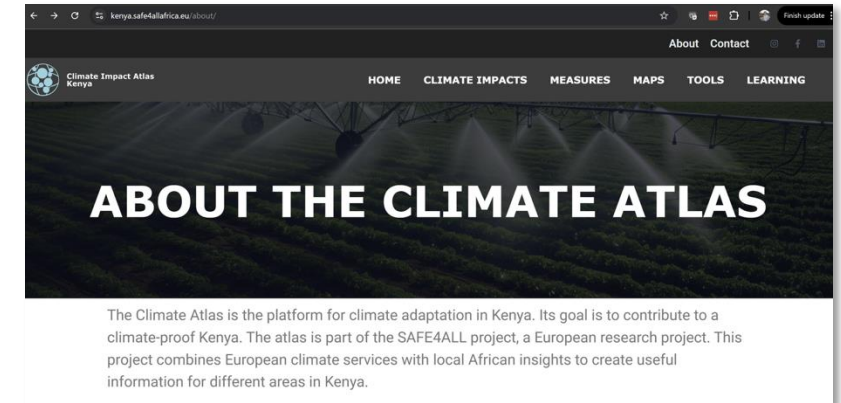
Summarise and communicate key climate risks

EXAMPLE: Durban



Comprehensive climate risk assessments

- Can be very time and resource intensive
 - Requires a lot of data
 - Aggregating indicators creates a 'black-box'
- To enable risk assessments, a climate atlas can be very powerful resource



Rapid Climate Risk Assessment

- More engaging
- Lower data requirements, but also less evidence based
- Not spatially explicit
- Easier to connect to an action perspective

Choosing the right tool for the job

Rapid CRA

Comprehensive RCRA



What is the next step for the user?

- awareness raising?
- getting support for action?
- Design of climate proof infrastructures?
- Where are you in the adaptation process



For climate action

- We don't need to know everything about future climate change
- Many adaptation options are no regret (urban greening, water retention, ecosystem rehabilitation)
- For doing the right things, you need to understand the local context
- Uncertainty in climate risk data should not become a reason for not acting!

Questions





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**Understanding Climate Risk and Its Impacts
Across Systems: Insights from Nakuru County,
Kenya**

Emmanuel Ochola Matsaba (JKUAT)

Understanding Climate Risk and Its Impacts Across Systems

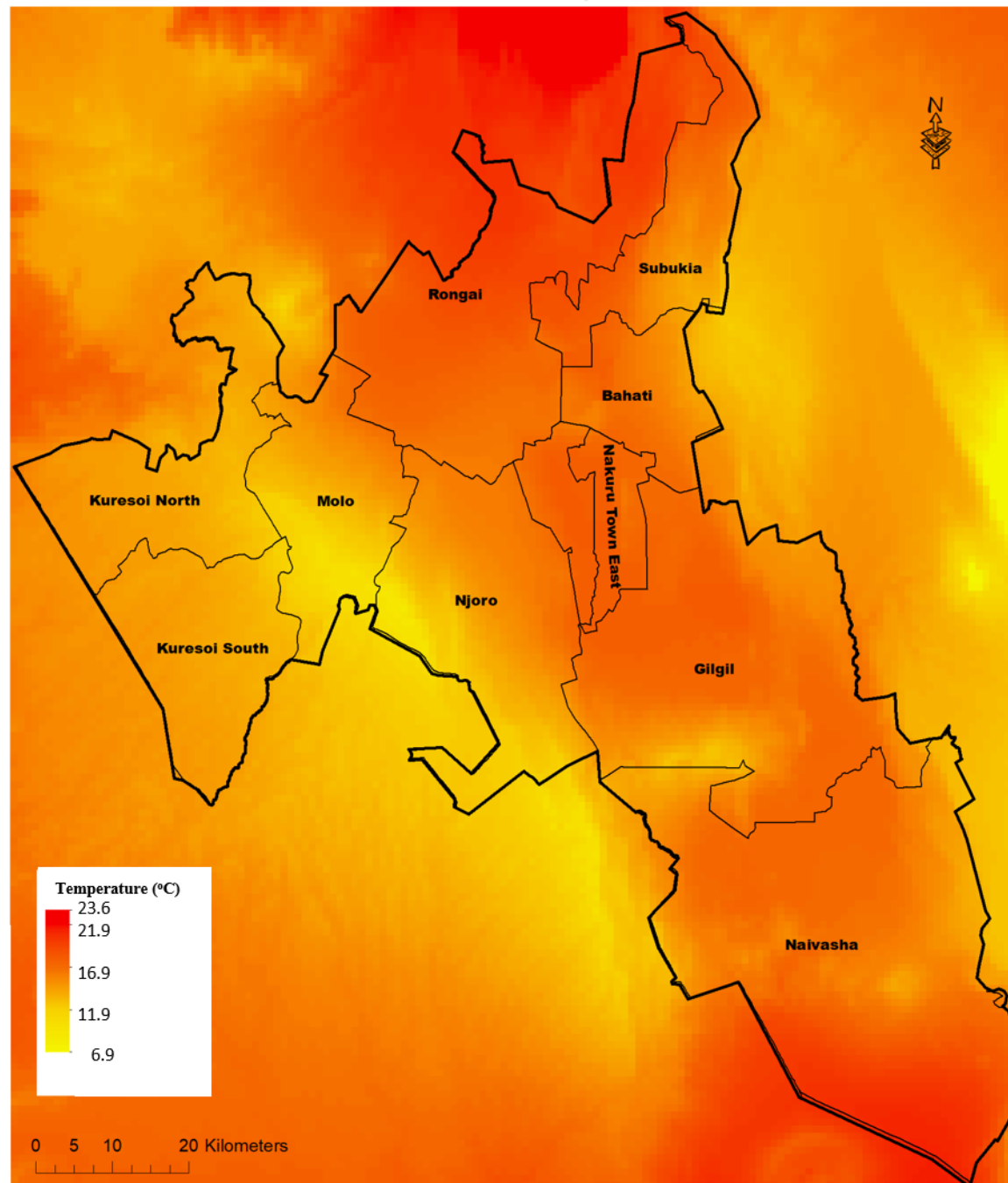
Insights from Nakuru County, Kenya

Presented by: Emmanuel Ochola
Matsaba

Organisation: Jomo Kenyatta
University of Agriculture and
Technology (JKUAT)

Date: 04/06/2025

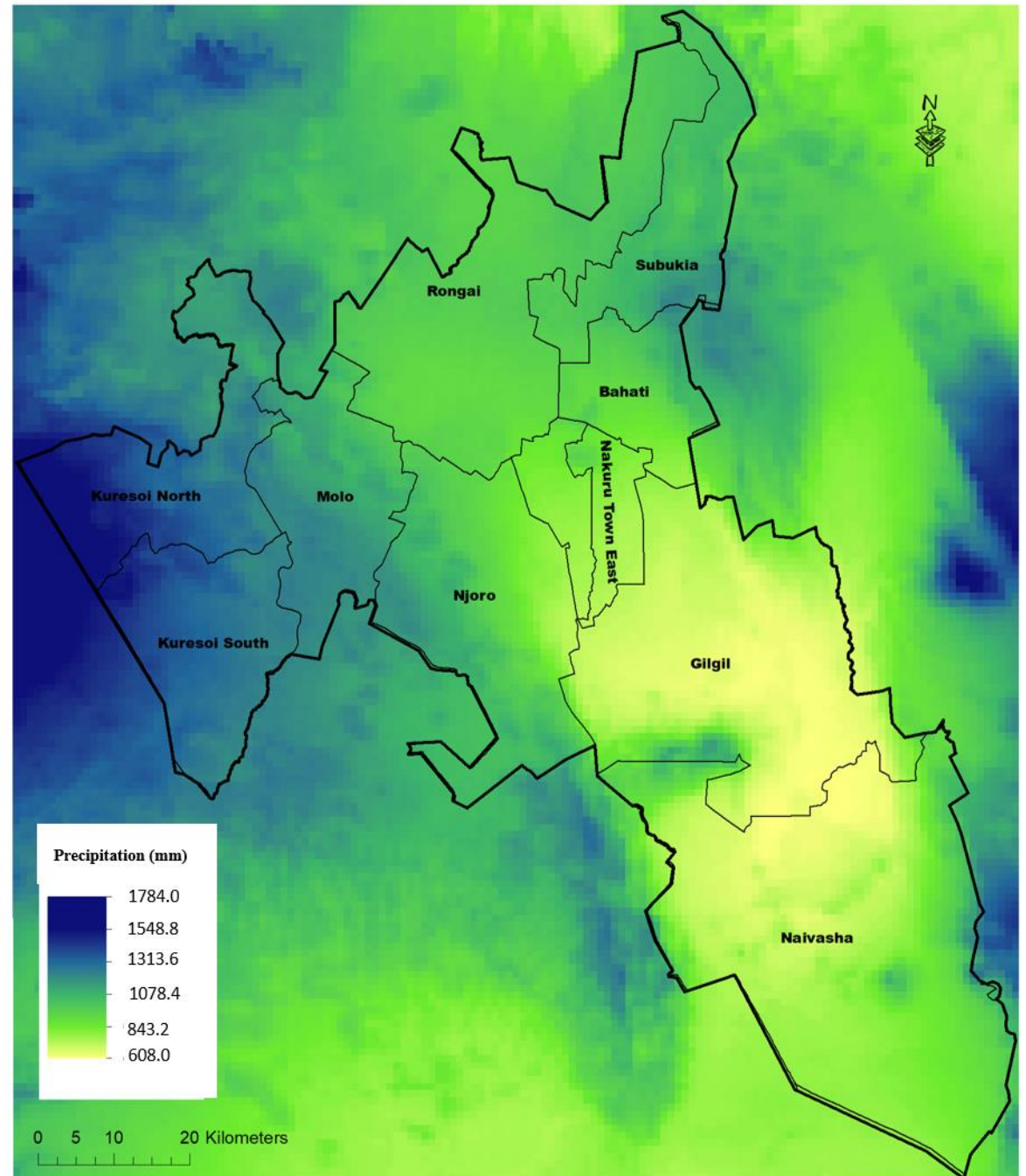
Annual Mean Temperature



Objectives of the Session

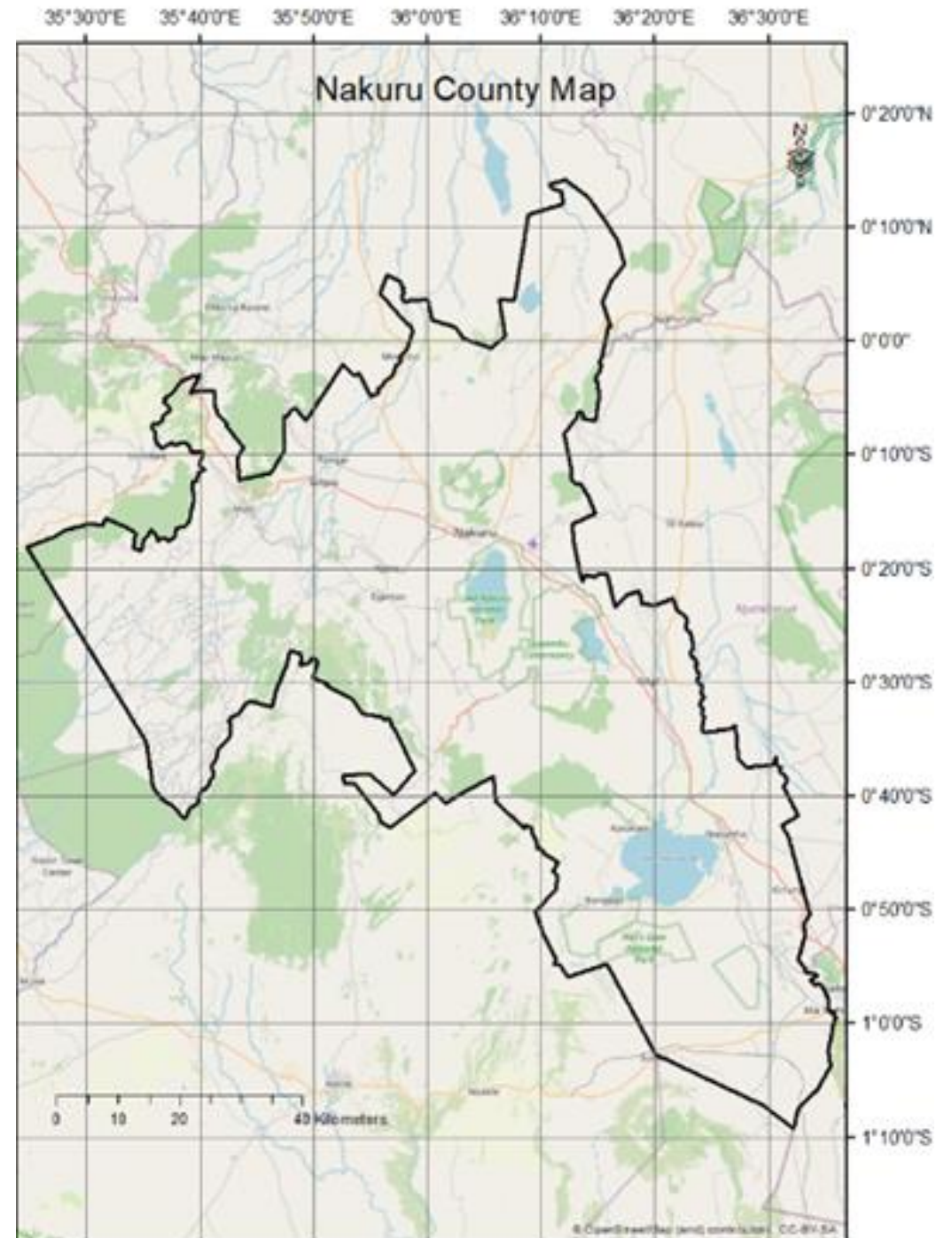
- Understand climate risk in a localised context.
- Learn about assessment methodologies.
- Explore sectoral and cascading climate impacts.
- Discuss adaptation pathways and resilience strategies.

Annual Precipitation



Nakuru County in Context

- **Geography:** Located in Kenya's Rift Valley
- **Area:** ~7,500 km²
- **Population:** 2.16 million (2019 Census)
- **Main sectors:** Agriculture, tourism, manufacturing
- **Diversity:** Highly diverse and ecologically significant.
- **Challenges:** Poverty (29.1%), food insecurity, and climate vulnerabilities.



Objectives of the Assessment

- **Map** climate indicators (temperature/precipitation).
- **Assess** ecosystem vulnerabilities.
- Develop **adaptation** pathways for resilience



Key questions:

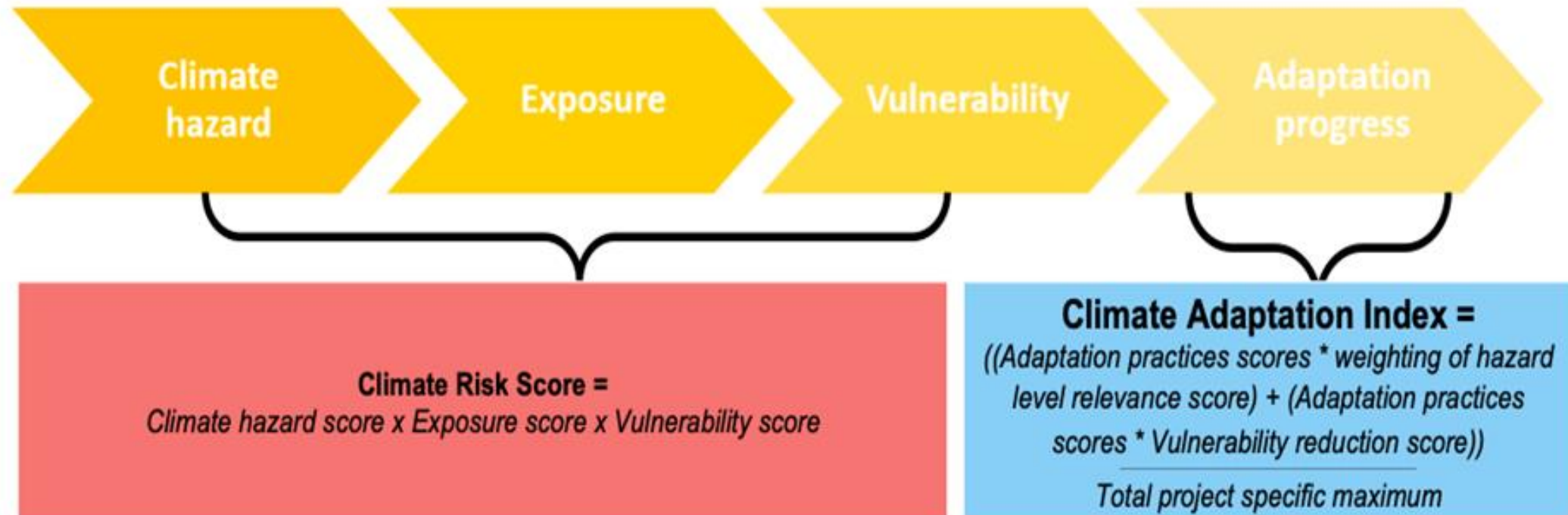
1. What climate-related **hazards** are experienced in Nakuru County, and what are their future projections?
2. How does one perceive climate change risks and their associated **impacts** on livelihoods?
3. Do the existing ecosystems (critical ecological services) have adequate resources to support sectors?
4. Are the existing **practices harmonious** with nature, based on agroecology principles?
5. What are the **best practices to facilitate adaptation** while ensuring the least environmental impact?

Methodological Framework

1. **GIS Tool** was used for mapping patterns and impacts of climate change (temperature/precipitation) indicators.
2. **Household surveys** (200 farmers) were used to capture information across 9 sub-counties.
3. **Climate vulnerability assessment** involved hazard identification and mapping of impacts, and identification of climate-responsive measures.
4. **Climate Adaptation Index (CAI)** Tool was used to capture hazards and their exposure levels.
5. **Agroecology Criteria Tool (ACT)** was used to capture the level of implementation of agroecology practices by farmers.
6. **Adaptation pathways** for a just transition to low low-carbon and resilient climate future were developed based on management practices implemented by farmers.

Methodological Framework

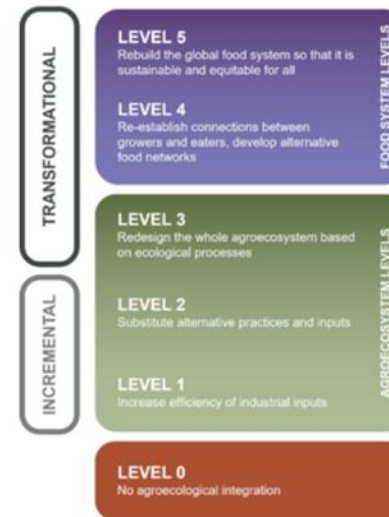
- **Climate Adaptation Index (CAI)** tool captured information about climate change-related hazards and their exposure levels in two scores:
 - **Climate Risk Score** to contextualize climate risk and vulnerabilities
 - **Climate Adaptation Index** - score the adaptation practices promoted based on available measures.



Methodological Framework

- **The Agroecology Criteria Tool (ACT)** was used to score adaptation practices implemented by farmers.
- Develop possible mitigation & adaptation pathways for a transition to low low-carbon and resilient climate future.

