

19th June 2024

9:30 - 11:00

15:00 - 16:30



## WHO Technical Webinar Series



https://www.who.int/teams/environme nt-climate-change-andhealth/climate-change-andhealth/country-support/webinars



Date & time (CEST)	Topic*
24 <sup>th</sup> April 2024	Getting started: climate change and health vulnerability & adaptation assessments
30 <sup>th</sup> April 2024	WHO as an Accredited Implementing Entity of the Adaptation Fund; Accessing AF funding for Climate Change and Health
15 <sup>th</sup> May 2024	WHO Operational Framework for building climate resilient and low carbon health systems
12 <sup>th</sup> June 2024	Developing a Health National Adaptation Plan: Introduction
19 <sup>th</sup> June 2024	GIS and risk mapping in climate change and health vulnerability & adaptation assessments
10 <sup>th</sup> July 2024	Climate resilient and environmentally sustainable health care facilities
17 <sup>th</sup> July 2024	Quantitative approaches for Vulnerability & Adaptation assessments: sensitivity analyses and projecting future health risks of climate change
18 <sup>th</sup> Sept 2024	Integrating health in NDCs and LT-LEDS
25 <sup>th</sup> Sept 2024	Developing a Health National Adaptation Plan: Quality criteria for HNAPs
16 <sup>th</sup> Oct 2024	Conducting a gender analysis for climate change and health vulnerability & adaptation assessments



**AM session: French and Arabic PM session: French and Spanish** 



# To activate interpretations (in English):

- Click on the interpretation icon.
- 2. Select "English"
- **3. Optional :** mute original audio

# Pour activer les interprétations (en français):

- Cliquez sur l'icône d'interpretation
- 2. Sélectionnez "Français"
- 3. Facultatif: couper le son d'origine

# Para activar interpretación (en español)

- Haga clic en el icono de interpretación.
- 2. Seleccionar "Español"
- 3. Opcional: silenciar el audio original

لتفعيل التفاسير باللغة العربية

- اضغط على أيقونة . 1 التفسير.
  - اختر "العربية" 2.
  - اختياري: كتم .3. الصوت الأصلي



Time	Agenda item	Speaker
9:30 - 9:35	Welcome & housekeeping	Dr Amy Savage,
		Technical Officer, Climate Change
		and Health Unit, WHO
9:35 - 9:50	Opening & setting the scene	Dr Diarmid Campbell-Lendrum,
		Head, Climate Change and
		Health Unit, WHO
9:50 - 10:20	Introduction to GIS and Risk Mapping in V&As	Dr James Chirombo,
		Biostatistician, Malawi Liverpool
		Wellcome Programme
10:20 - 10:35	Climate and Health Emergency Virtual Space	Samuel Omara, GIS Specialist-
		Project Facilitator
		GIS Centre for Health, WHO
	Country experience with spatial analysis in a	David Ogier, Climate Change,
	CCH V&A: Nigeria	Disaster Risk and GIS Consultant
10:35 – 10:55	Discussion and Q&A	Dr James Chirombo
10:55 – 11:00	Close webinar	<b>Dr Amy Savage</b> , WHO



Time	Agenda item	Speaker
<b>15:00 – 15:05</b>	Welcome & housekeeping	<b>Dr Amy Savage</b> Technical Officer, Climate Change and Health Unit, WHO
15:05 – 15:20	Opening & setting the scene	<b>Dr Diarmid Campbell-Lendrum</b> , Head, Climate Change and Health Unit, WHO
<b>15:20 – 15:50</b>	Introduction to GIS and Risk Mapping in V&As	<b>Dr James Chirombo</b> , Biostatistician, Malawi Liverpool Wellcome Programme
15:50 – 16:05	Climate and Health Emergency Virtual Space	Samuel Omara, GIS Specialist- Project Facilitator GIS Centre for Health, WHO
	Country experience with spatial analysis in a CCH V&A: Cote d'Ivoire	<b>Dr Yao Etienne Kouakou</b> , Researcher, Swiss Center for Scientific Research, Côte d'Ivoire
16:05 – 16:25	Discussion and Q&A	Dr James Chirombo
16:25 - 16:30	Close webinar	Dr Amy Savage, WHO



# Geographical information in climate change vulnerability and adaptation assessments

Dr Diarmid Campbell-Lendrum
Unit Head
Climate Change and Health Unit, WHO

### A geographically determined health description well before GIS

Whoever wishes to investigate medicine properly, should proceed thus...

...when one comes into a city to which he is a stranger, he ought to consider its situation, how it lies as to the winds and the rising of the sun; for its influence is not the same whether it lies to the north or the south, to the rising or to the setting sun. ...

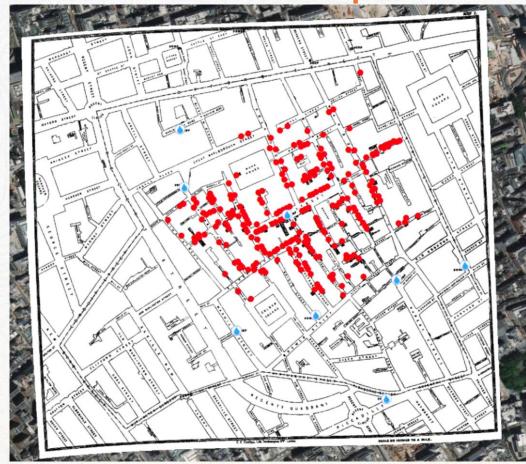
...and the ground, whether it be naked and deficient in water, or wooded and wellwatered, and whether it lies in a hollow, confined situation, or is elevated and cold

Hippocrates, On Airs, Waters, and Places

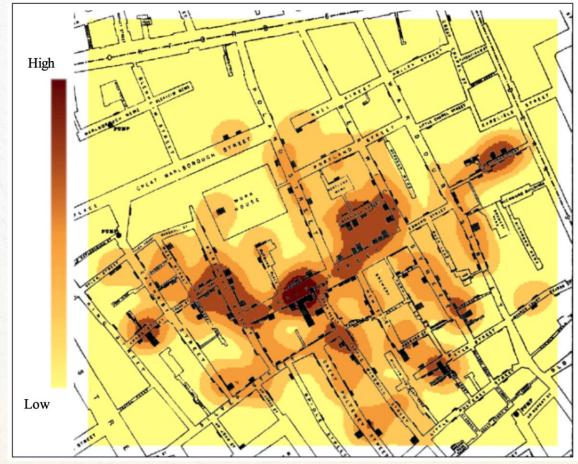


https://www.pica-ai.com/ai-image-generator-from-text/

### A more recent example: John Snow's map converted to GIS



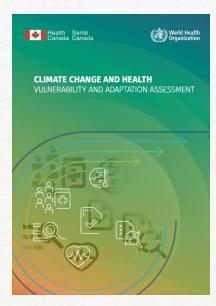
John Snow's map georeferenced on a modern satellite image. Each point records the number of casualties for a specific address



Kernel Density map created from the weighted layer of the casualties. The highest class of values can be seen in the surroundings of the Broad Street pump.

### GIS in V&A assessments

"A geographical perspective and the use of geographical information systems (GIS) offer opportunities to show current distributions of, for example, vulnerable populations and the spatial relationship to disease vectors, river basins prone to flooding, health care facilities, and other important variables of interest to public health officials".



### V&A Steps where GIS is particularly useful

### Step 2: Vulnerability assessment

**Step 2C** Identify trends in upstream drivers of climate-sensitive health outcomes and the geographical distribution of risks.

Step 2D Identify vulnerable populations and geographical regions.

**Step 2E** Document baseline information for monitoring changes in future vulnerability and evaluating adaptation options.