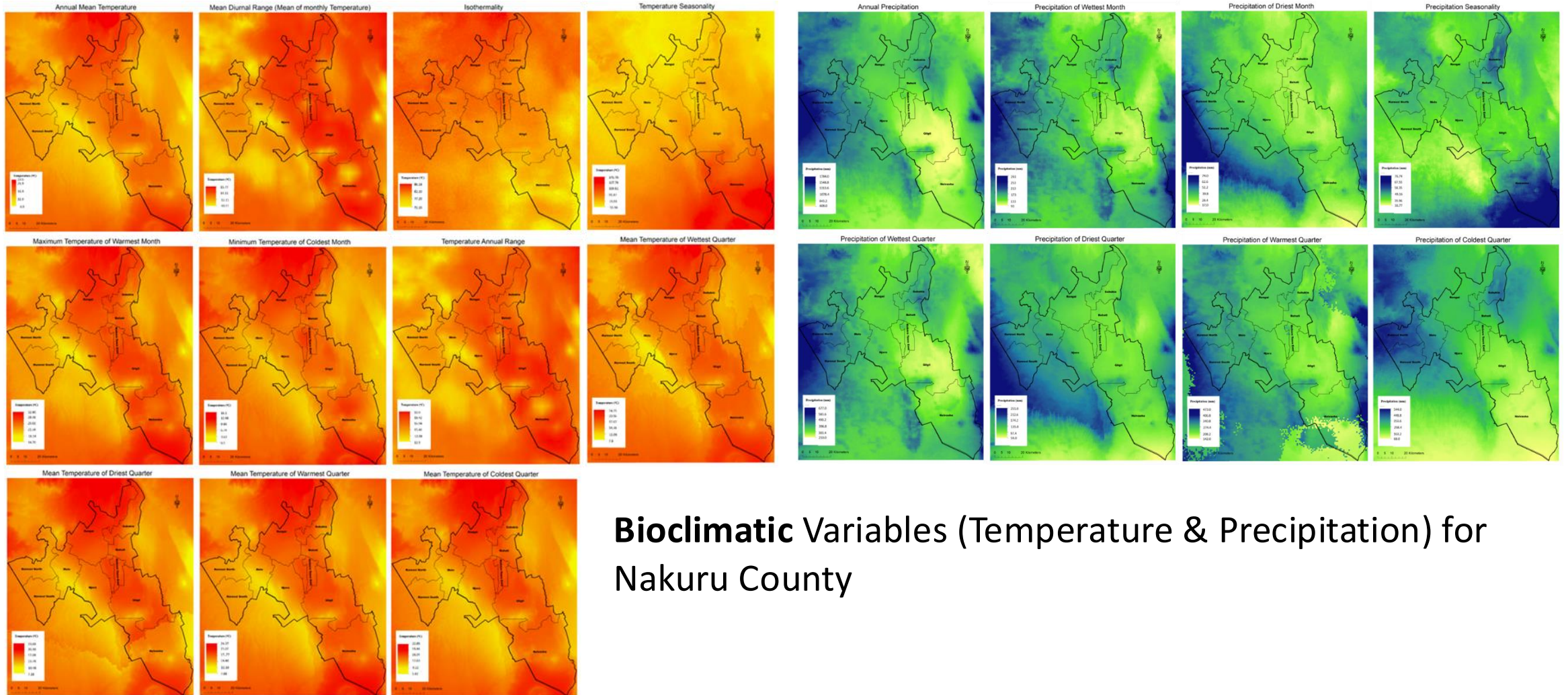
5 Levels of Food Systems Transition



The 13 Agroecology Principles linked to the 3 operational principles of sustainable food systems



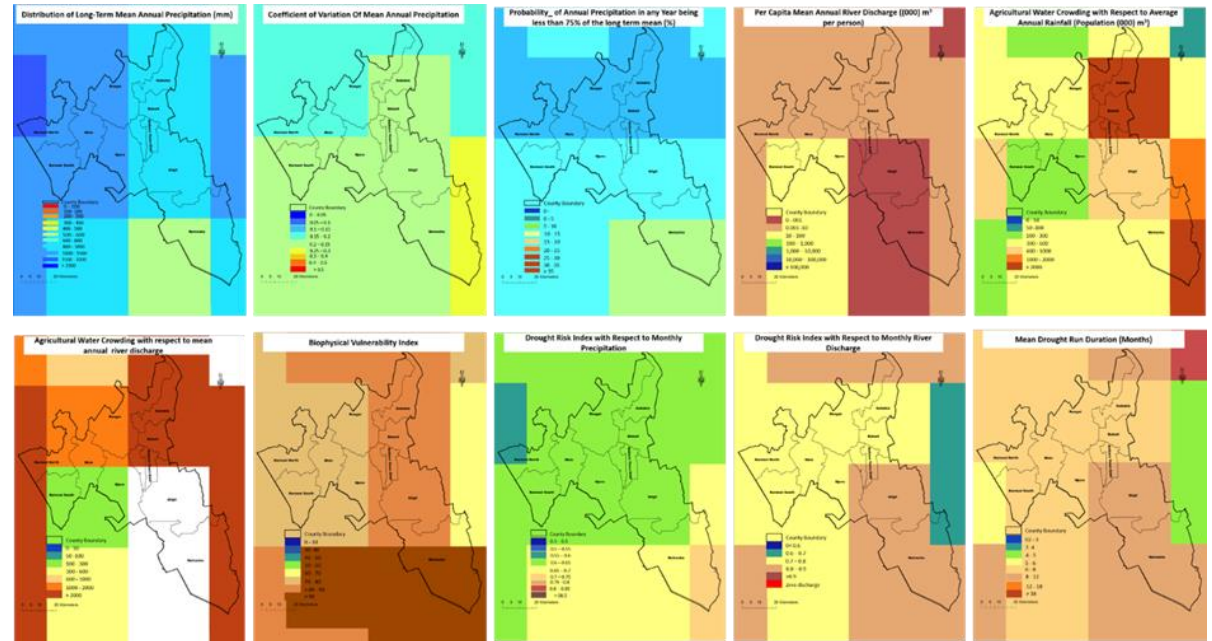
Findings - Climate Trends in Nakuru



Bioclimatic Variables (Temperature & Precipitation) for Nakuru County

Findings - Climate Trends in Nakuru

- Average Temp: 17.5°C; Rainfall: ~762mm/year
- Temperature rise: +3.4°C by 2100 (RCP8.5).
- Rising temperatures in lowland areas.
- Water stress: Medium-high risk.
- Highest rainfall in Kuresoi North/South
- Frequent droughts and variable precipitation
- Low adaptation uptake (e.g., only 40% practice soil conservation).



Understanding Climate Risk

Hazard: Droughts, floods, erratic rainfall, heatwaves



Exposure: Communities, crops, infrastructure



Vulnerability: Limited adaptive capacity, poor infrastructure, low literacy



Impact: Systemic effects on livelihoods, food security, health, and biodiversity

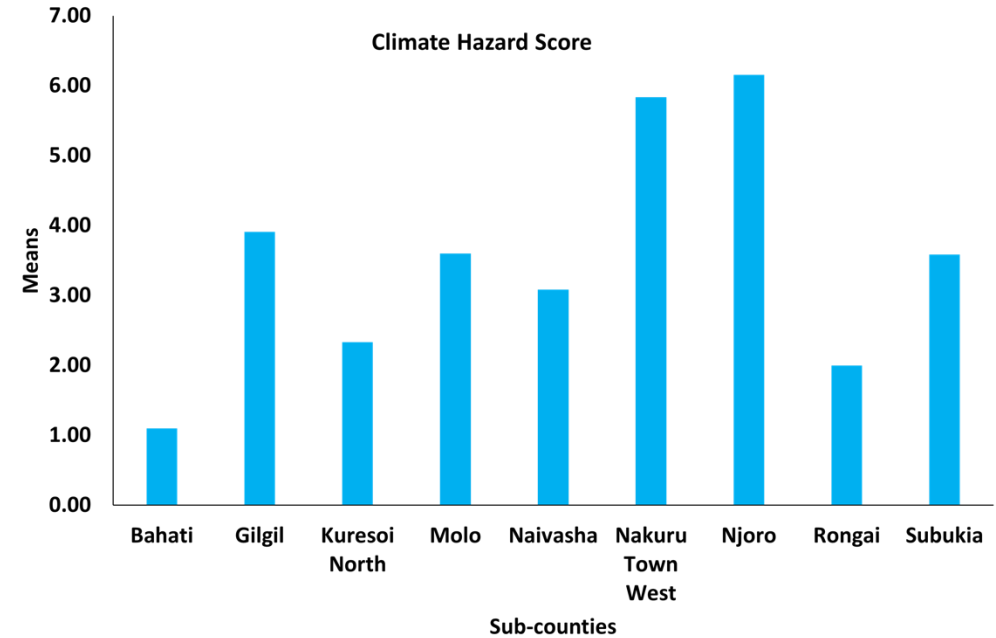
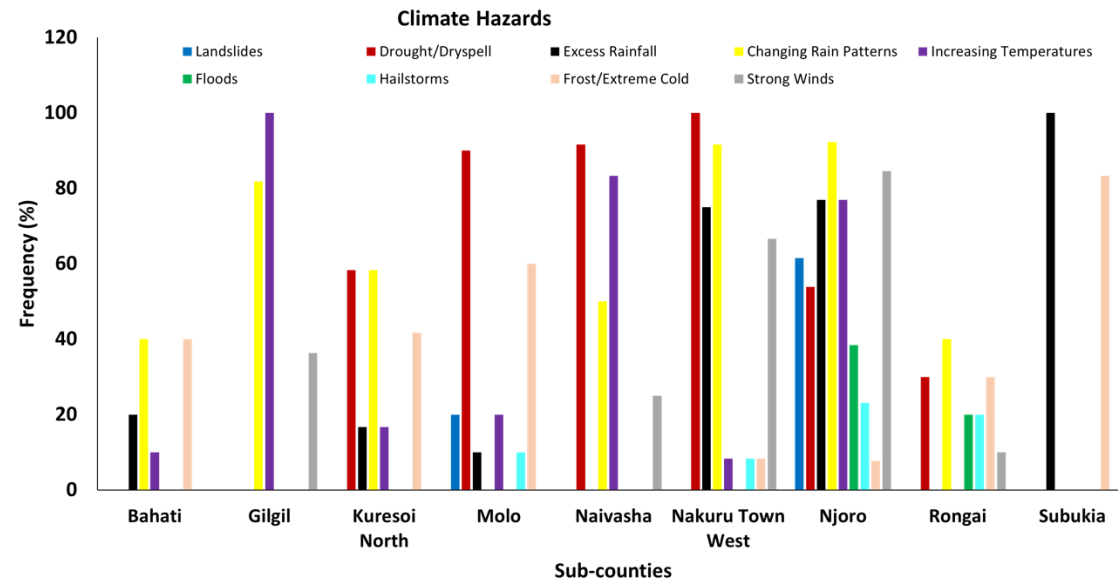


Climate Action: Adaptation &/or Mitigation practices, e.g. agroecological practices

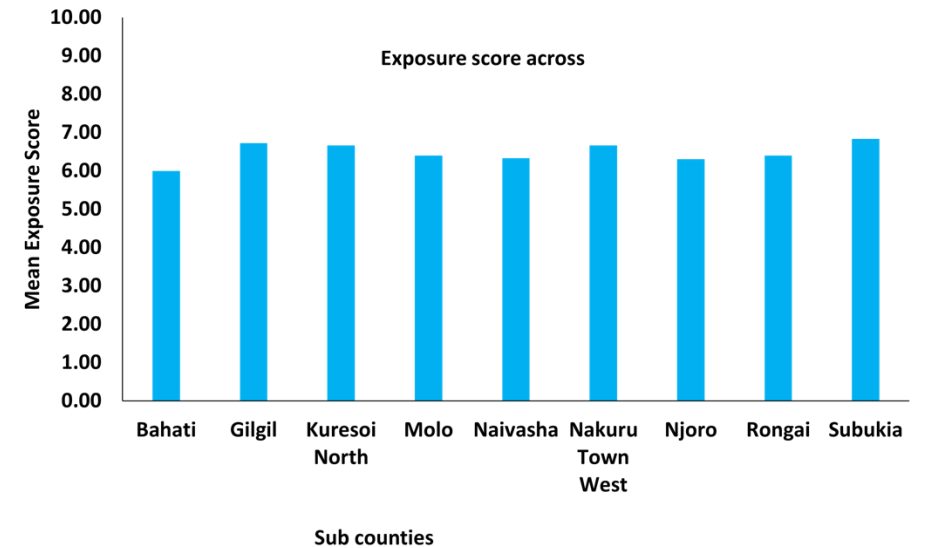
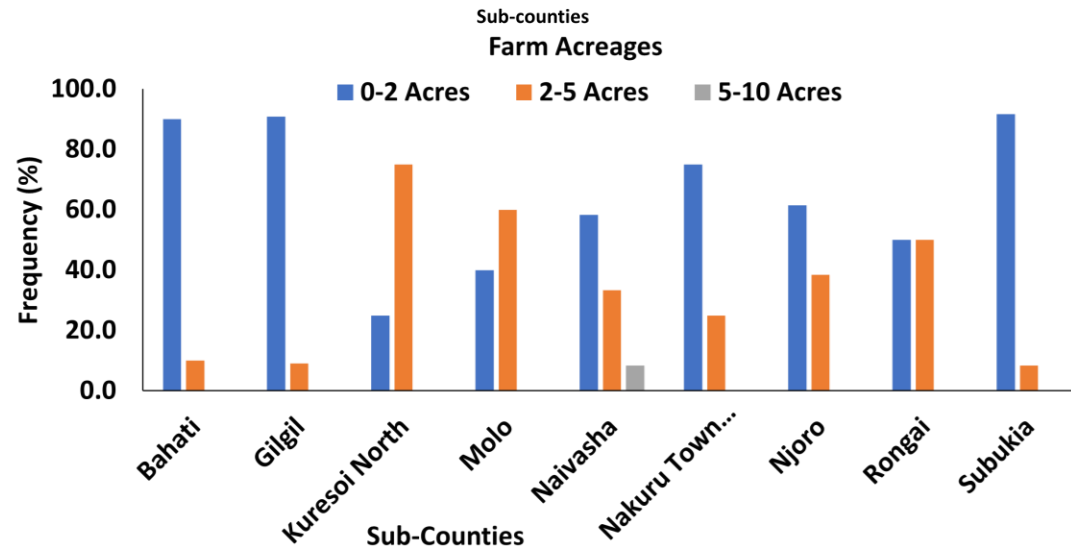
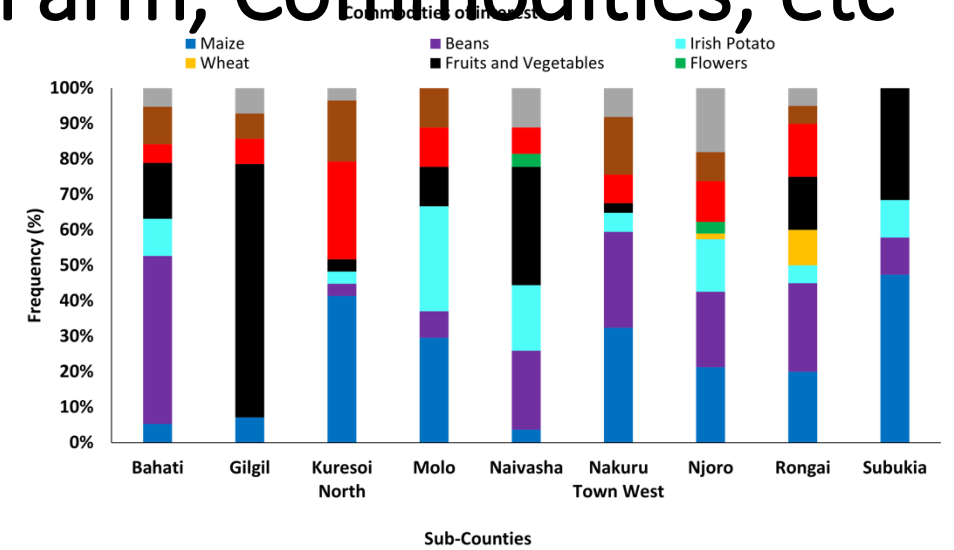
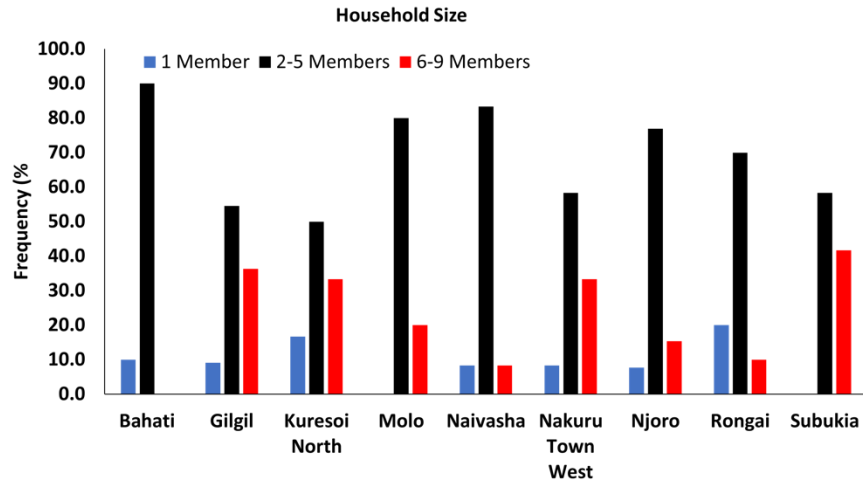


Findings - Key Climate Hazards Identified

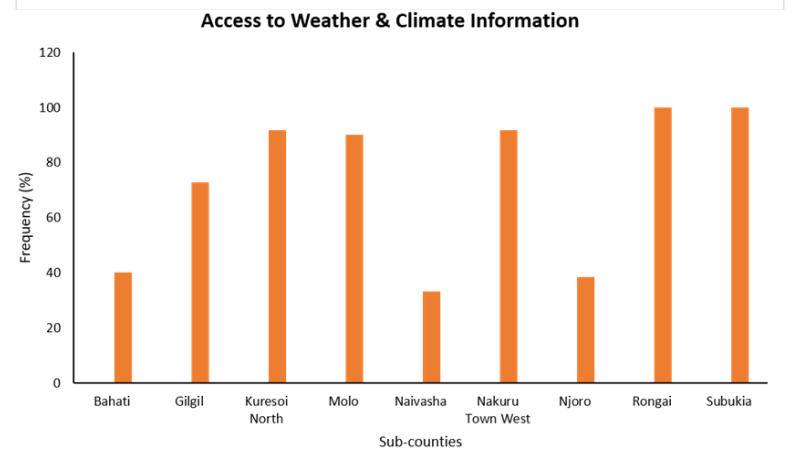
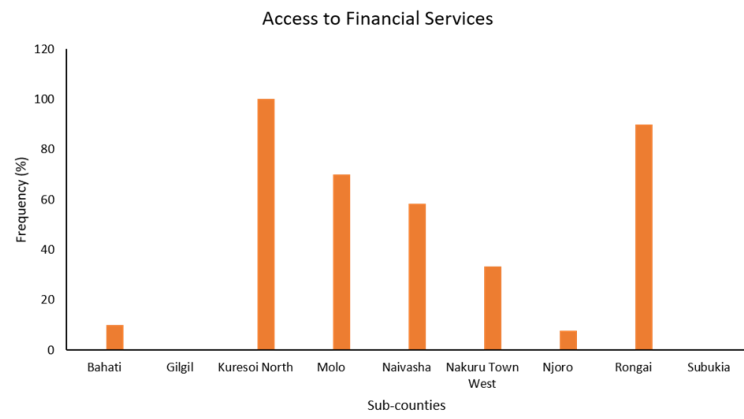
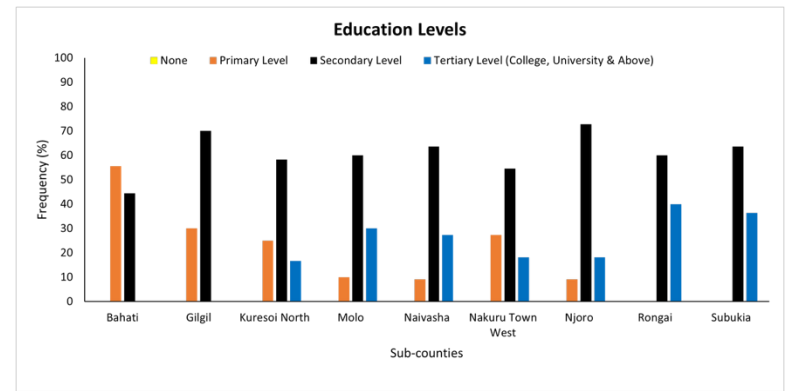
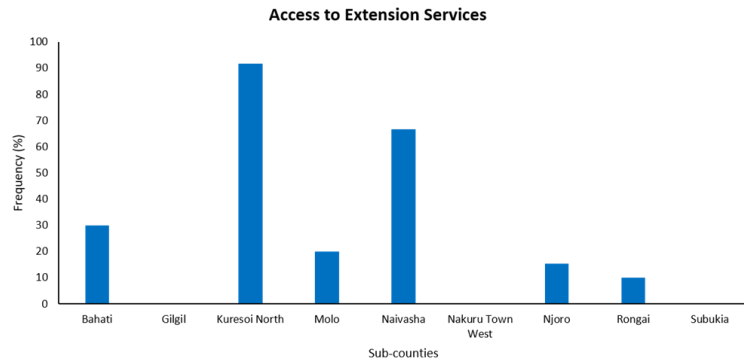
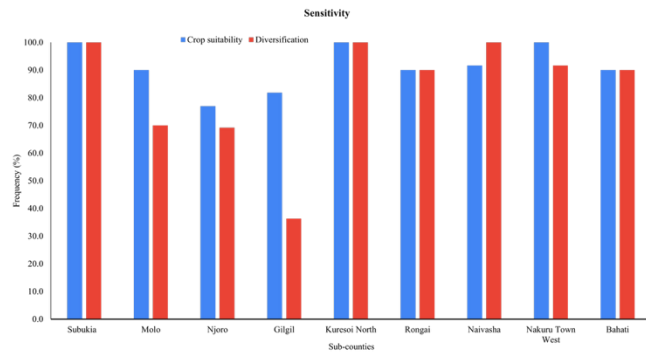
Top hazards:



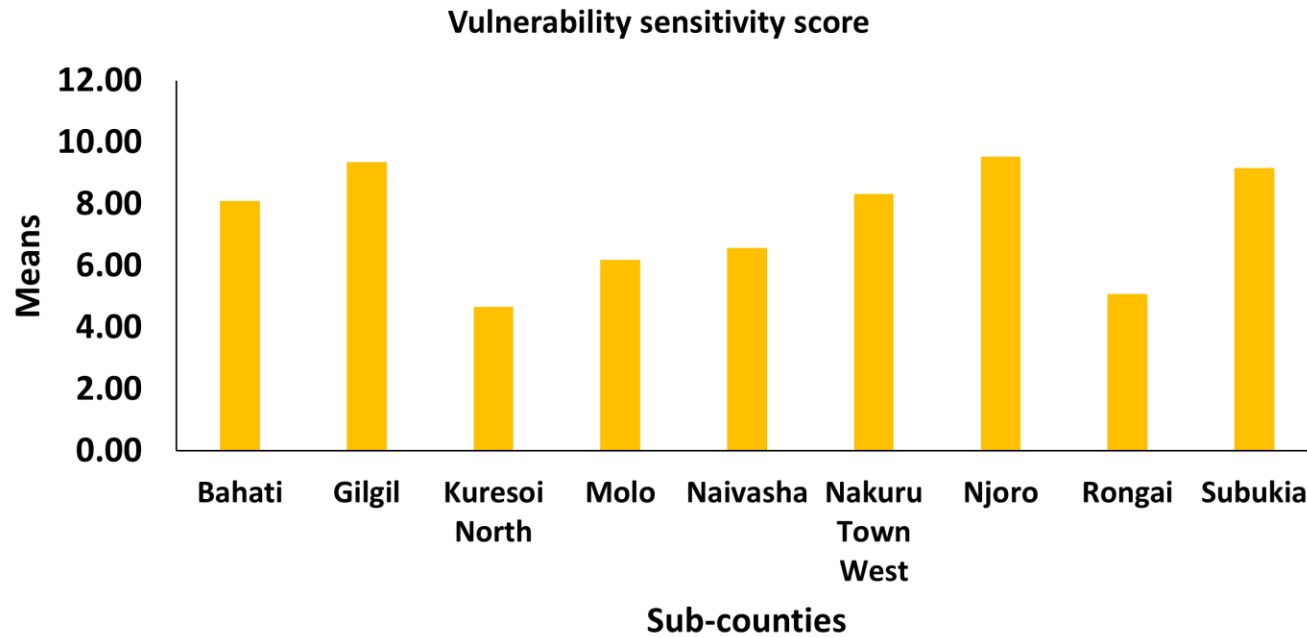
Findings – Exposure :Household, Farm, Commodities, etc



Findings – Vulnerability (Sensitivity x Capacity)



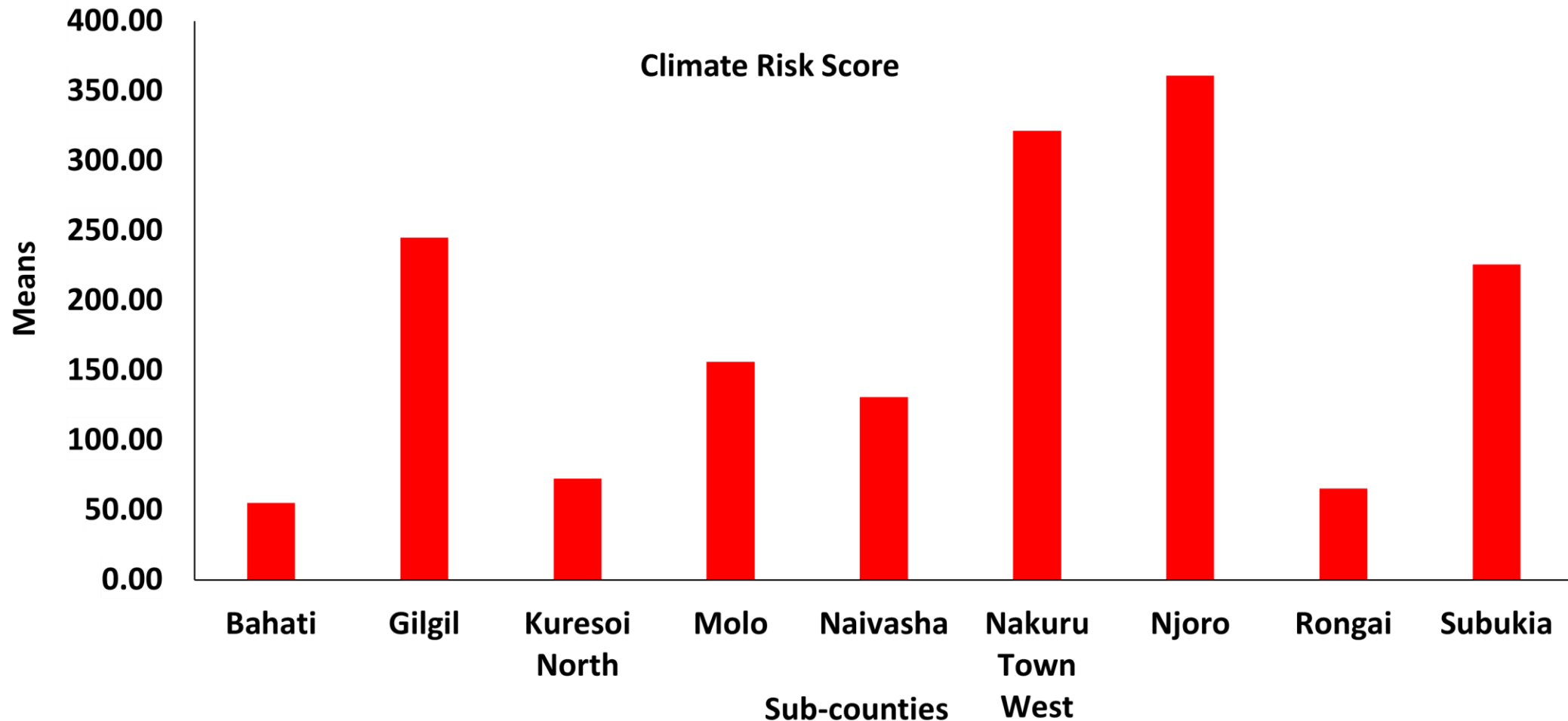
Findings – Vulnerability (Sensitivity x Capacity)



Sensitivity factors = Suitability of crops and On-farm diversification.

Capacity factors = access to extension, financial, weather & climate information and education level across Nakuru.

Findings – Climate Risk (Climate hazard x Exposure x Vulnerability)



Findings - Sectoral Impacts – Agriculture

Climate Change Impacts on Smallholder Farmers



1. Production Impacts

Crop Failures → Hunger

- Reduced yields (maize, beans, potatoes)

Soil + Pests = Lower Yields

- Degradation, erosion, and more pests/diseases

Unpredictable Cycles

- Delayed planting, shifting seasons



2. Harvest & Storage Impacts

Poor Quality = Low Income

- Spoilage, rotting, fungal infections

Post-Harvest Losses

- Shorter shelf life, heat / chilling damage

Costs Rise



3. Marketing & Sales Impacts

Market Chaos

- Delayed sales, poor linkages, low prices

Roads Blocked

- Floods/droughts limit market access

Financial Losses

- High promotion costs, unsold spoiled produce



4. Social & Economic Crisis

Food Shortages → Hunger

- Longer “hunger seasons.”

Economic Collapse

- Crime, school dropouts, displacements

Health Risks

Other Sectoral Impacts



Water & Ecosystems

- Medium to high water and drought risk scores
- Reduced water quality and quantity
- Impacts on Lake Naivasha and Nakuru ecosystems
- Decreased biodiversity and increased habitat loss



Health

- Increased Climate-sensitive disease burden from heat and floods (e.g., malaria, respiratory issues)
- Malnutrition



Infrastructure

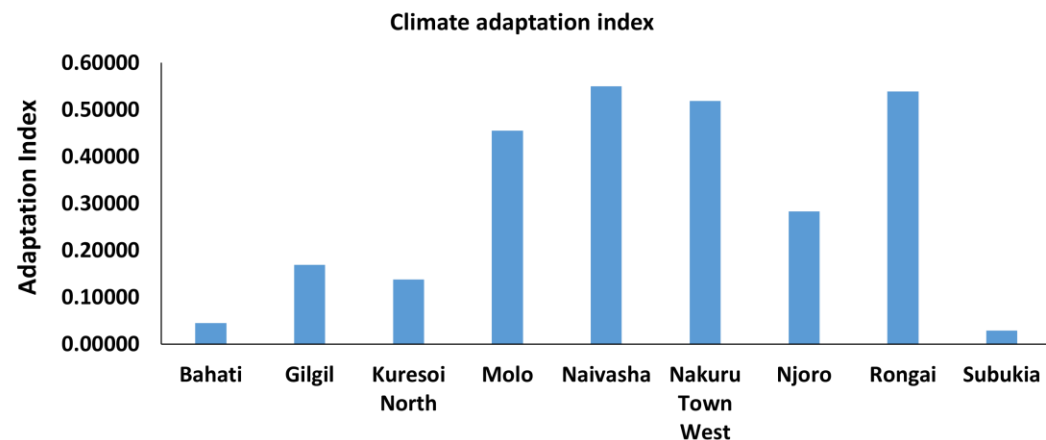
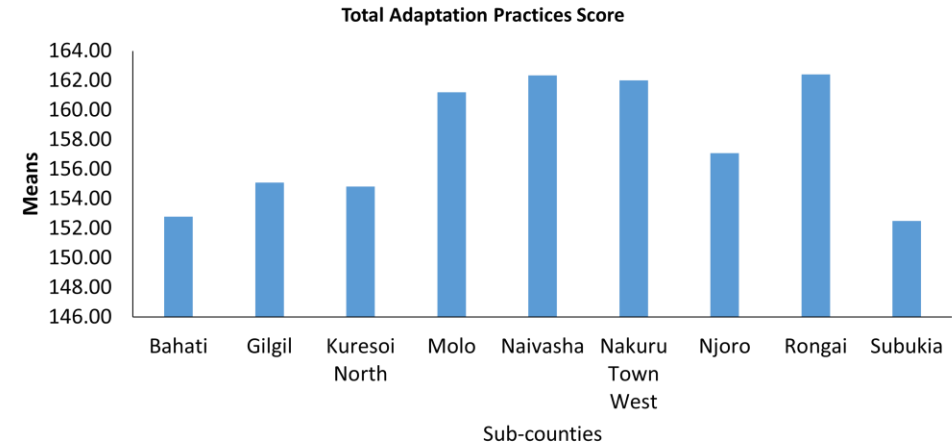
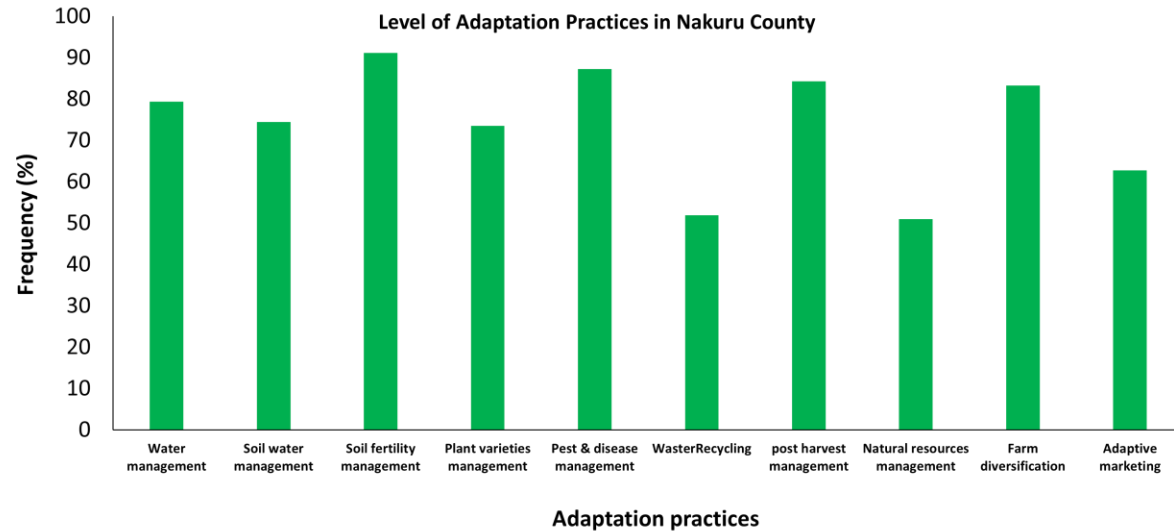
- Damage to rural roads and markets from floods and landslides



Tourism

- Disruption in natural attractions (e.g., Lake Nakuru degradation) due to extreme weather leading to a Loss of income in nature-based economies

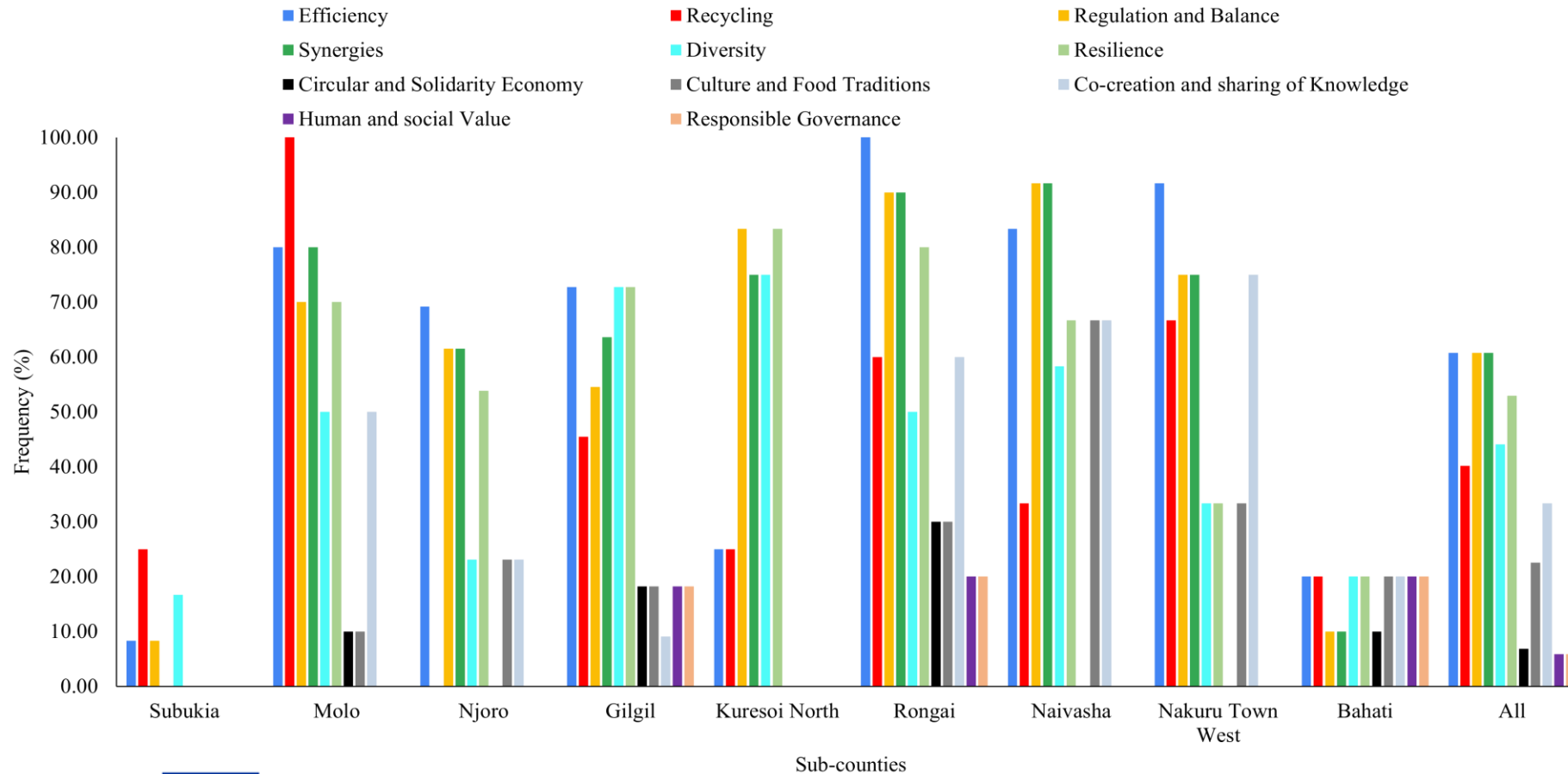
Findings- Adaptation Progress



- ✓ **Rongai, Naivasha:** Highest adaptation index
- ✓ **Bahati, Subukia:** Lowest resilience
- ✓ Access to services and information is uneven
- ✓ Adaptation practices vary widely

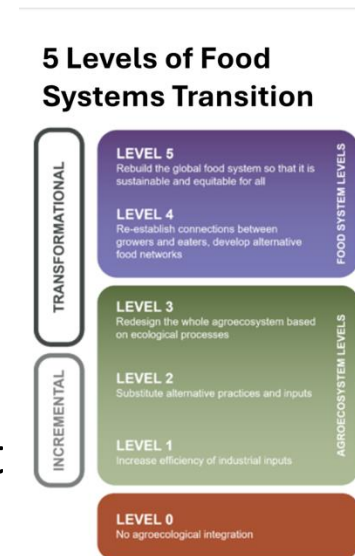
Agroecology as a Resilience Strategy

Agroecology Dimension in Nakuru County



Recommended Pathways for Nakuru

- Promote sustainable soil and land management
- Scale agroecology and seed sovereignty
- Enhance stakeholder innovation platforms
- Strengthen ecosystem-based adaptation
- Expand agroforestry and organic inputs
- Improve local markets and extension services
- Adopt renewable energy and waste management



The 13 Agroecology Principles linked to the 3 operational principles of sustainable food systems



Why Interdisciplinary Approaches Matter

- Climate risk is social, economic, and ecological
- Requires collaboration across sectors
- Involves governance, finance, science, and community voices

Conclusion

- Climate risk requires interdisciplinary action.
- Localized data = Effective solutions.
- Climate risk in Nakuru is real, complex, and growing
- Sector-wide impacts require integrated responses
- Agroecology is a promising entry point for systemic transformation.
- Building resilience needs policy support, investment, and community agency.

Q&A / Discussion

- What insights resonated most?
- How can we replicate localised assessments elsewhere?
- What's your role in building resilience?