"Spatial mapping is a valuable approach for describing the geographical distribution of current or projected future vulnerabilities and hazards. A geographical perspective can integrate, visualize and analyse health and environmental data used or produced during the assessment. Maps also serve as important communication tools for explaining assessment results".

### V&A Steps where GIS or basic mapping can also be useful

### Step 1: Getting started

Step 1C define the health risks, outcomes, geographical region and time period that will be the focus of the assessment.

### Step 3: Capacity assessment

Step 3B Assess the current capacity of the health systems to address the risks of climate sensitive health outcomes

### Step 4: Future risk assessment

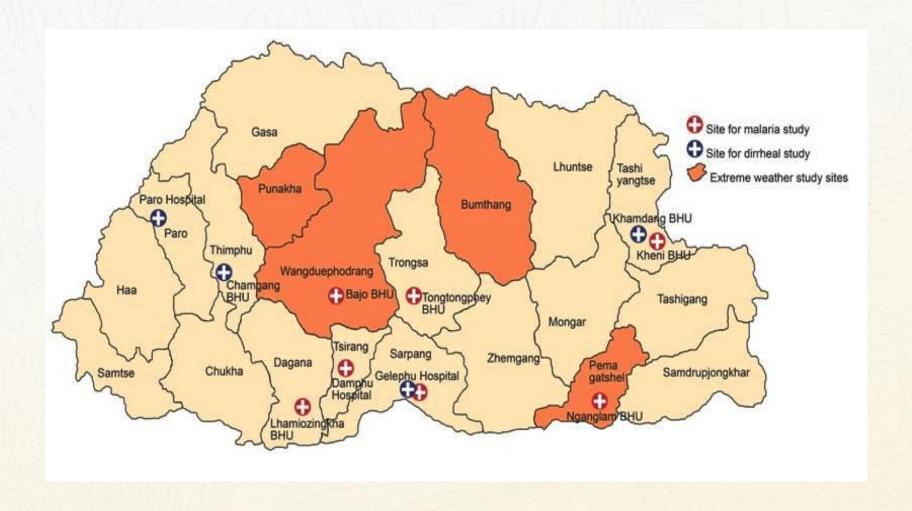
Step 4A Describe how current health risks could change under diverse scenarios of climate change and development.





# **Step 1**Defining the study area:

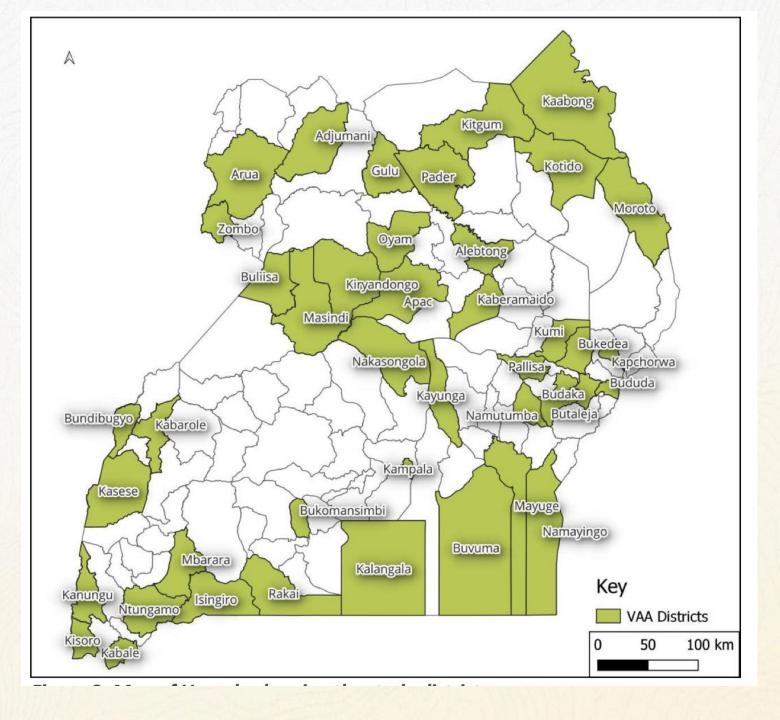
The V&A team identified sites to assessing diarrhoeal diseases, malaria, and for extreme weather events



# **Examples of GIS used in V&A assessments: Uganda**

**Step 1**Defining the study area:

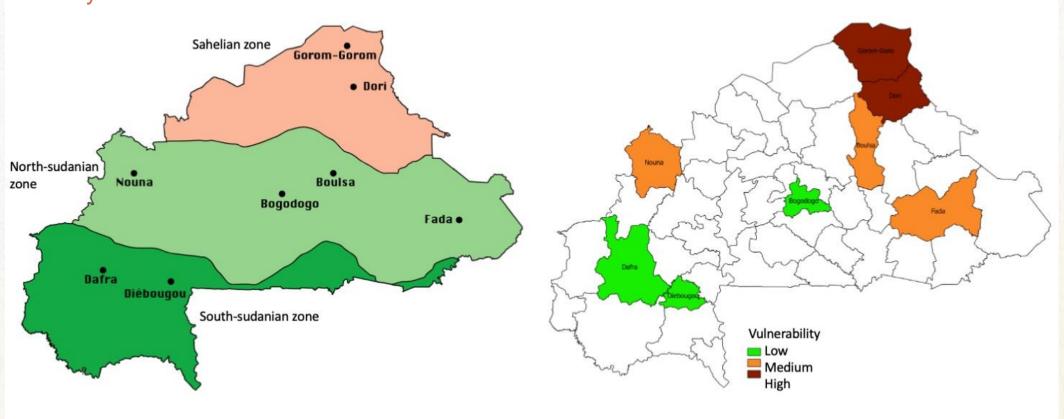
Districts were selected based on past occurrence of health hazards including droughts, storms, floods and extreme temperatures



### **Examples of GIS used in V&A assessments: Burkina Faso**

Step 1

Defining the study area

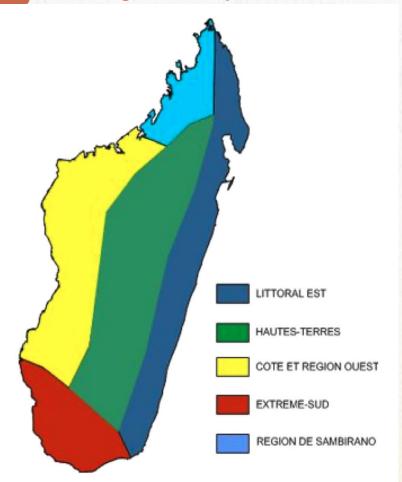


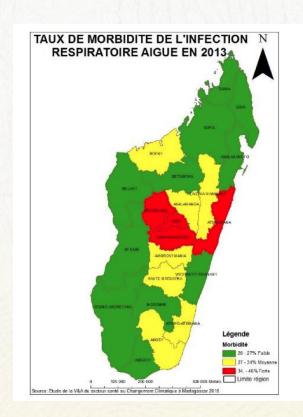
- Three climatic zones (Sahelian, North-sudanian and south sudanian).
- Data collected in 8 health districts.
- Three climate-sensitive diseases: malaria, respiratory diseases, and diarrhoea, with special focus on meningitis.
- Vulnerability levels by health district is shown to be partly determined by the climatic zones, with the two districts with high vulnerability located in the dry, Sahelian zone.

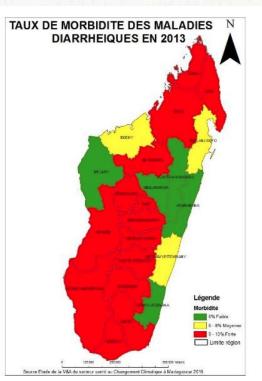
### **Examples of GIS used in V&A assessments: Madagascar**

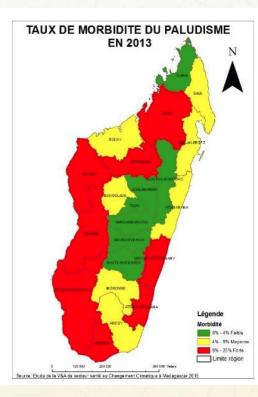
Step 1

Defining the study area







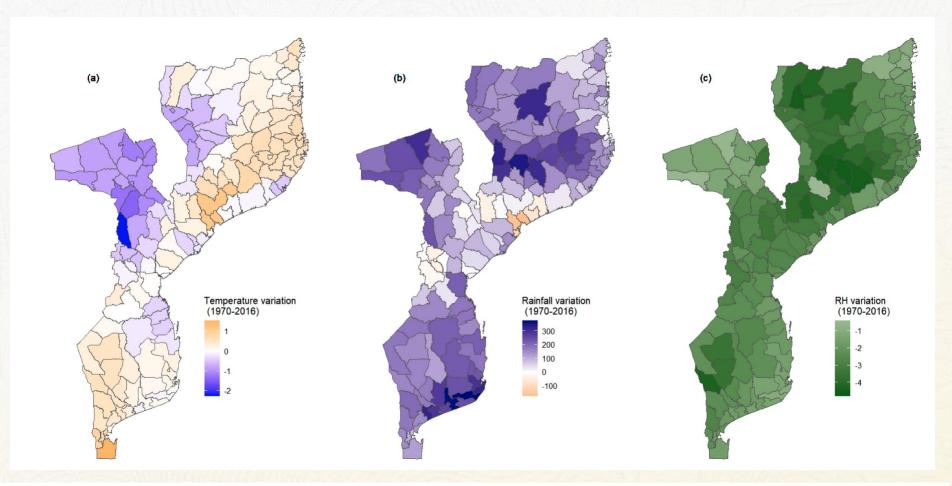


5 climatic zones

Acute respiratory infections, diarrhoeal diseases and malaria

### **Examples of GIS used in V&A assessments: Mozambique**

Step 2: Vulnerability assessment Identify trends in upstream drivers of climate-sensitive health outcomes and the geographical distribution of risks.



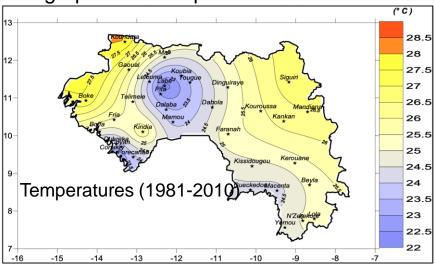
Spatial distribution of temperature variation (a); spatial distribution of rainfall variation (b); and Spatial distribution of relative humidity variation (c), for 1979 - 2016.

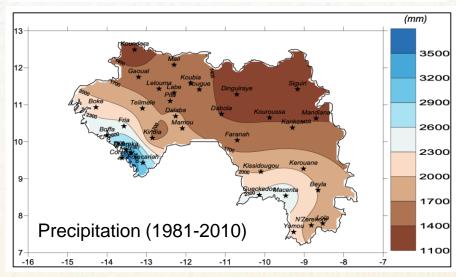
# Examples of GIS used in V&A assessments: Guinea

Step 2

Identify vulnerable populations and geographical regions.

### Geographical description of climatic variables





# Health sector vulnerability (top) and Malaria (bottom) for the study regions

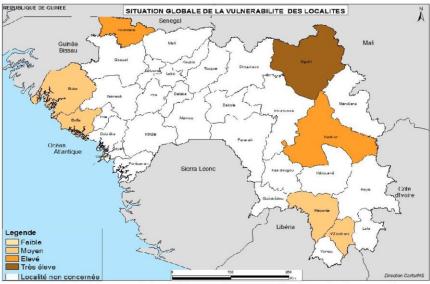


Figure 37. Vulnérabilité du secteur de la santé face aux changements climatiques dans les zones cibles

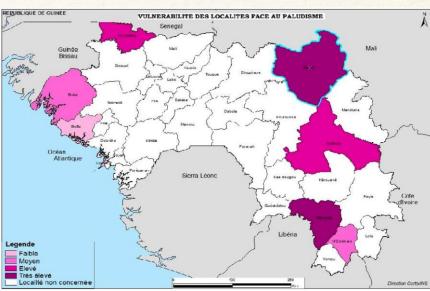
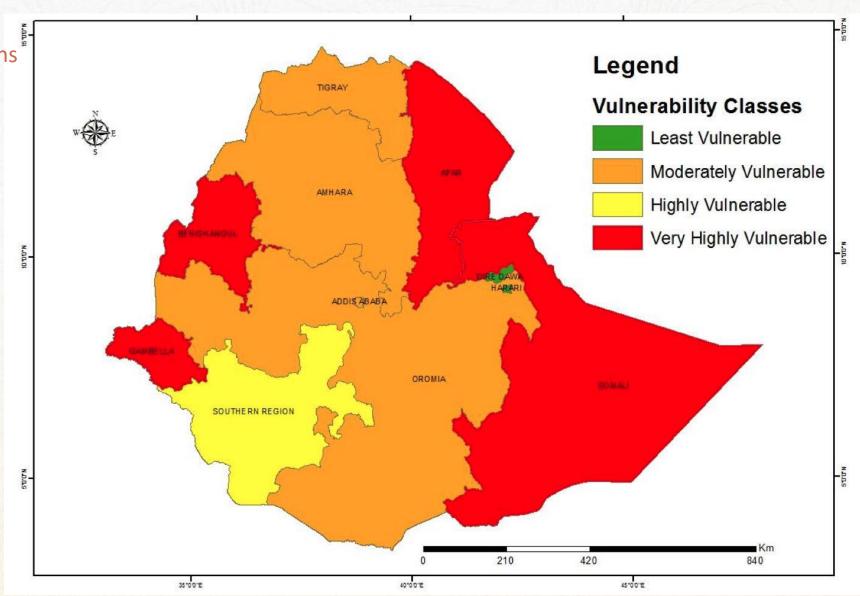


Figure 38. Vulnérabilité face au Paludisme dans les zones cibles

### **Examples of GIS used in V&A assessments: Ethiopia**

Step 2
Identify vulnerable populations and geographical regions.

By combining regional data on exposure, sensitivity and adaptive capacity, the V&A calculated a health vulnerability index. The map shows the HVI by Region



### **Examples of GIS used in V&A assessments: Liberia**

**Step 2**Identify vulnerable populations and geographical regions.

Overall vulnerability was determined as a function of sensitivity to climate change related health risks and its capacity for responding to climate variability and change