Questions





SAFE4ALL
A F R I C A

Climate Risks and Food Security in SSA
Ignacio Saldivia Gonzatti (WUR)

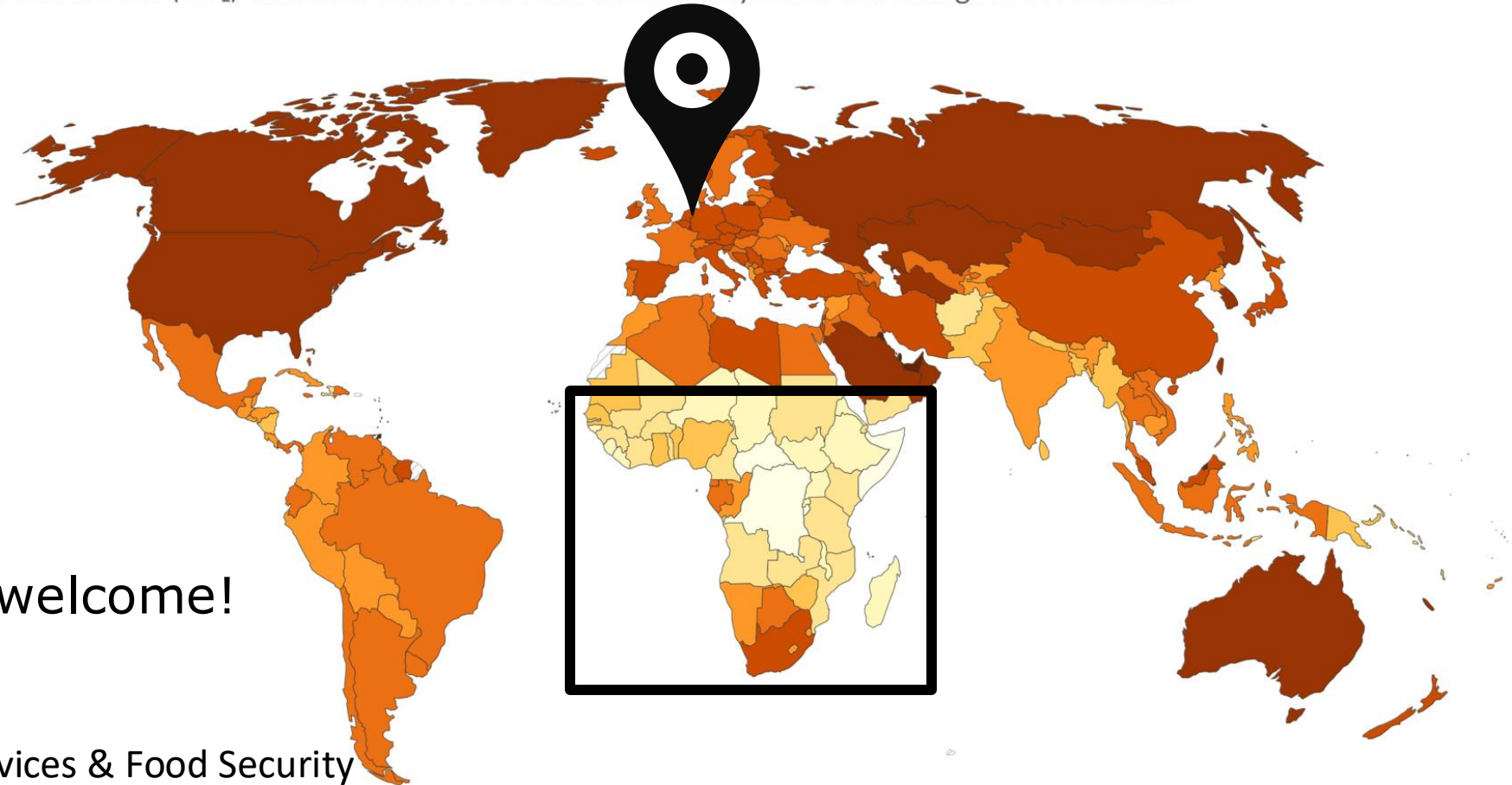


The SAFE4ALL project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101137814

Per capita CO₂ emissions, 2022

Carbon dioxide (CO₂) emissions from fossil fuels and industry. Land-use change is not included.

Positionality
statement



Critical feedback is welcome!

Ignacio Saldivia Gonzatti

PhD candidate on Climate Services & Food Security

E-mail: ignacio.saldiviagonzatti@wur.nl



Data source: Global Carbon Budget (2023); Population based on various sources (2023)
OurWorldinData.org/co2-and-greenhouse-gas-emissions | CC BY

Topics of today

Why Sub-Saharan Africa?

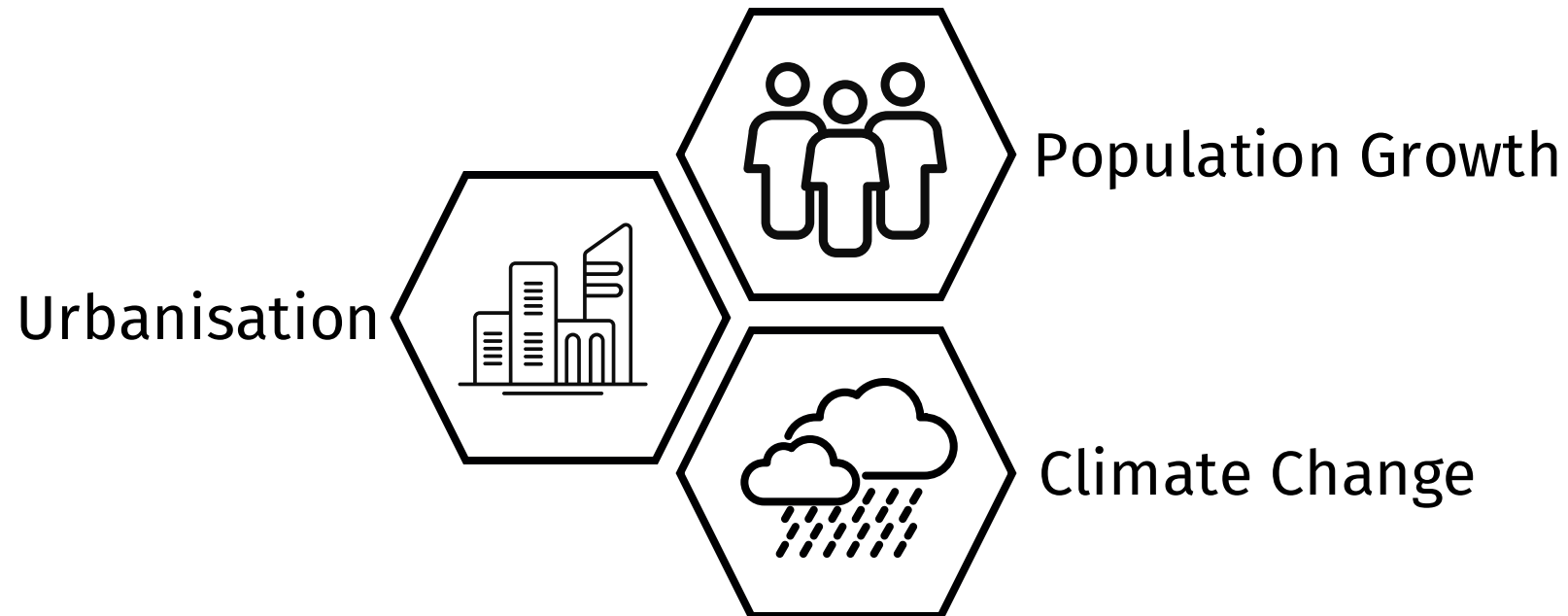
Food security theory and facts

Climate change impacts on food security

Three examples of climate impacts

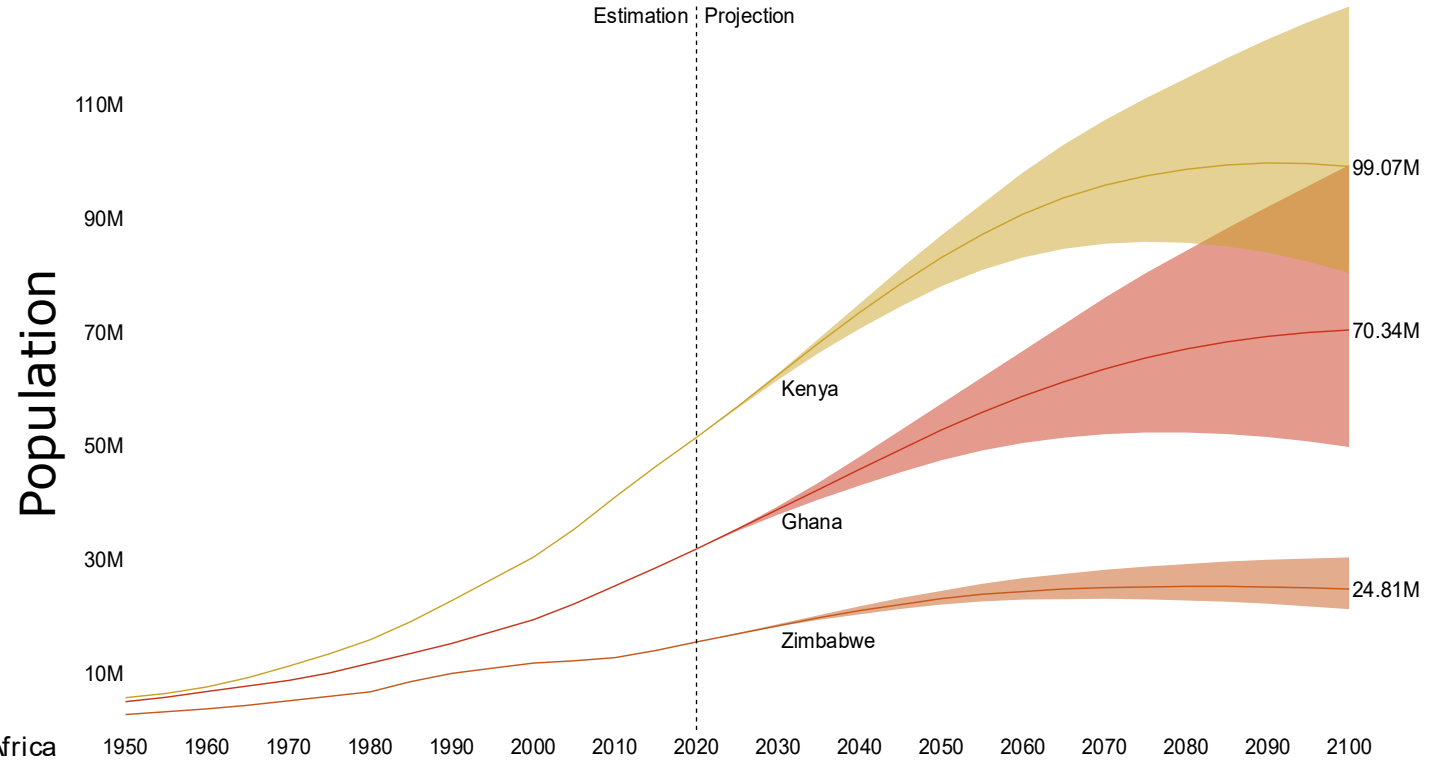
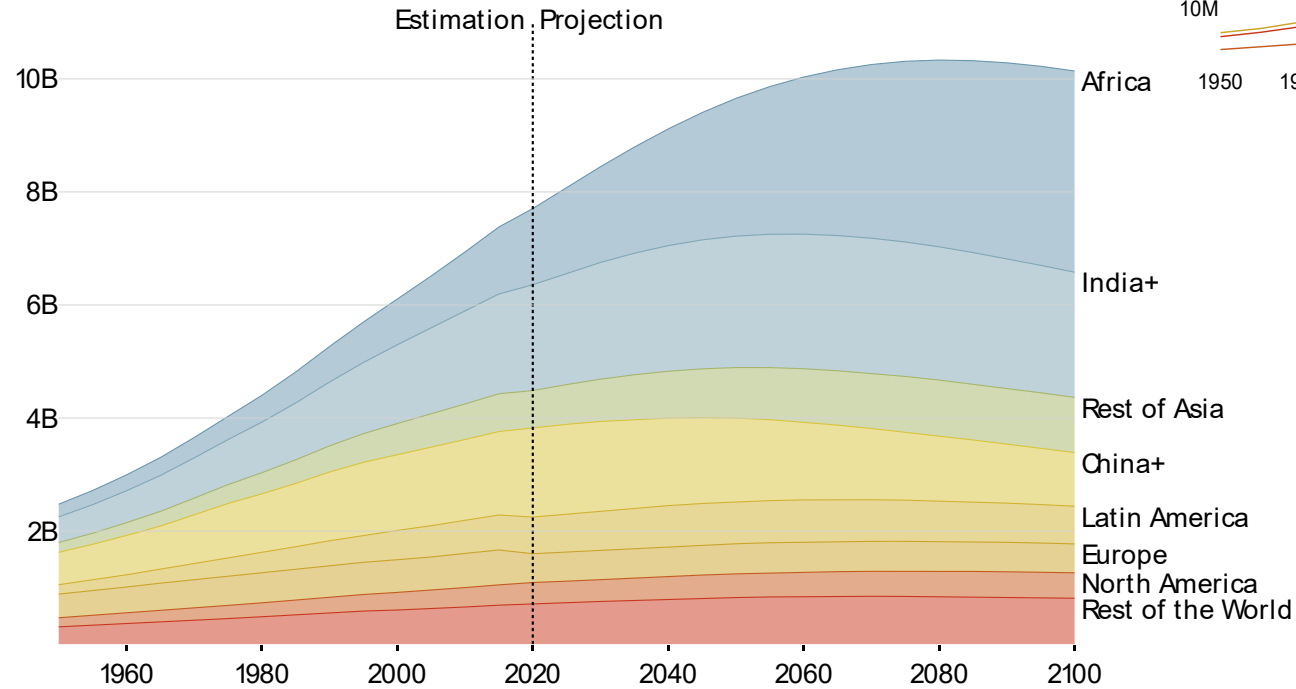
Foodshed Information Service

Drivers of Change in the Food System



Why Sub-Saharan Africa?

Population by Region



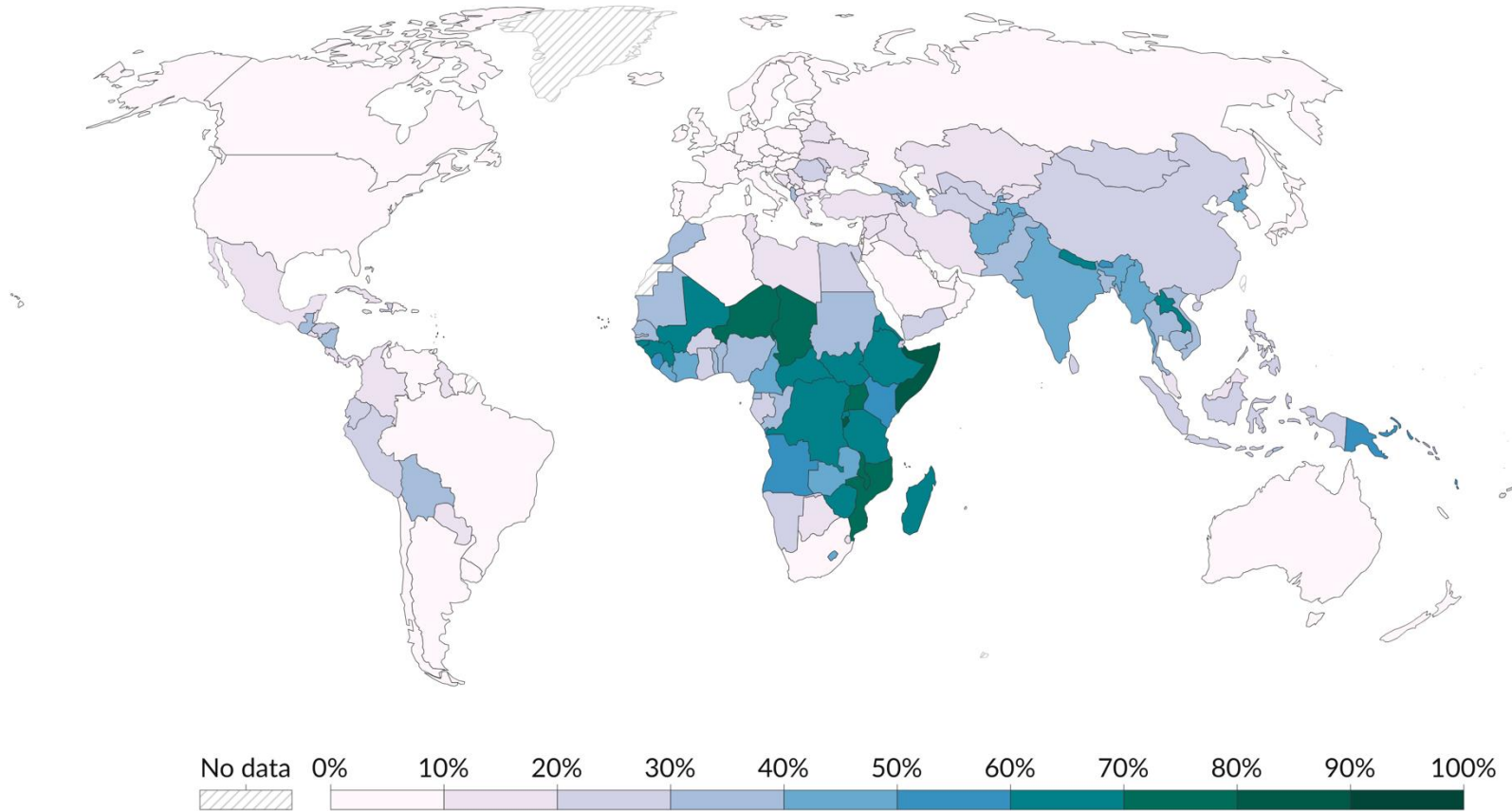
Source: SSP 3.1
<https://data.ece.iiasa.ac.at/ssp/>

Why Sub-Saharan Africa?

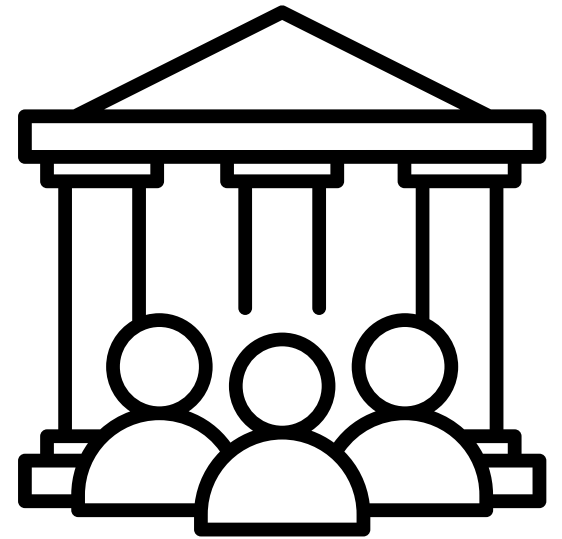
Share of the labor force employed in agriculture, 2019

Our World
in Data

Agriculture includes the cultivation of crops and livestock production, as well as forestry, hunting, and fishing. Employment includes anyone engaged in any activity to produce goods or services for pay or profit.



Why Sub-Saharan Africa?



Climate variability in SSA

ENSO effects across Africa by season

El Niño impacts (Dec-Feb)



La Niña impacts (Dec-Feb)



El Niño impacts (June-Aug)

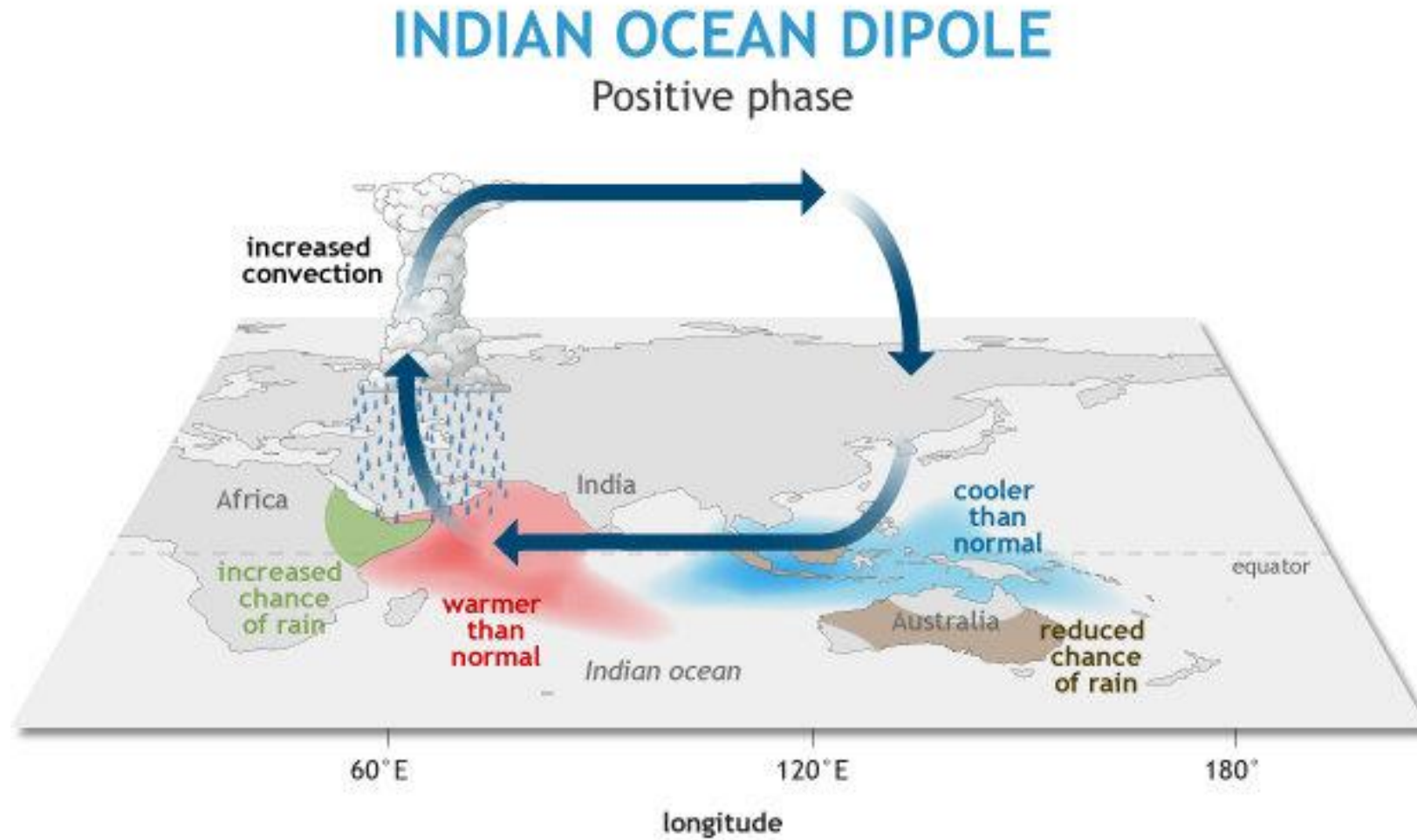


La Niña impacts (June-Aug)

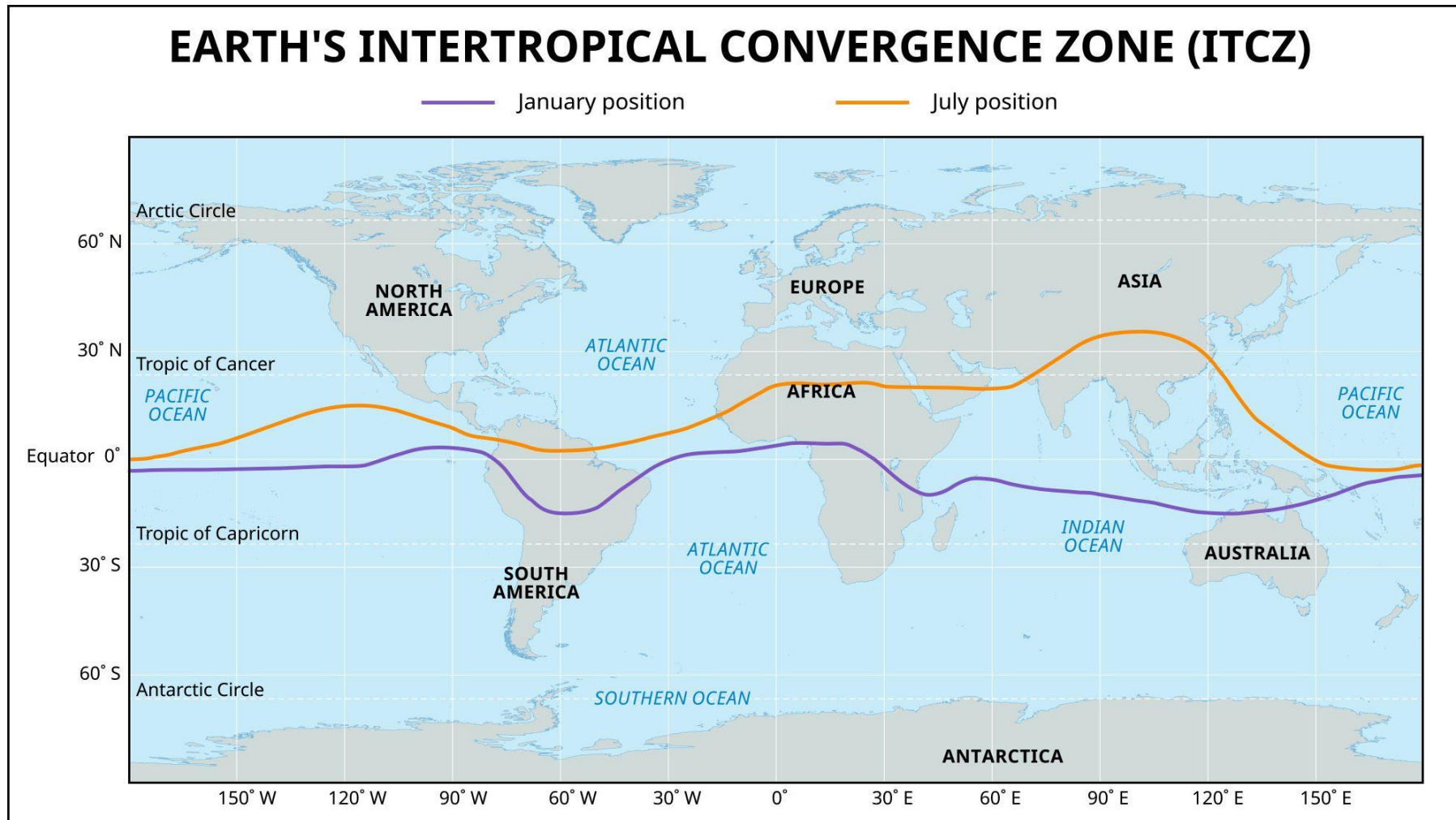


-  Cool
-  Wet
-  Dry
-  Warm and dry
-  Cool and wet

Climate variability in SSA



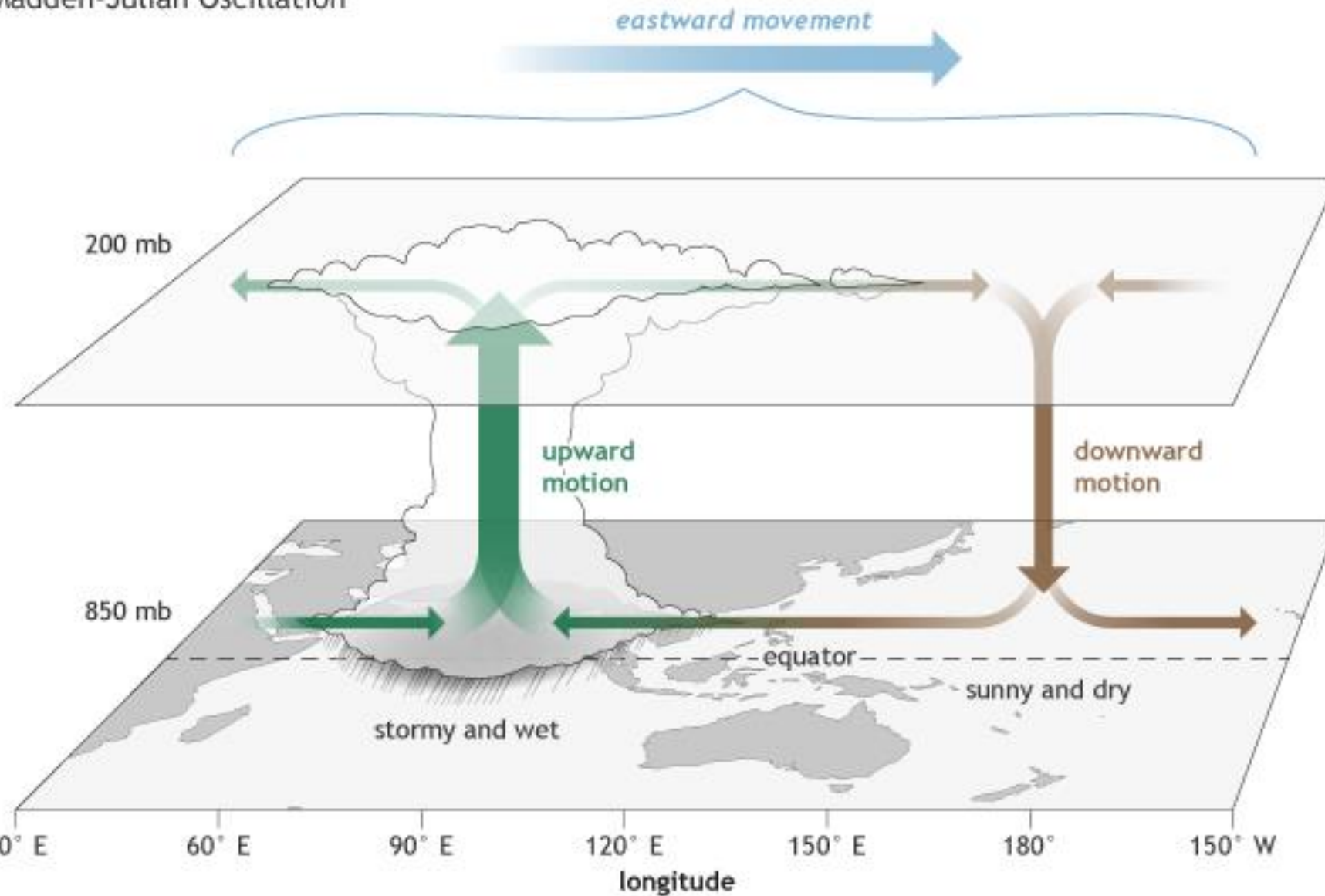
Climate variability in SSA



Sources: Hai Cheng et al., "The Global Paleomonsoon As Seen Through Speleothem Records from Asia and the Americas," *Climate Dynamics*, 39:1045–62 (2012); and Bernhard Paul Wagner et al., "Neolithisation of the Aegean and Southeast Europe During the 6600–6000 calBC Period of Rapid Climate Change," *Documenta Praehistorica*, 41:1–31 (2014).

Climate variability in SSA

Madden-Julian Oscillation



Climate variability in SSA

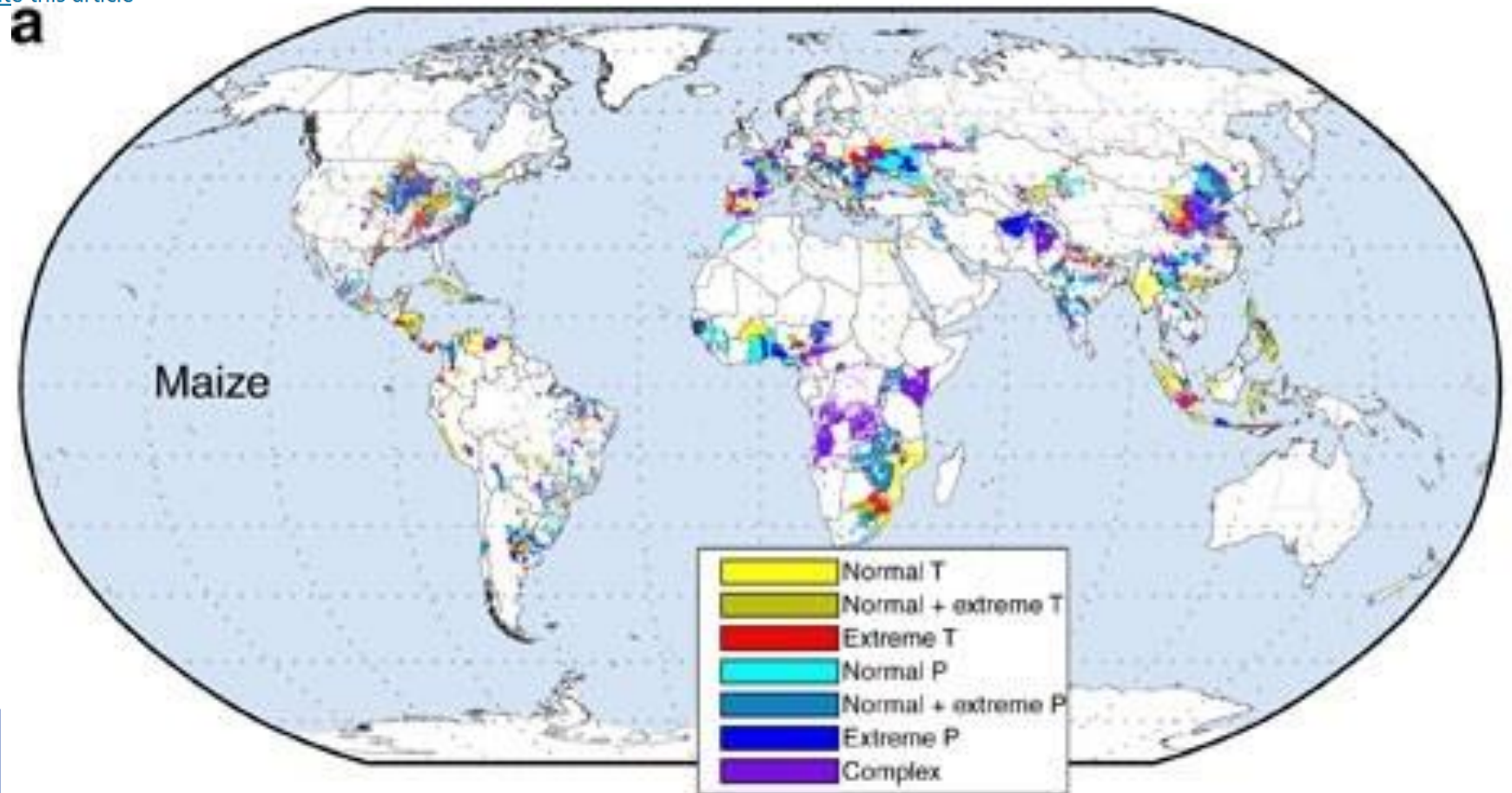
Article | [Open access](#) | Published: 22 January 2015

Climate variation explains a third of global crop yield variability

[Deepak K. Ray](#) , [James S. Gerber](#), [Graham K. MacDonald](#) & [Paul C. West](#)

[Nature Communications](#) **6**, Article number: 5989 (2015) | [Cite this article](#)

70k Accesses | 162 Altmetric | [Metrics](#)



Poll: In your view, what is the main reason Sub-Saharan Africa is especially vulnerable to food insecurity under climate change?

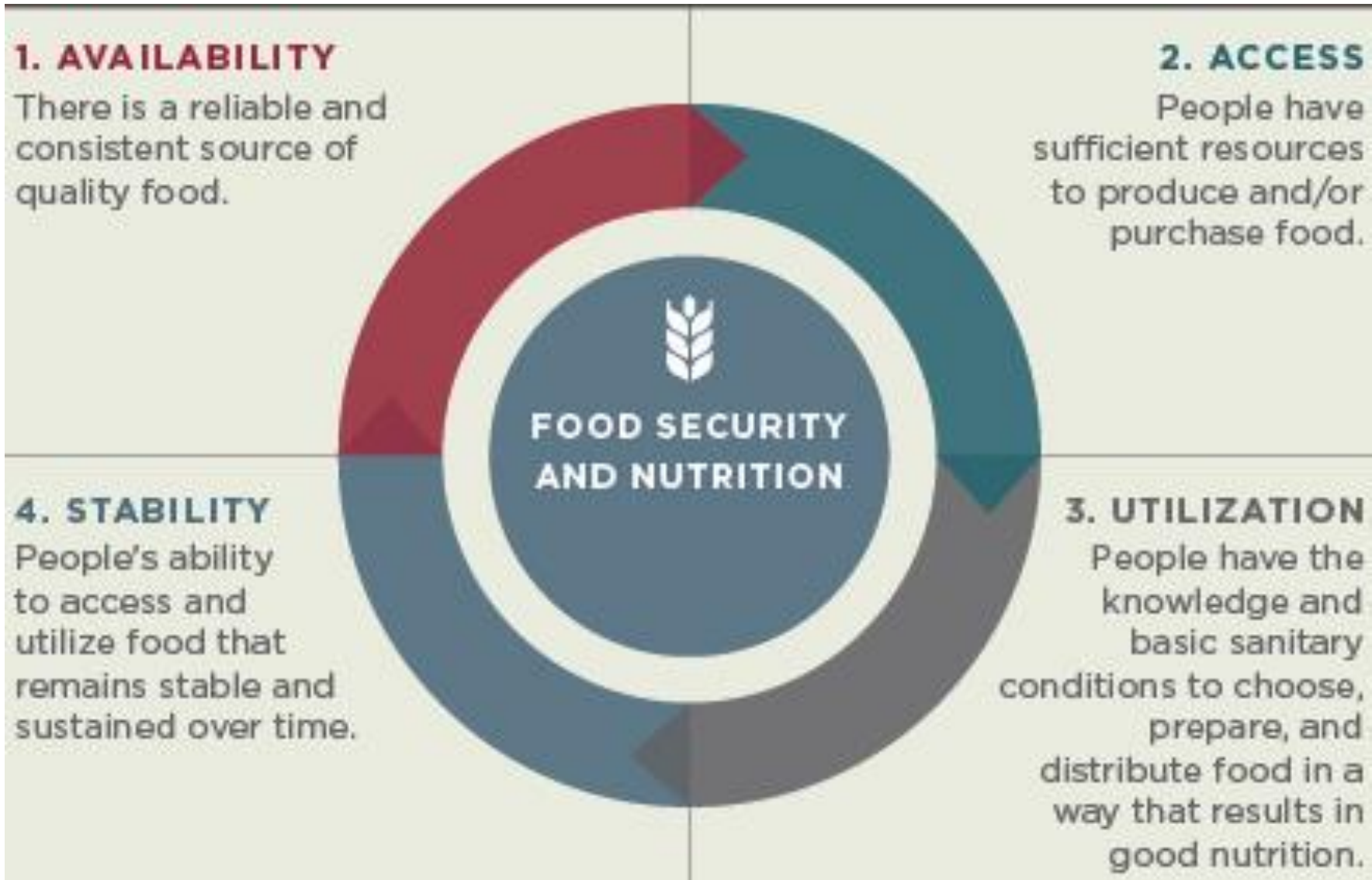
- A. Historical and colonial legacies**
- B. Environmental and geographic challenges**
- C. Governance and policy challenges**
- D. Economic inequality**
- E. Climate variability and extreme events**

Food security is multi-dimensional



*Starvation is a matter of some people not having enough food to eat,
not a matter of there not being enough food to eat.*