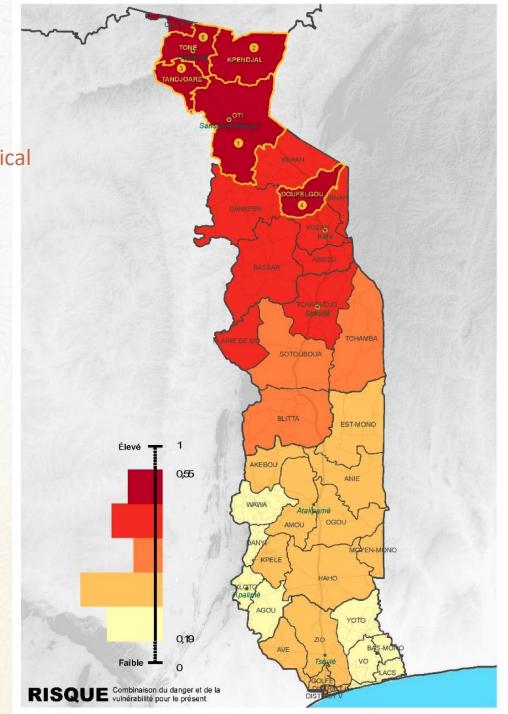


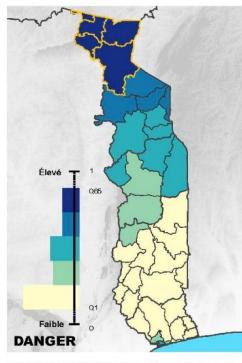
# **Examples of GIS used in V&A assessments: Togo**

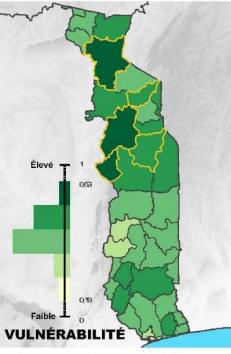
Step 2

Identify vulnerable populations and geographical regions.

Hazards, vulnerability and risk of respiratory infections



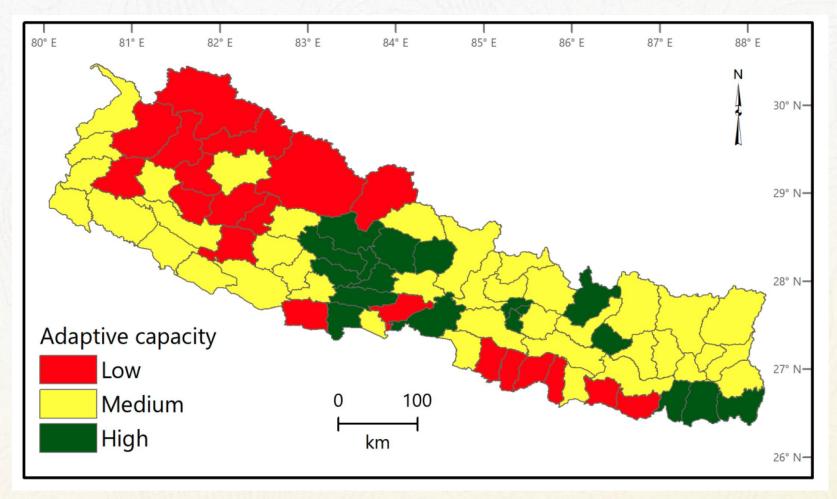




### **Examples of GIS used in V&A assessments: Nepal**

Step 3: Capacity assessment

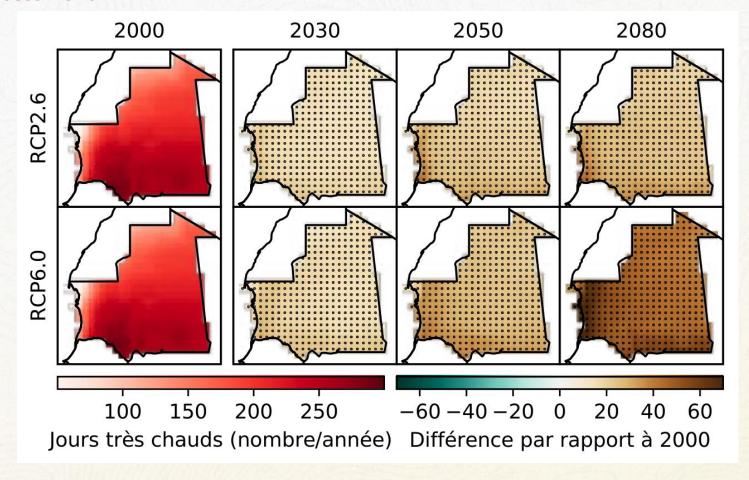
Assess the current capacity of the health systems to address the risks of climate sensitive health outcomes



The adaptive capacity score included indicators on human capacity (education, availability of resources, availability of health facilities and institutions, livelihoods, and access to information and technology

# **Examples of GIS used in V&A assessments: Mauritania Step 4**

Future risk assessment



Projections du nombre annuel de journées très chaudes (température maximale quotidienne supérieure à 35 °C) en Mauritanie pour différents scénarios d'émissions de GES.

### In summary, GIS and mapping are used in V&As to:

- Identify study areas
- Mapping of hazards, exposures and vulnerabilities
- Data analysis (e.g. geographical correlations)
- Understand trends (e.g., forecasting future risks)
- Display complex information in a simple visual form
- Communication and advocacy
- Decision making

Not all V&As used mapping or GIS. Those that used, were mostly for geographical display of base data or results, not for geographical data analyses.

# THANK YOU!

**Environment, Climate Change and Health** 

https://www.who.int/teams/environment-climate-changeand-health

### **Climate Change**

https://www.who.int/teams/environment-climate-changeand-health/climate-change-and-health

Email: healthclimate@who.int





# Introduction to GIS and Risk Mapping in V&As

James Chirombo Malawi Liverpool Wellcome Programme

19 June 2024

# **Objectives**

- To understand terminology associated with spatial data and mapping.
- To enable participants to find spatial data from different sources.
- To provide an overview of mapping using QGIS.

# Introduction

- Spatial data is simply data that is associated with a geographical location.
- Could be recorded with its coordinates, e.g. latitude and longitude.
- GIS is a computer system designed for spatial data, allowing users to:
  - Visualize spatial data
  - Create spatial data files (e.g. transfer data from a spreadsheet to a map)
  - Analyse spatial data

# **GIS** software

- Quantum GIS (QGIS), ArcGIS, etc.
- We'll introduce QGIS



# **GIS** software

Quantum GIS (QGIS), ArcGIS, etc.

We'll use QGIS



- Open source (freely available) desktop GIS
- · Base functions, plus additional plug-ins to extend its capabilities.

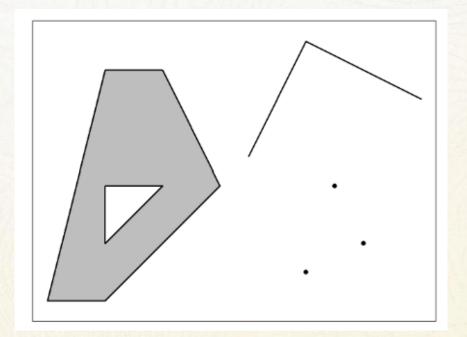
# Types of spatial data

Spatial data represented using

- 1. Vector data
- 2. Raster data

# **Vector data**

- Vector data
  - For displaying points, lines and polygons
  - For example, household locations, administrative boundaries, rivers etc.



# Working with vector data

- Vector commonly stored in a file format known as shapefile.
- Note that a shapefile is made up of several related files. You need all of them
- Other file formats exist such as geopackage and geoJSON

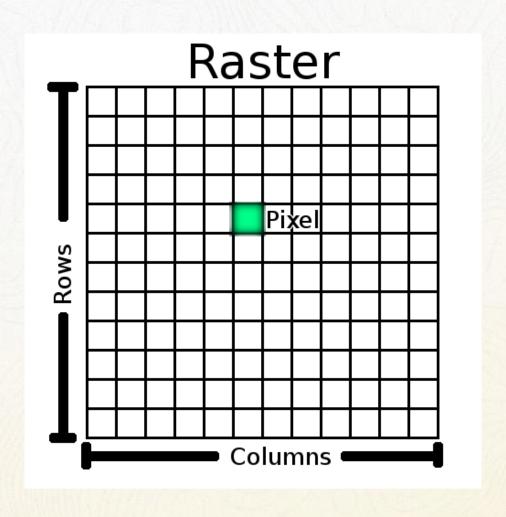
### **IMPORTANT**

Shapefile files need three auxiliary file extensions to function as a layer in GIS software. If these extensions are not together in the same folder, the layer will not display in the mapping canvas.