- Amartya Sen, 1981



Other food security concepts

Sovereignty

Collective right to define our own food policies and systems

Stability

Consistency of food supply and access

Sustainability

Long-term environmentally and socially just food systems

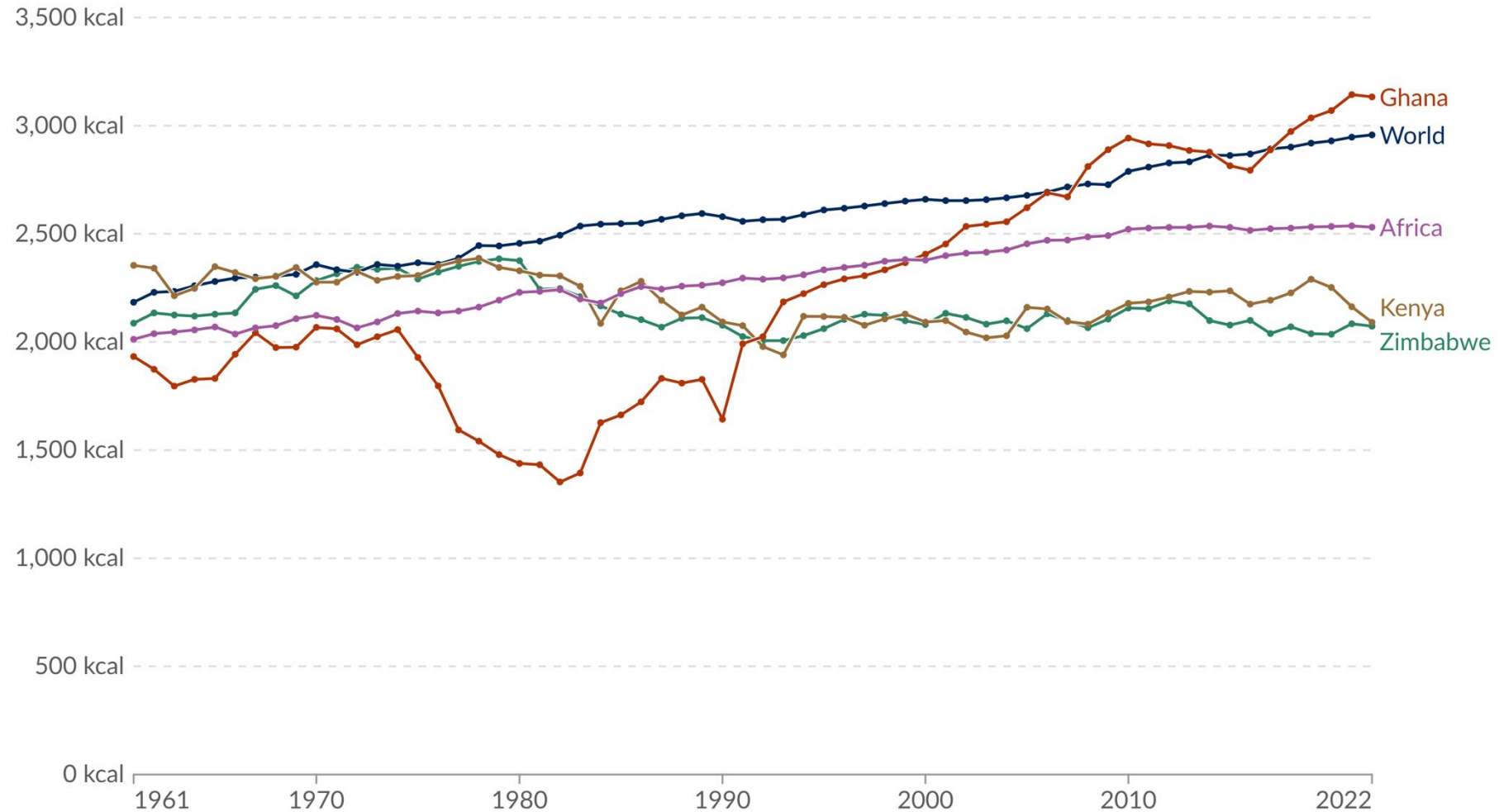
Resilience

Withstanding and recovering from shocks

Some facts about food security

Daily supply of calories per person, 1961 to 2022

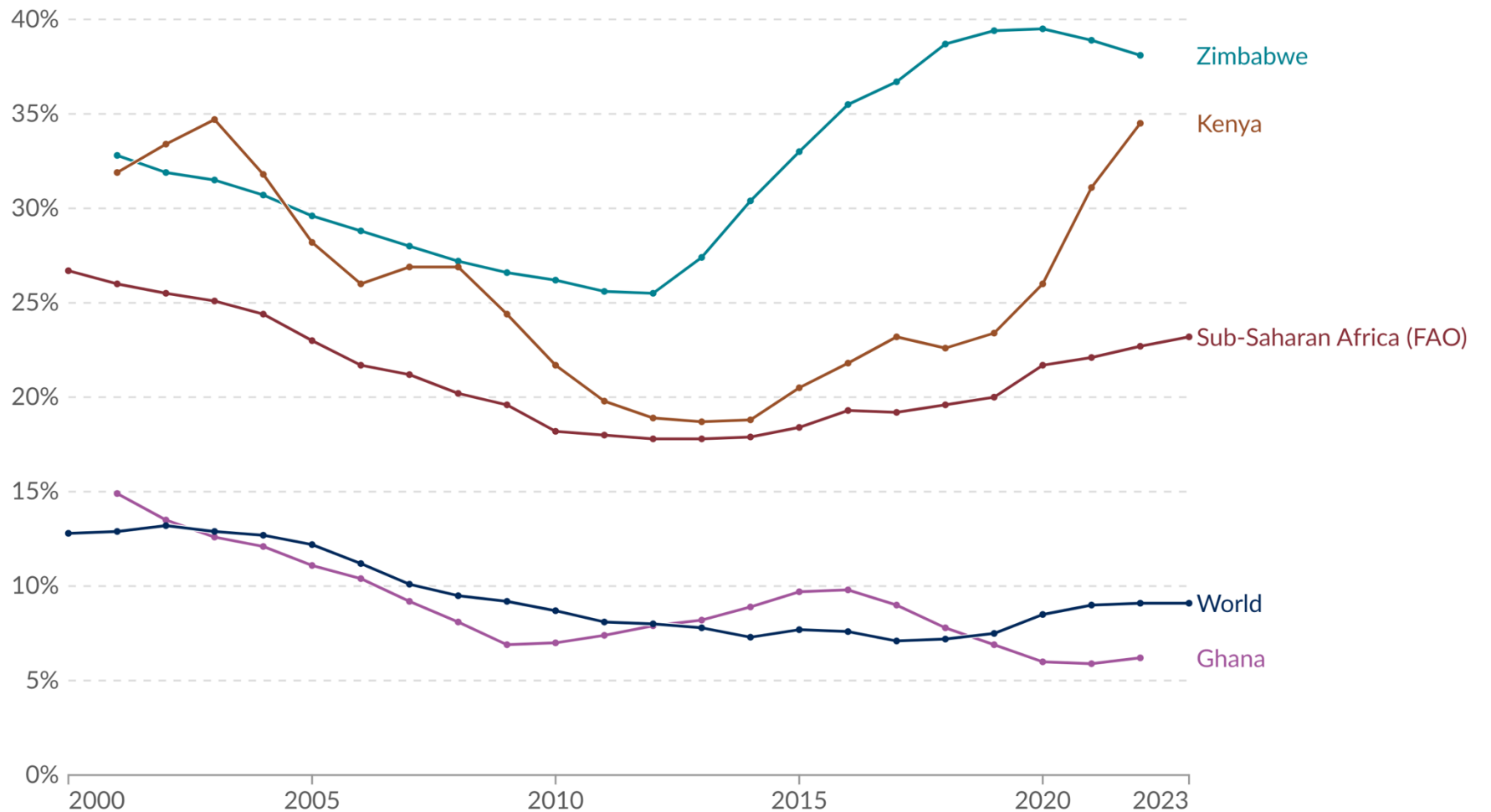
Measured in kilocalories per person per day. This indicates the calories that are available for consumption, but does not necessarily measure the number of calories actually consumed, since it doesn't factor in consumer waste.



Two-in-ten people in SSA do not get enough to eat

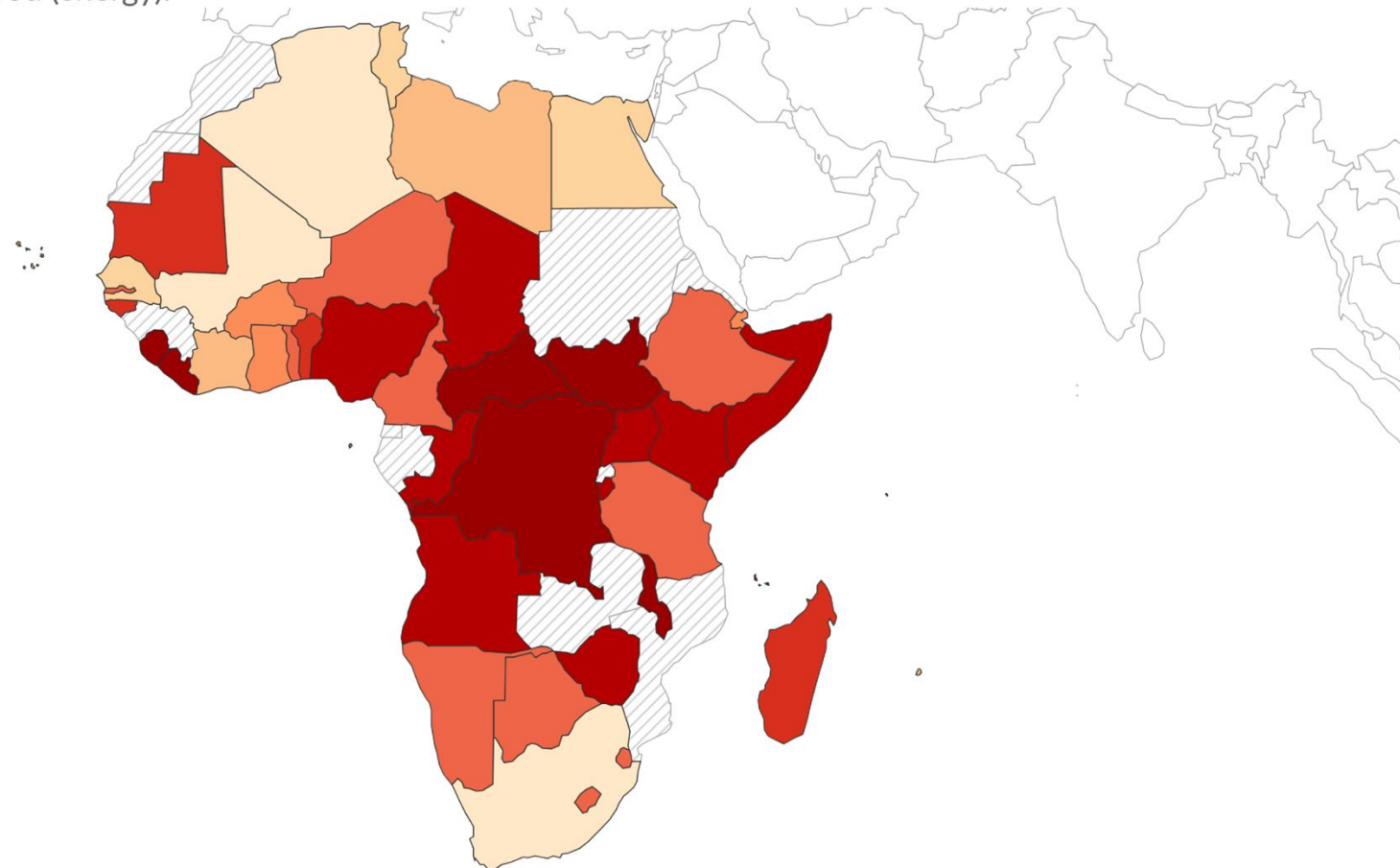
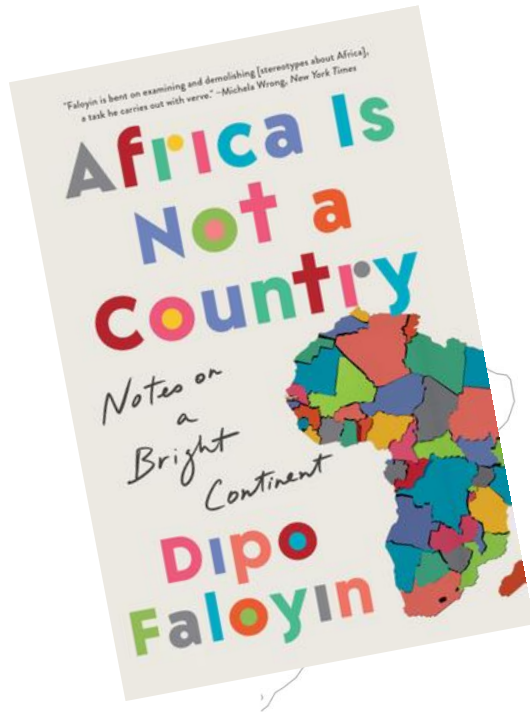
Share of the population that is undernourished

Share of individuals that have a daily food intake that is insufficient to provide the amount of dietary energy required to maintain a normal, active, and healthy life.



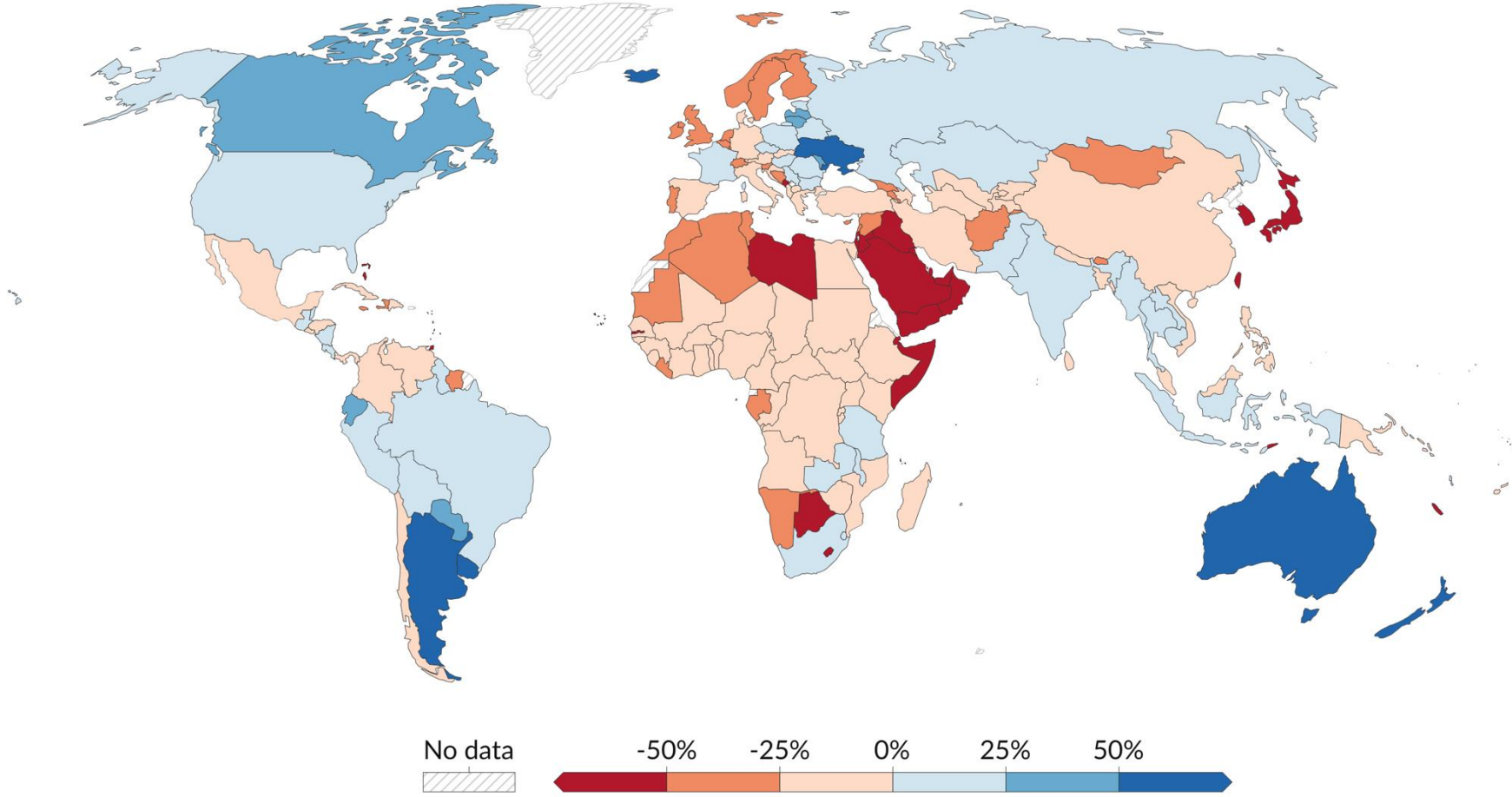
Share of population with moderate or severe food insecurity, 2022

Food insecurity¹ is defined by the Food Insecurity Experience Scale (FIES). Moderate food insecurity is associated with the inability to regularly eat healthy, nutritious diets. Severe food insecurity is more related to insufficient quantity of food (energy).



Net trade of food products as a share of domestic supply, 2022

Net exported tonnes of food products expressed as a share of domestic supply. This includes items primarily intended for human consumption, but some may also be used for non-food purposes such as biofuels or animal feed. Positive values mean that countries are net exporters and negative values mean they are net importers.



How do crop yields affect land use for food production?

South Asia achieved all of its increased food production through higher yields

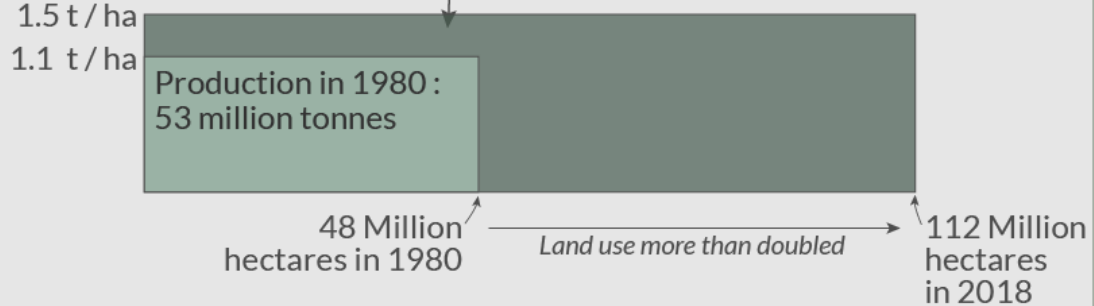
The **height** of the rectangles represents the **cereal yield**
The yield is measured in tonnes per hectare.



The **width** of the rectangles represents the **land used for cereal production**

Sub-Saharan Africa increased food production mostly through the expansion of land

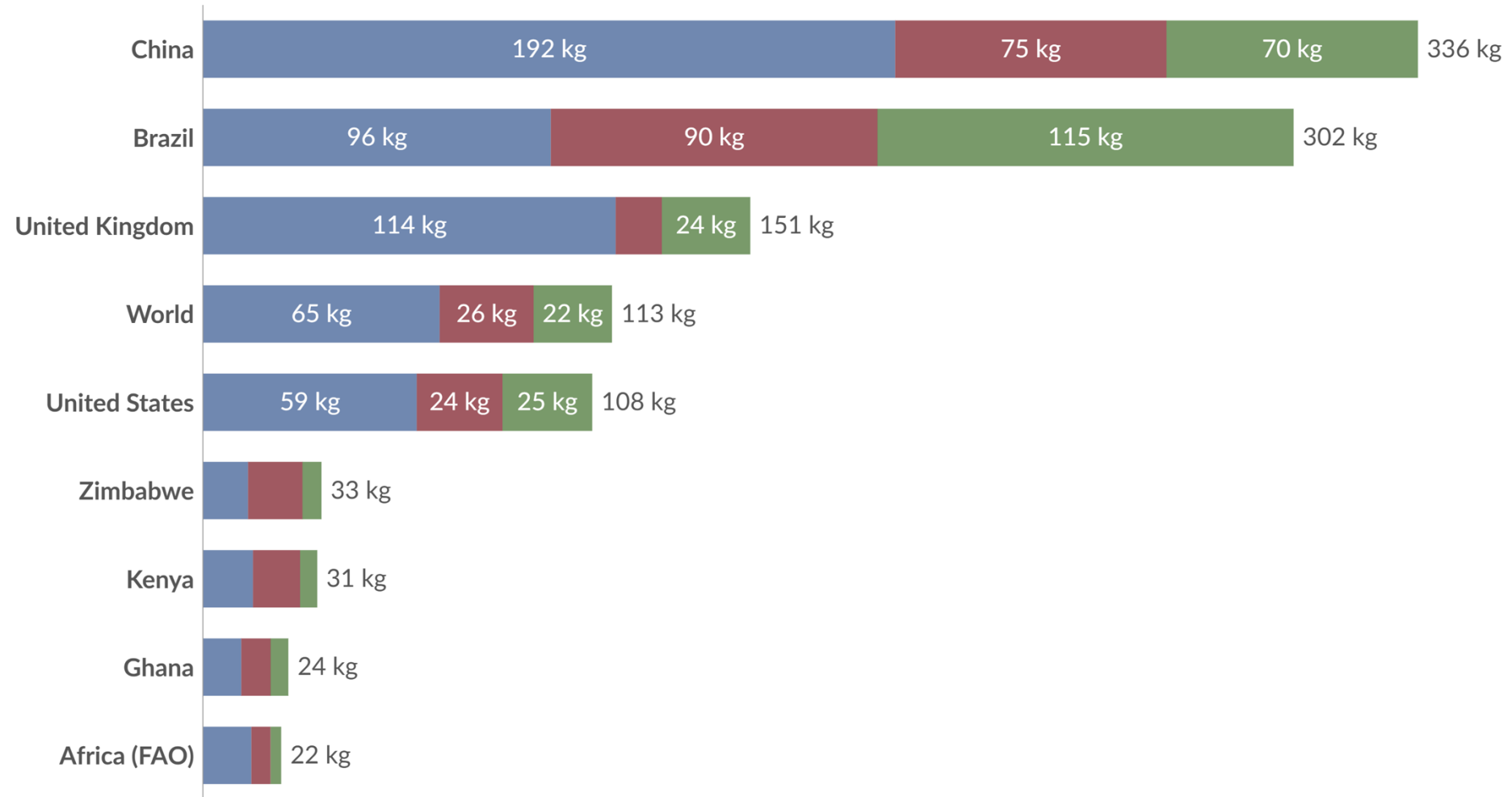
Cereal production in Sub-Saharan Africa in 2018 : 161 million tonnes
(a tripling relative to 1980)



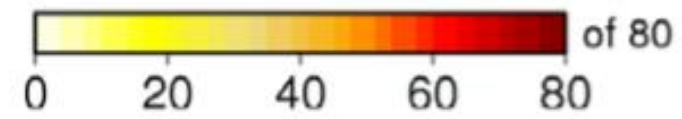
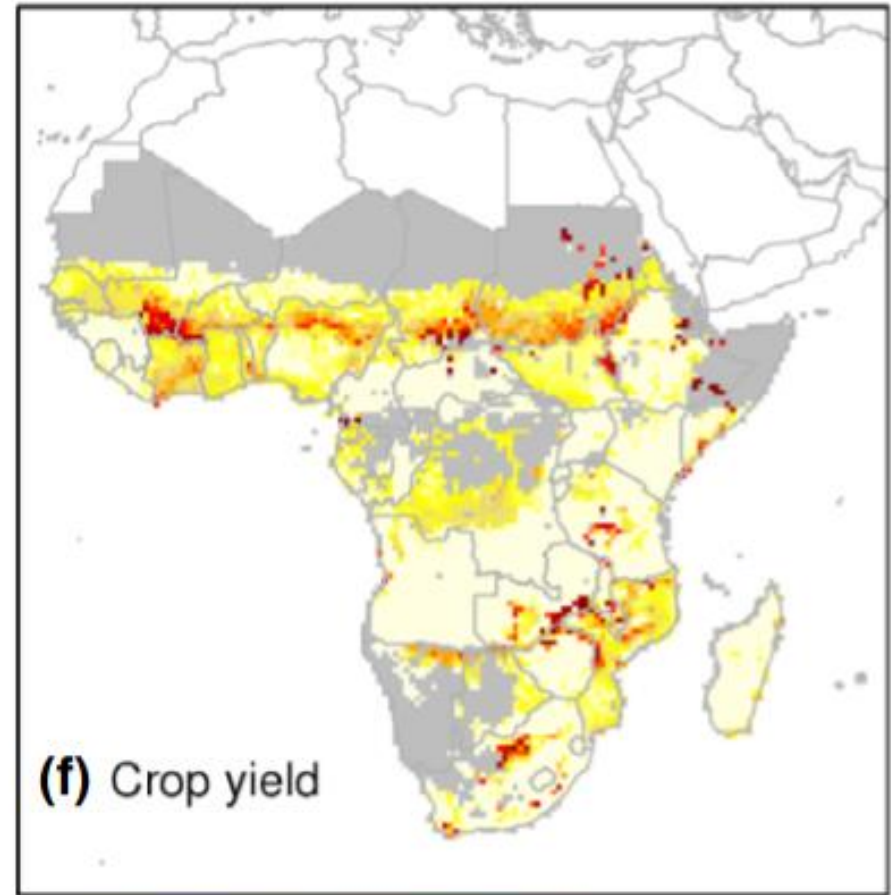
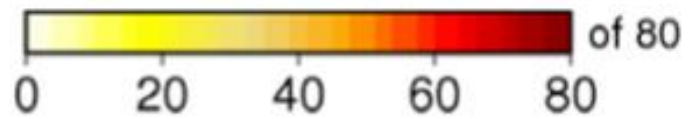
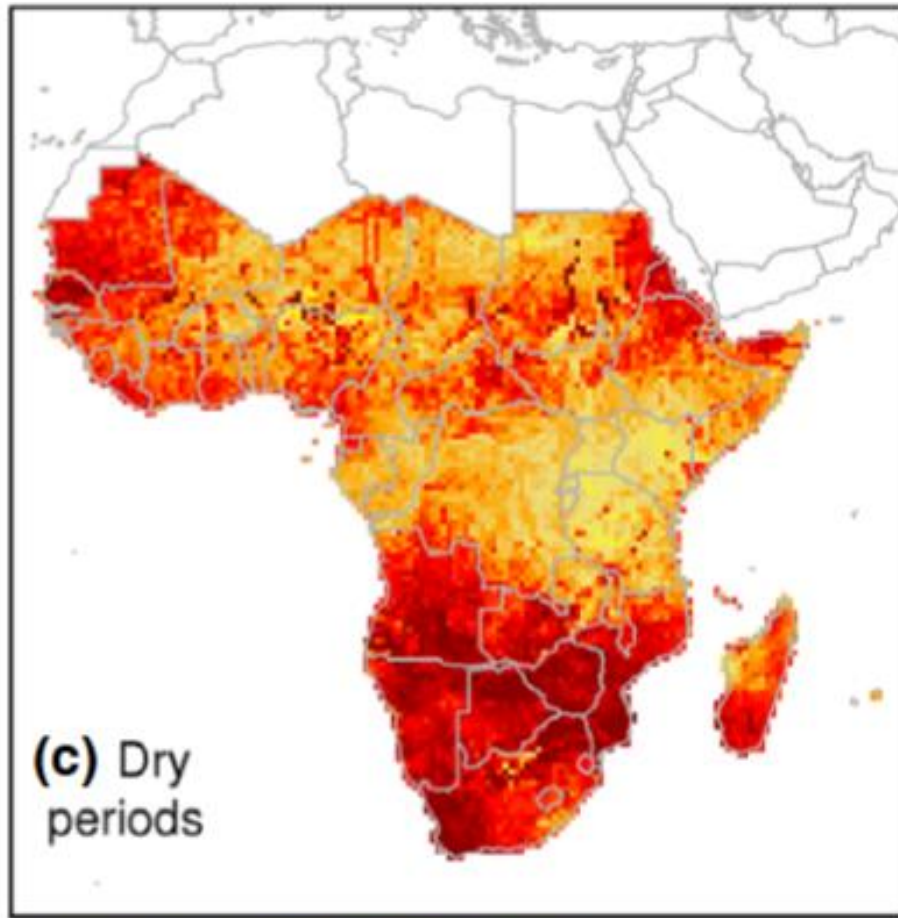
Fertilizer use per hectare of cropland, 2022

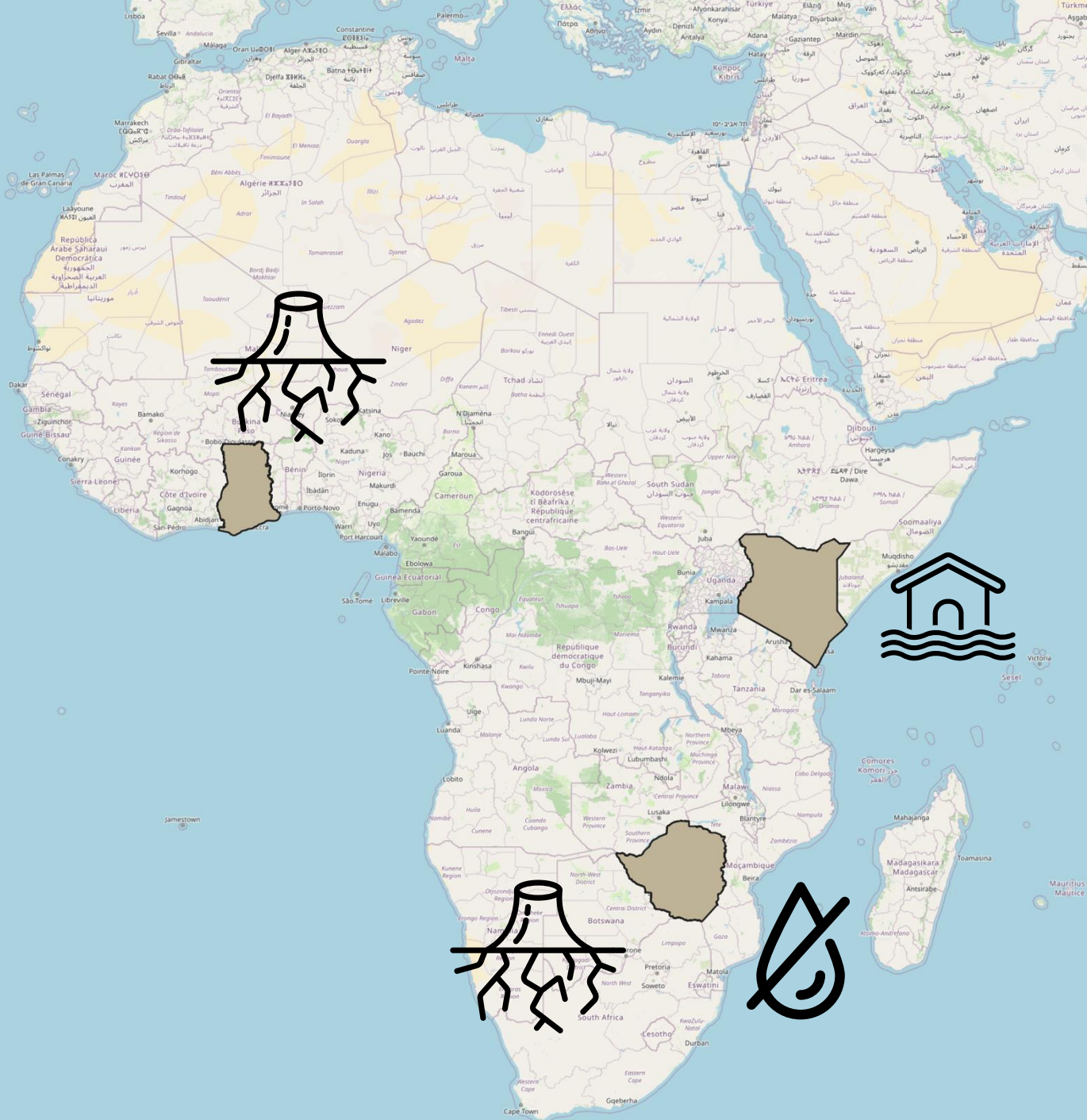
Use of fertilizers per area of cropland, which corresponds to the sum of arable land and permanent crops.

■ Nitrogen ■ Phosphorous ■ Potassium



Climate change impact on food security





Increasing dry periods in Southern and Western Africa

Increased flooding probability in East Africa

Decreased freshwater availability in Southern Africa

Müller, C., Waha, K., Bondeau, A., & Heinke, J. (2014). Hotspots of climate change impacts in sub-Saharan Africa and implications for adaptation and development. *Global Change Biology*, 20(8), 2505–2517.

<https://doi.org/10.1111/gcb.12586>

Climate change impact on food security

Availability

Lower crop yields, reduced water availability, livestock losses

Access

Price volatility, income losses, trade disruptions

Utilization

Reduced nutritional quality and increased foodborne diseases

Stability

More frequent extreme events disrupting food supply and access

Which pillar of food security do you think is most at risk from climate change in your context or region of interest?

A. Availability (Is there enough food produced?)

B. Access (Can people afford or reach the food?)

C. Utilization (Is food nutritious and safe?)

D. Stability (Is food access reliable over time?)

Questions

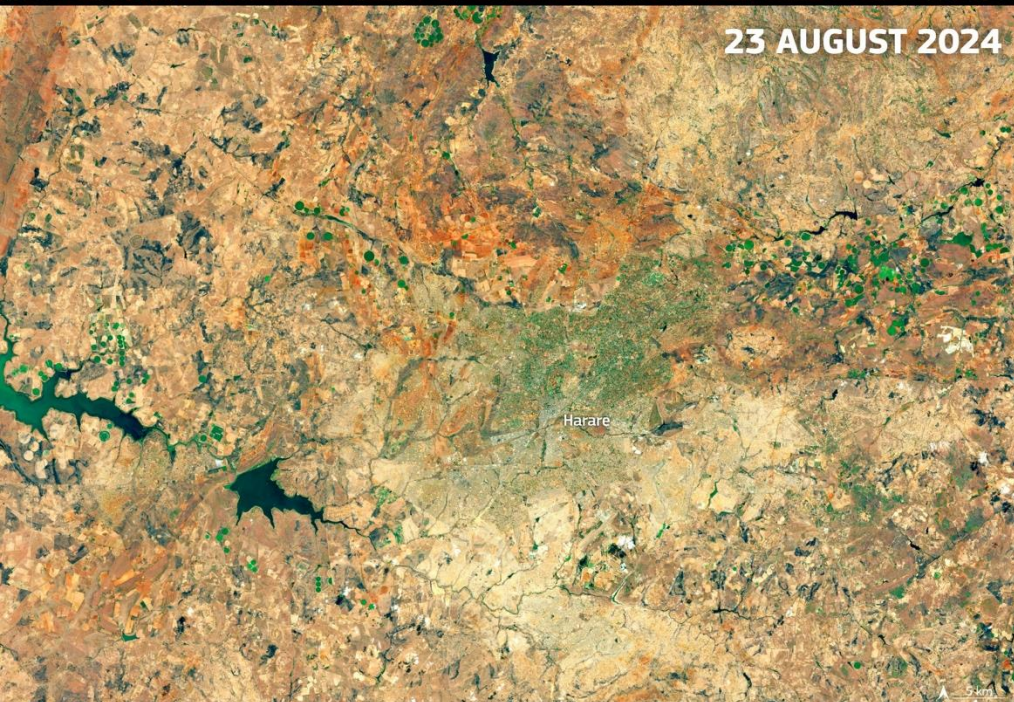


Climate Risks & Food Security

Three case studies



19 AUGUST 2022



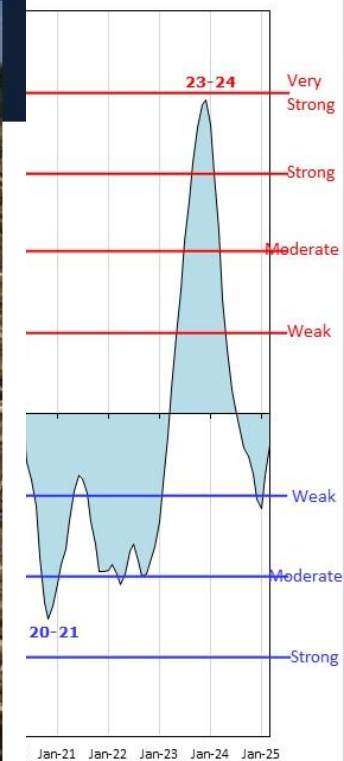
23 AUGUST 2024

CC impact on crops

Zimbabwe example

Zimbabwe declares drought disaster, the latest in a region where El Nino has left millions hungry

“More than 80% of our country received below normal rainfall,” President Emmerson Mnangagwa said in a speech calling for international aid.



In your view, which of the following has the most severe impact on food production in Sub-Saharan Africa?

A. Droughts - reduce yields, dry out soils, kill crops and livestock

B. Floods - destroy crops, erode soils, and damage infrastructure

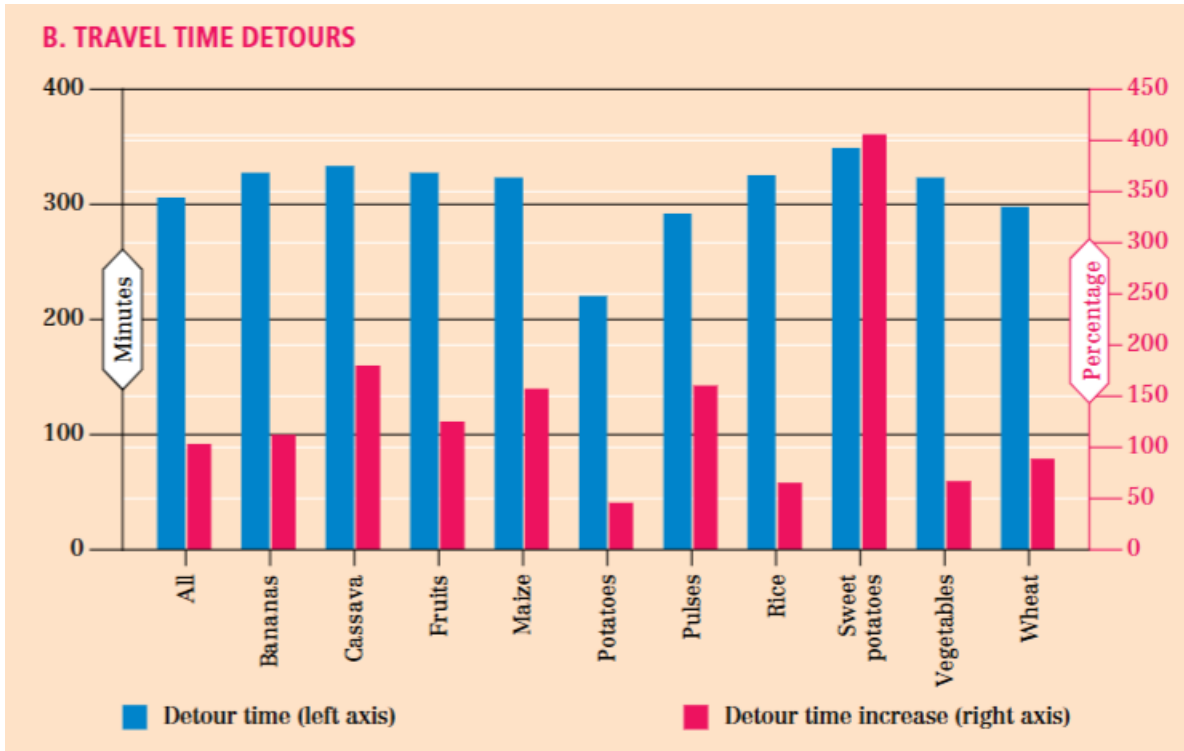
C. Unpredictable seasons - make it harder to plan planting and harvests

D. Pests and diseases - worsened by changing temperatures and humidity

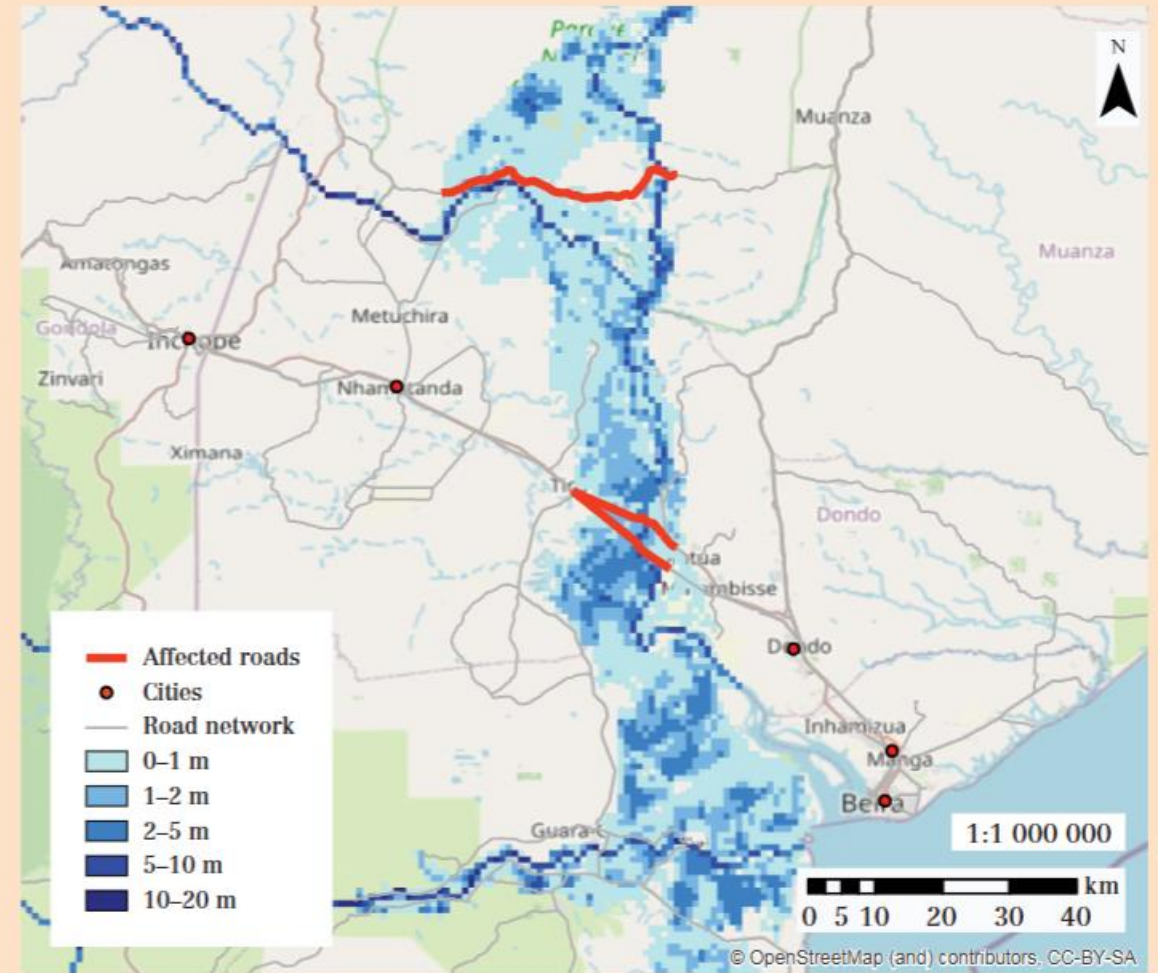
E. Extreme heat - causes crop stress and lowers productivity