The **mandatory** extensions are .*shp* (stores the geometry), .*shx* (index position) and .*dbf* (standard database containing the attribute table).

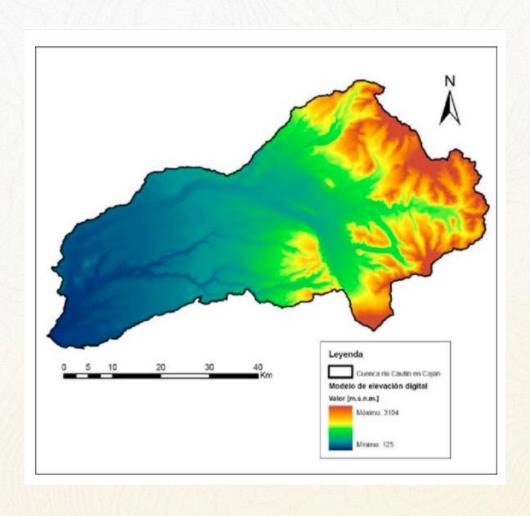
The .prj extension is not mandatory, but including it is strongly recommended as it contains coordinate system information.

- Also known as grid data.
- Raster data are made up of a matrix of pixels (cells).
- Each pixel contains a value that represents the condition for the area the cell covers.
- Raster data used for displaying information that is continuous over space.



Raster data is obtained mostly in two ways.

- Satellite imagery
- Aerial photography
- The process of capturing raster data using aerial/satellite is known as remote sensing.
- The size of the cells/pixes determines the spatial resolution.



# Global positioning system (GPS)

- There is a vast amount of freely available vector and raster data online.
   You will need to assign geographical coordinates to your own data.
- During data collection Use GPS receiver to record coordinates.
- After data collection Assign coordinates to your data using physical maps, e.g. Google maps.

## Sources of spatial data

### Some sources include:

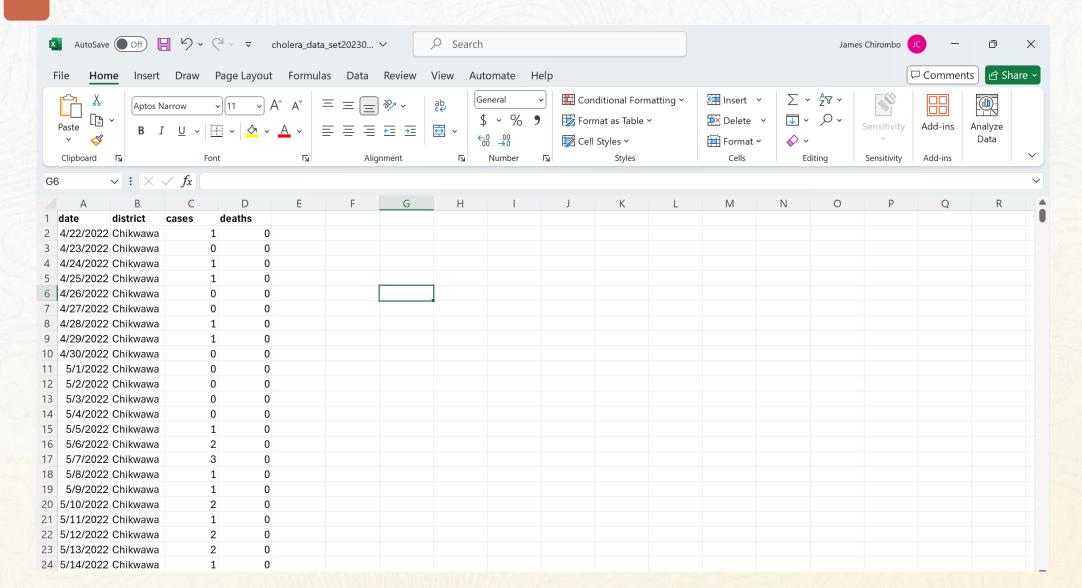
- Humanitarian data exchange <a href="https://data.humdata.org/">https://data.humdata.org/</a>
- Administrative boundaries <a href="https://gadm.org/data.html">https://gadm.org/data.html</a>
- Climate data <a href="https://worldclim.org/">https://worldclim.org/</a>
- Population data <a href="https://www.worldpop.org/">https://www.worldpop.org/</a>

## Mapping cholera in Malawi

## Cholera

- Recent cholera outbreaks in Malawi.
- To show spatial heterogeneities in cholera cases and deaths.
- Can we show any seasonality patterns.
- Cholera case data from the Public Health Institute of Malawi.

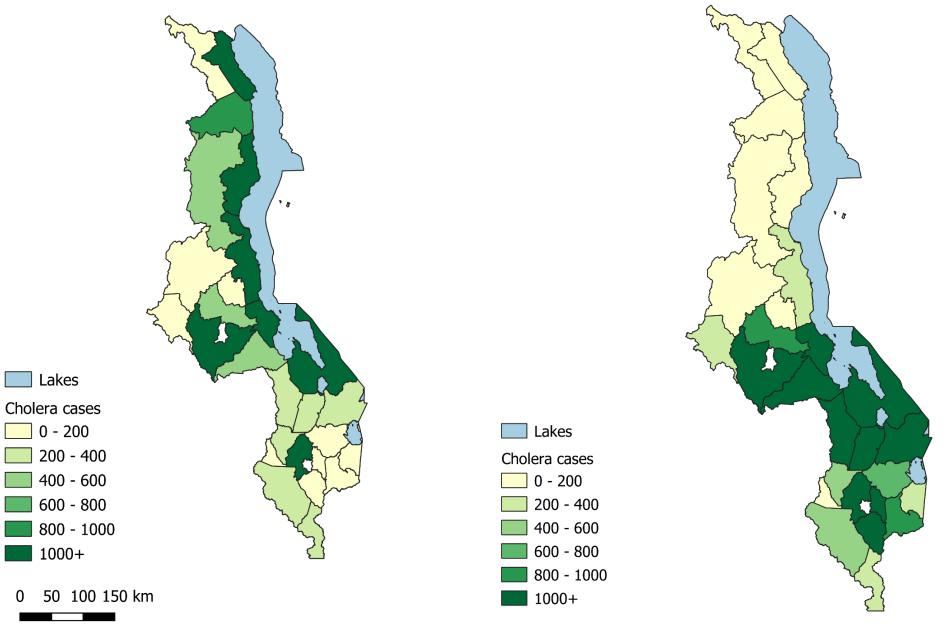
### **Data overview**



## Data processing

- Aggregate the data at the district level.
- This can be easily done in a spreadsheet application such as Excel or a statistical programme such as R.
- After this step, data exported to QGIS and merged with the spatial data (Malawi districts in this case).

## Cholera cases - 2022



Cholera cases - 2023

# Cholera deaths -Cholera deaths 20 - 40

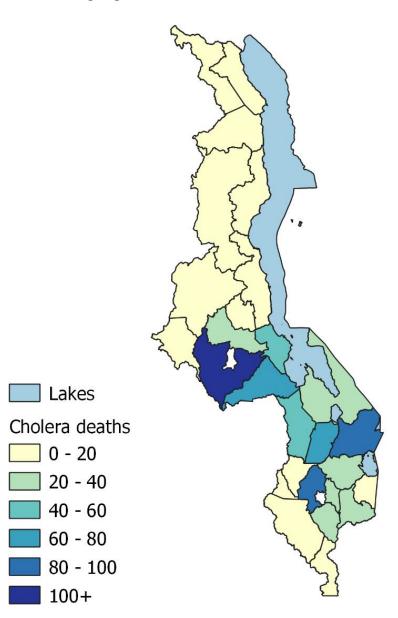
Lakes

0 - 20

60 - 80

80 - 100 100+

### Cholera deaths -2023



### Conclusion

- GIS can help visualise trends in disease outcomes.
- There is a need for spatial data to allow risk mapping.
- Risk mapping provides valuable tools for public health agencies.

# Climate & Health in Emergencies Virtual Space (CHEVS)

Collaborative effort by Readiness Assessment and Prioritization HQ/CRS and GIS Centre for Health/ HQ DDI Units



Name of Project:

Climate & Health in Emergencies

Presented By:

Samuel OMARA

Presented To:

Climate and Health V&A

### **Presentation Outline**

- CHEVS Working group activities e.g. Flood Risk Vul. Analysis
  - Health Services Geographical Accessibility Disruption
  - Potential sites for Relocation/Setting temporary Health Services for Partners
- CHEVS Global Platform

## Overview of the 2023 El Niño climate pattern and its primary health effects

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. The regions and seasons shown on the map below indicate typical but not guaranteed impacts of El Niño.



### Public Health Situation Analysis

### El Niño

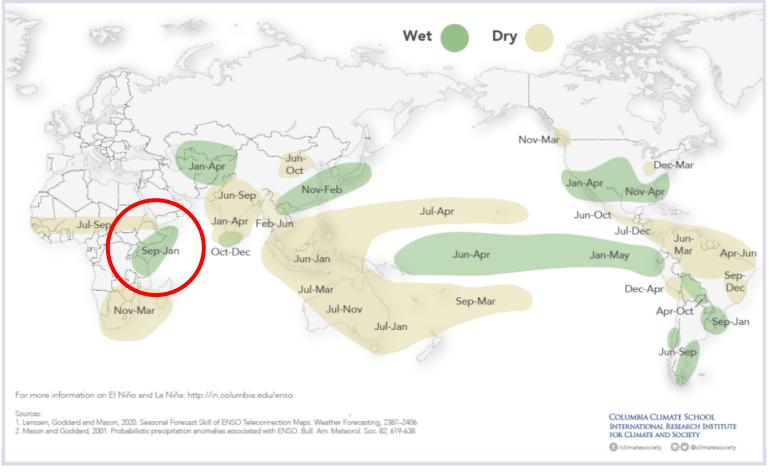
Global Climate Event

Covering July-September 2023

select III Willia official countries. Asserting period. July Sep 2003 Start state of school, 34% 2000. Spekings of orbits Heatherner, drought, wildfires, floods. he, food insecurity infectious documes, curioner

of start and Response Completion with Inputs from feature the best of expects within 1990 and wetness. It may be updated periodically based on charges in the





- Working group est. August 2023 Lead by WHO GIS Center for Health/DDI/DNA, supported by a group consisting of (1) Health Cluster Information Management Officer (2) WHO Readiness team members (3) WMO experts (4) NGO representatives and (5) academics (6) PAHO
  - Development of concept note scope of work
  - Weekly meeting Tuesday (3PM CET)



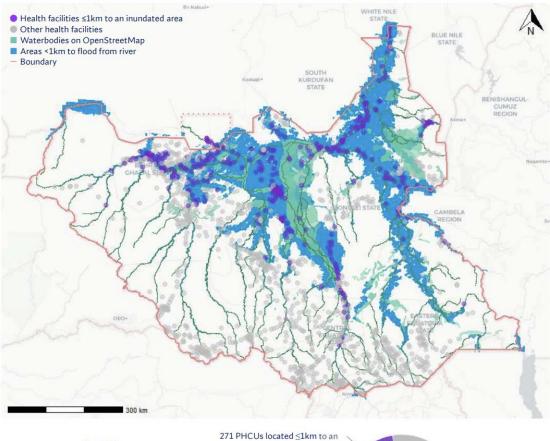
- Somalia
- South Sudan
- Ethiopia pipeline



## **Greater Horn of Africa South Sudan:** Flood Vulnerability Assessment for Health Facilities

As of 31 March 2024

### Location of health facilities\* by flood vulnerability status

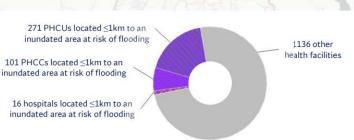


24 %

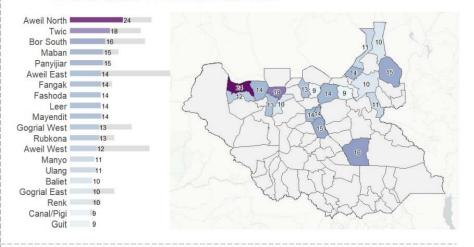
of total area exposed to the risk of flooding

388

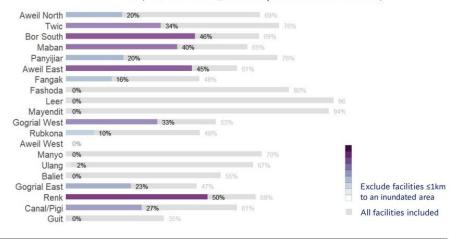
health facilities located ≤1km to an inundated area at risk of flooding



Top 20 counties with the highest number of health facilities located ≤1km to an inundated area



### Reduced percentage of the population ≤5km to the nearest health facility (facilities located ≤1km to any inundated area excluded)



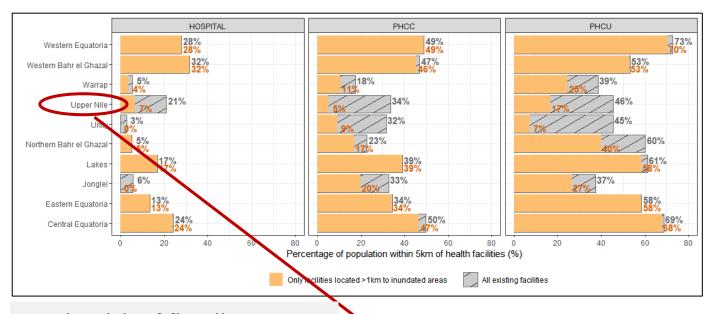
<sup>+</sup> Health facility list obtained from SSD WCO. A total of 1524 health facilities with valid GPS coordinates were included in this assessment.

Esri, © OpenStreetMap contributors, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS. Flood data obtained from https://ec.europa.eu/jrc/en/research-topic/floods.

The boundaries and names shown and the designation shown here do not imply official endorsement or acceptance by the United Nations.