Trade disruptions Mozambique case study

Model of 1-in-10-year inundation near the city of Beira

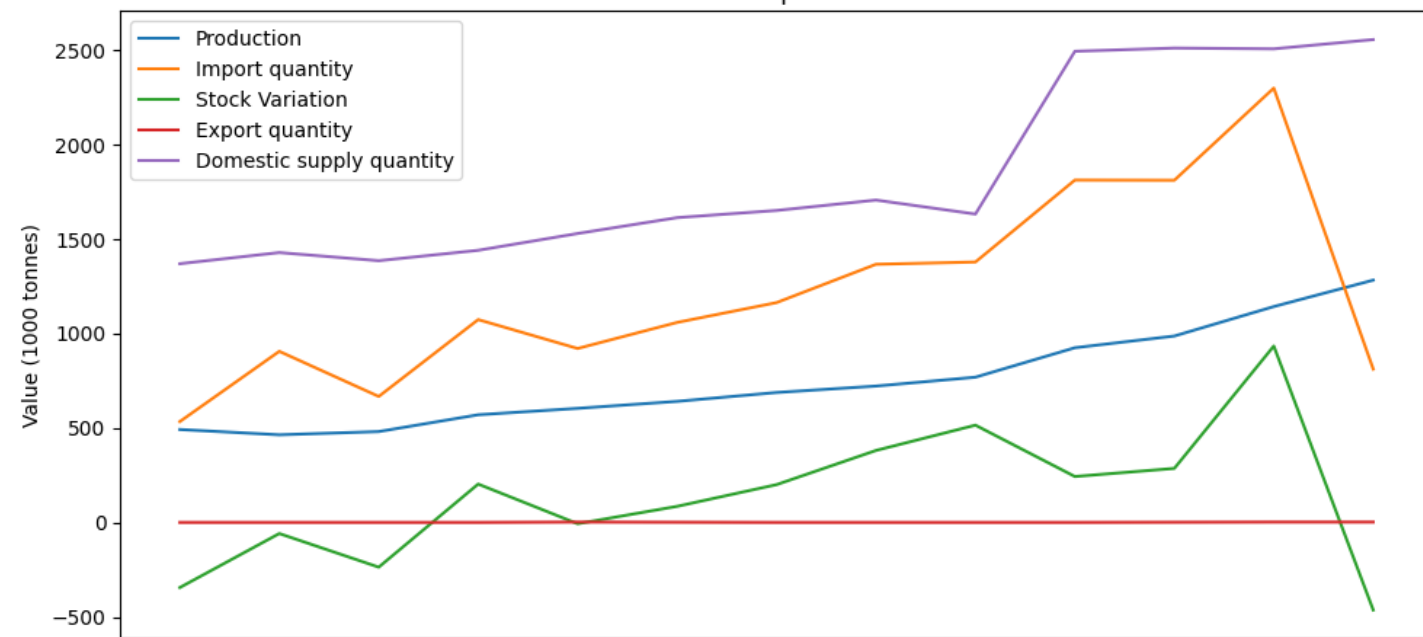


▶ **FIGURE 31** Flood scenario and affected roads in Mozambique

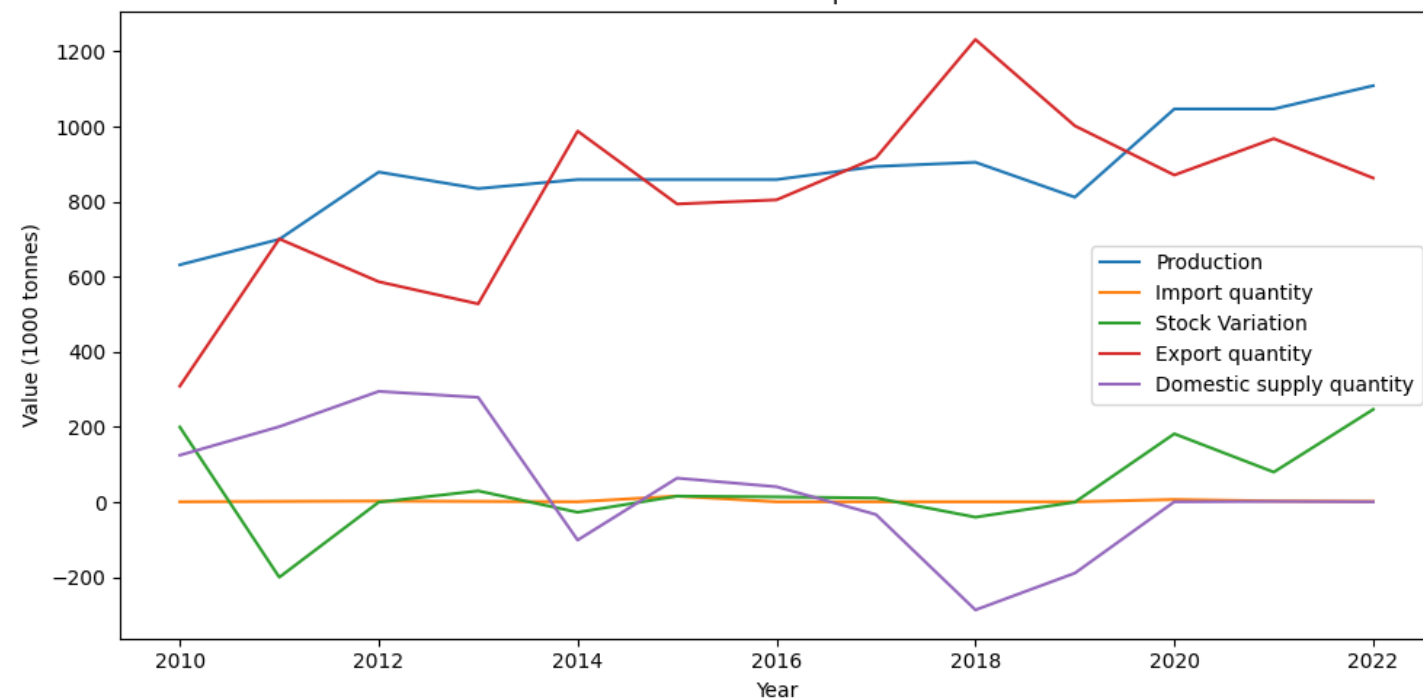


Source: [UN \(2020\)](#) modified by the authors.

Rice and products



Cocoa Beans and products



Food stability - Ghana case study



Which strategy do you believe has the most potential for strengthening food security under climate change?

A. Investing in local food production

B. Expanding social protection

C. Strengthening food supply chains and infrastructure

D. Improving climate information and early warning systems

E. Land tenure and governance reform

Foodshed Information Service



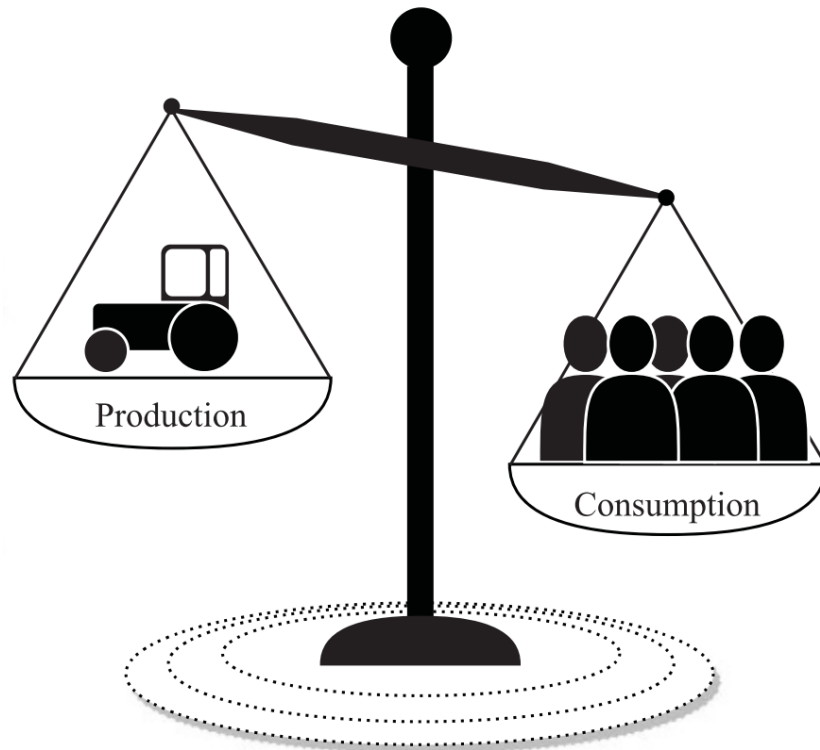
Funded by
the European Union

What is a foodshed?

The geographic area from which a population sources its food

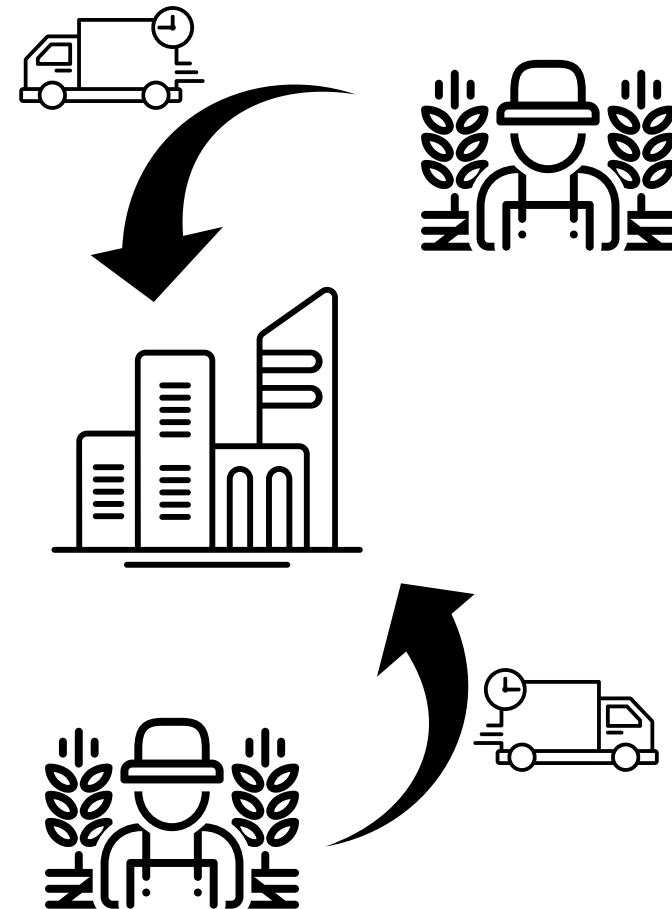
Types of foodshed analysis

Capacity

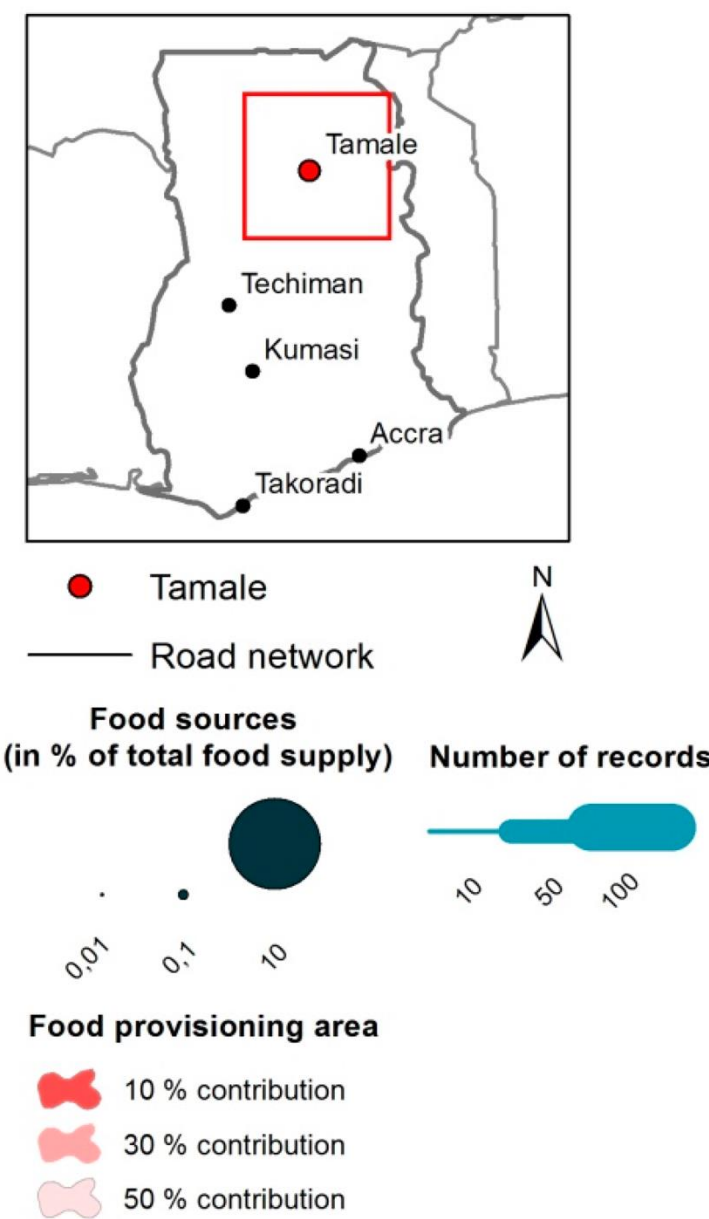
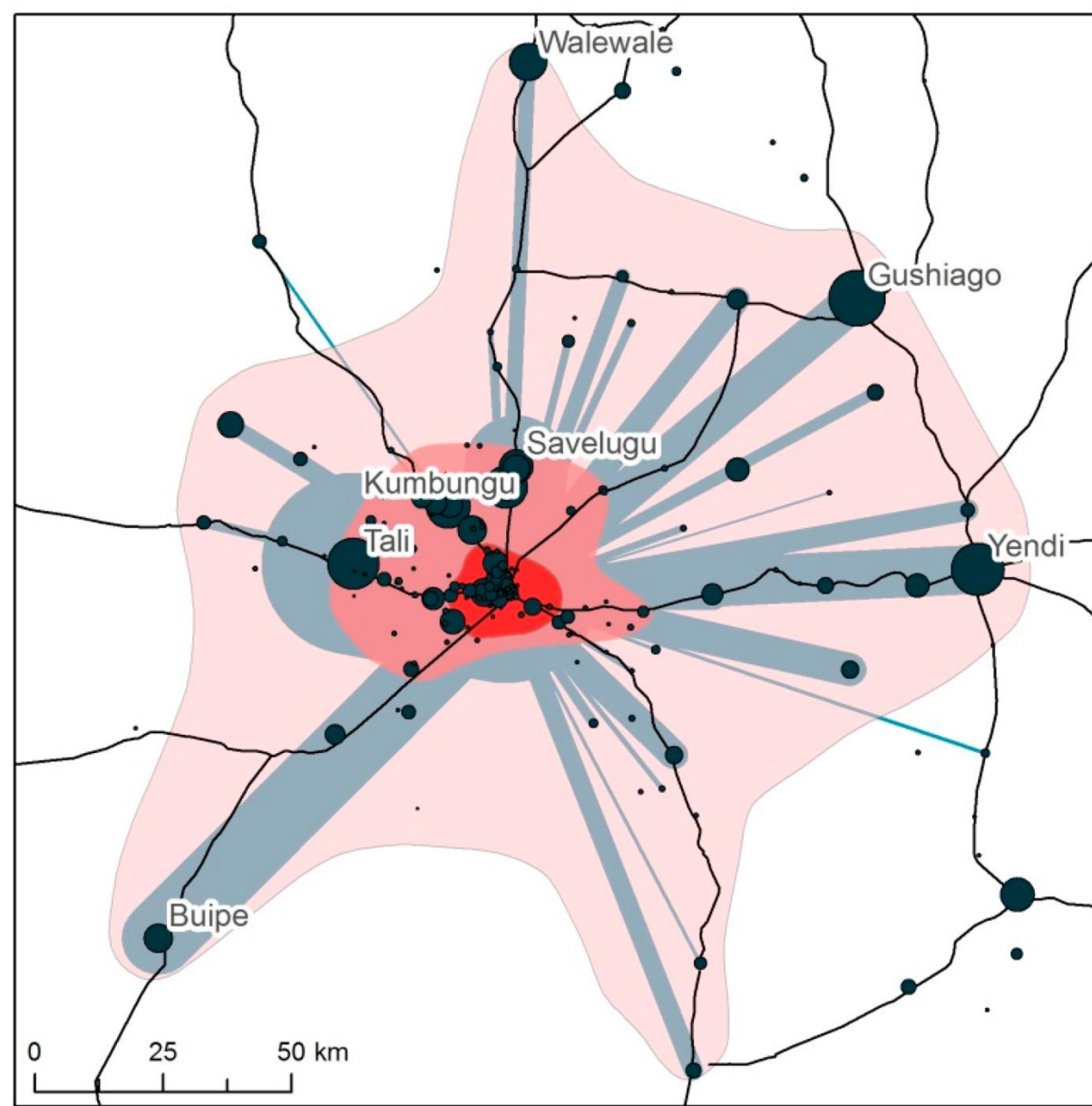


Adapted from Schreiber et al. 2021

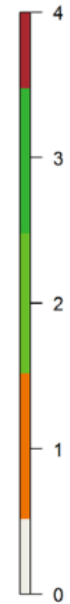
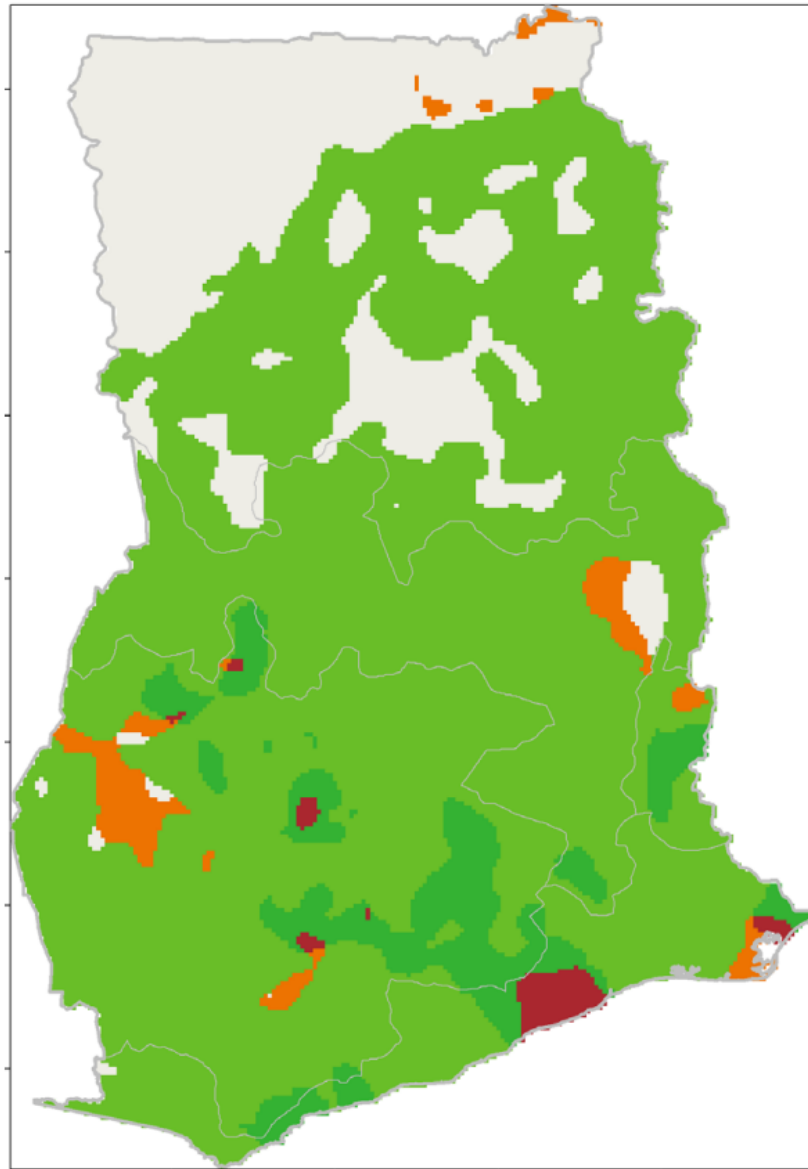
Flow



Flow study example



Capacity study example



4: Red; import due to high demand

3: Dark green; export with high demand (>1.5 ha)

2: Light green; export with demand less than 1.5 ha

1: Orange; import from other areas (demand < supply)

0: Light grey; irrelevant because demand and supply are less than 1.5 ha

Figure 19 Demand and supply of rice comparison at grid cell level in 2030 for the ECO scenario

What do you see as the most useful function of the foodshed approach?

- A. Visualizing food system dependencies and vulnerabilities
- B. Supporting spatial targeting of climate adaptation efforts
- C. Helping policymakers understand local-to-global food flows
- D. Connecting production and consumption for better planning
- E. Not sure yet but looks promising!

Question to reflect

What gaps still exist in our understanding of climate impacts on SSA's food security?

Thanks for your attention!

Ignacio Saldivia Gonzatti

Wageningen University, The Netherlands

E-mail address: ignacio.saldiviagonzatti@wur.nl

Questions





Next session!

Recordings will be posted on:
<https://kenya.safe4allafrica.eu/>

Online via
ZOOM
FOR FREE

ONBOARDING LEARNING PROGRAM

Session 4:

FUNDAMENTALS OF CLIMATE SERVICES

Discover how climate services turn data into actionable insights for better decisions



DATE

July 02, 2025



TIME

9 AM GMT, 11 AM CAT,
12 PM EAT



DURATION

1.5 hours



Climate
Adaptation
Services





SAFE4ALL
A F R I C A

Have a great day!