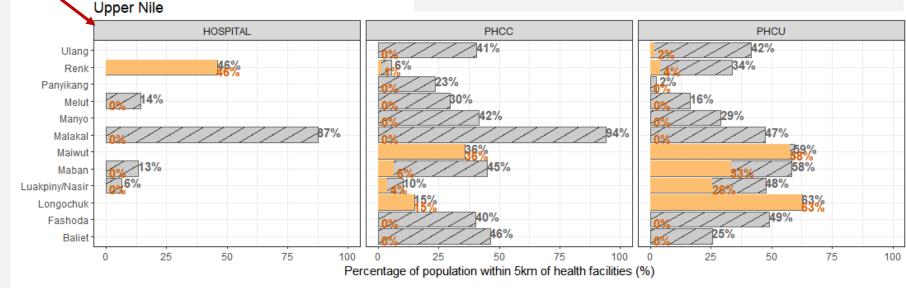
Creation date: 9 October 2023 Feedback Kerry Wong - wongk@who.int Samual Omara - omaras@who.int www.who.int

## Population geographical access Est. (5km): Health facilities with and without facilities at risk of flooding (≤1km to inundated areas), by facility type and state



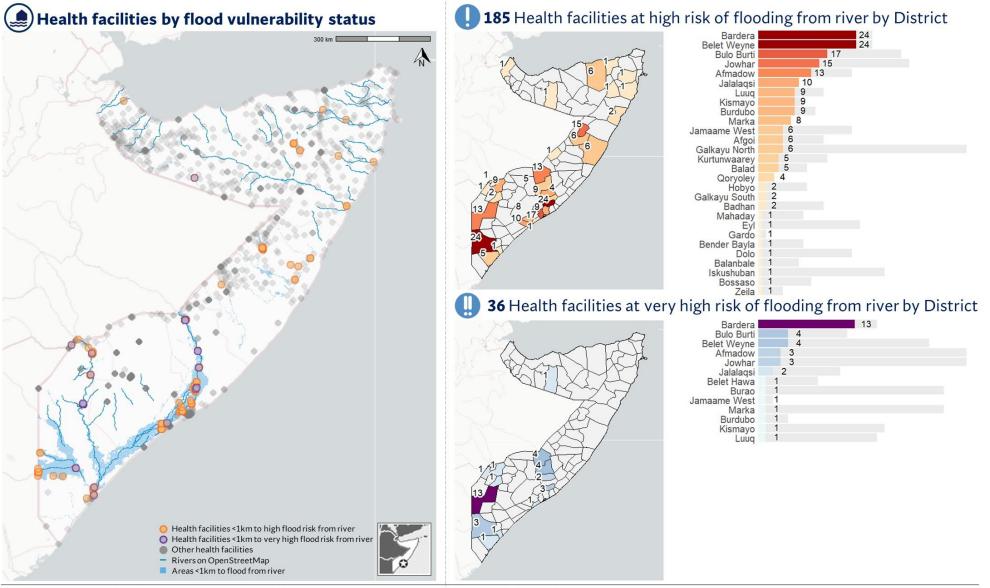
• In upper Nile State for example, 21% of the population have access to hospitals under usual circumstances (i.e., if all hospitals were considered), versus only 7% of the population would have hospital access if the hospitals located ≤1km to inundated areas were impacted by floods. PHCC access would reduce from 34% to 5%, while PHCU access would reduce from 46% to 17%.

The risk of flooding
 affects population access
 most prominently in 4
 states Upper Niles State,
 Unity State, Jonglei
 State, and Northern Bahr
 el Ghazal State. Note that
 population access
 estimates are not
 available for Abyei
 Admin State.



## **Greater Horn of Africa Somalia:** Flood Vulnerability Assessment for Health Facilities

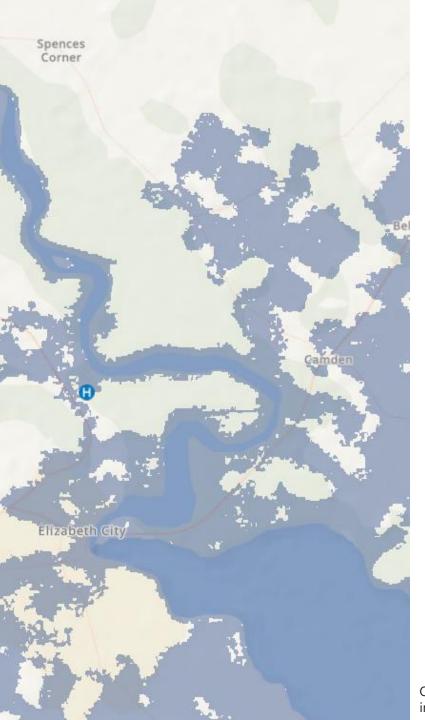
As of 9 October 2023



Esri, © OpenStreetMap contributors, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS. Flood data obtained from https://ec.europa.eu/jrc/en/research-topic/floods.

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Creation date: 9 October 2023 Feedback: Kerry Wong - wongk@who.int Samual Omara - omaras@who.int www.who.int



## Potential sites for Relocation/Setting temporary Health Services for Partners

### Taking proactive measures



**Hard infrastructure -** building of infrastructure designed to prevent flooding and contain waterways



**Living with risk -** range of measures geared toward enabling people and places to be able to tolerate flooding



**Relocation** - movement of people away from areas vulnerable to and affected by flooding

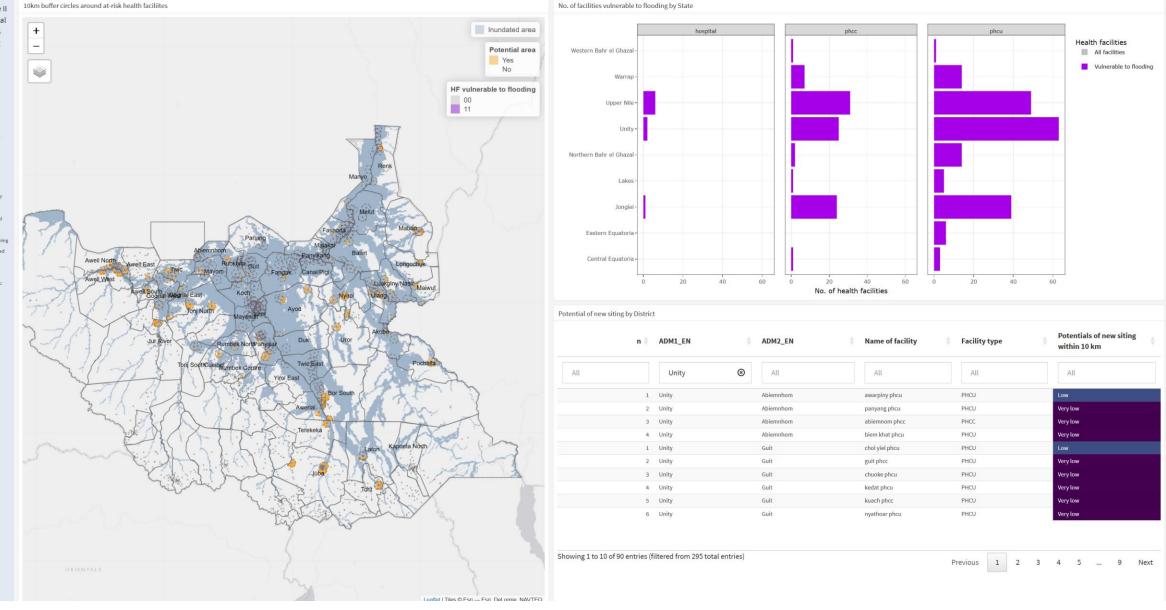
Quinn T, Heath S, Adger WN, Abu M, Butler C, Codjoe SN, Horvath C, Martinez-Juarez P, Morrissey K, Murphy C, Smith R. Health and wellbeing implications of adaptation to flood risk. Ambio. 2023 May;52(5):952-62.

This is a protytope for the Phase II analysis focusing on the potential of new sitings of health facilities previously identified as being at risk of the impact of flooding in South Sudan.

A suitablity analysis was undertaken to identify suitable higher grounds for siting. Considerations were given to:

- Distance from the original site
- Distance from any inundated area
- 3. Elevation

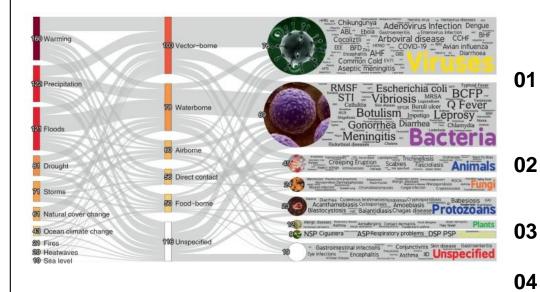
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### Link to offline Dashboard



## Background



WHO and El Niño, major short term health

impacts

Standard Operating Procedures (Inter Agency

Standing Committee).

PHSA El Nino & Health risks analysis

Decision making/ guidance for Readiness in

climate driven emergencies

•••



## Aim and Objectives

CHEVS is a first attempt to build a platform to explore Health in Climate Emergencies

WHO General Programme of Work (GPW) Section 2.1.3: Countries operationally ready to assess and manage identified risks and vulnerabilities

### Objective

# 1

Provide open-source platform to raise awareness on, and explore and research climate and health in emergencies

### Objective

# 2

Provide access to relevant knowledge, information and health emergency readiness using the Response Operations training tool

### Objective

#3

Empower users to take own initiatives on Climate & Health Readiness/
Preparedness by utilizing resources and intuitive GIS products



## Target Audience

8

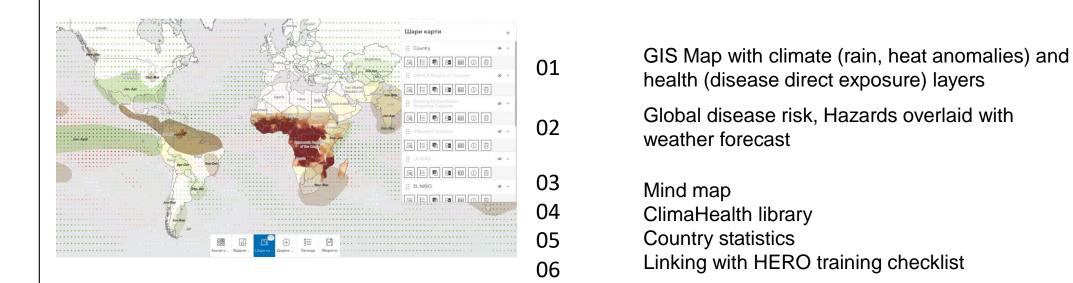
Project is intended for experts working in Emergency and Humanitarian settings



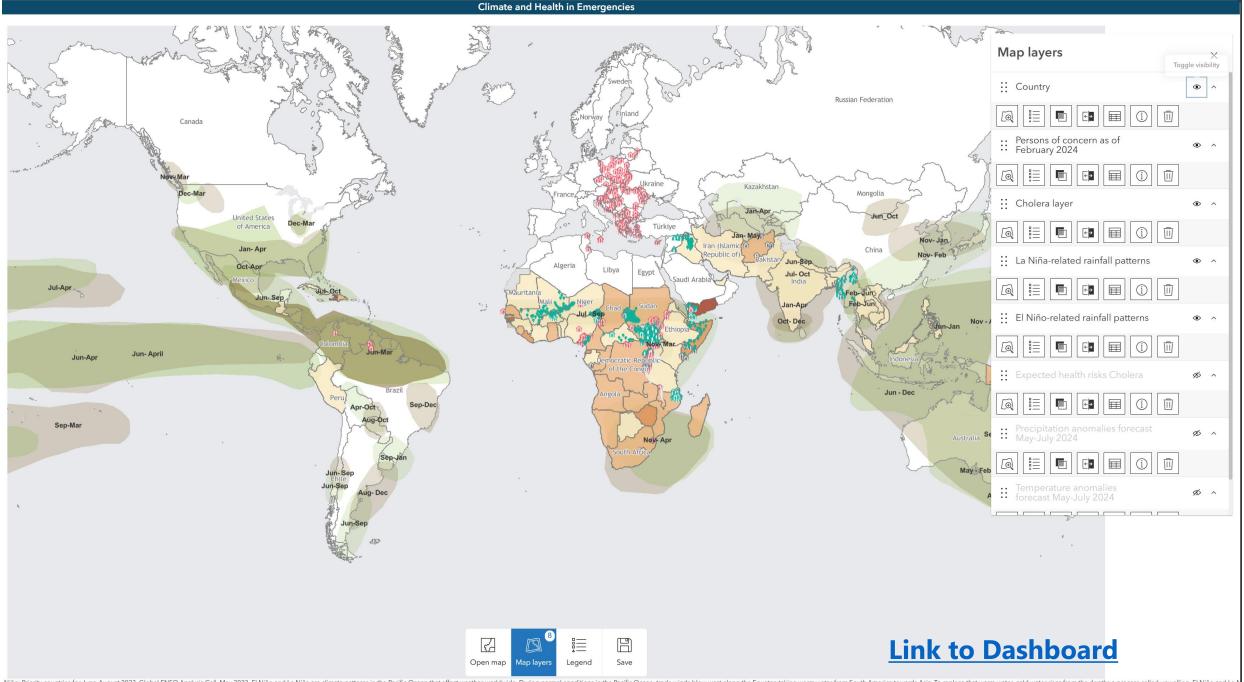


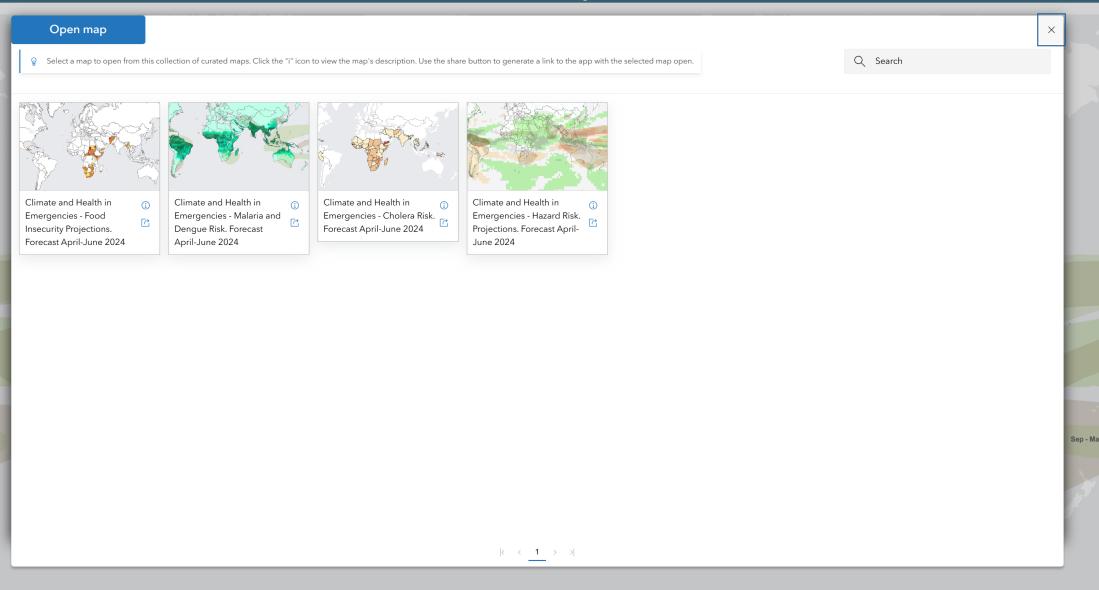
## Functionality





. . .















## Timeline 2024

(1)

Publication of the El Niño PHSA (1&2)

Working Group, Lead by WHO GISC HQ

0

Integration of GIS and Climate related layers

Developing Minimal Viable Product



Integration of Climahealth database

User survey developed to collect feedback



Presentations and awareness

CHVS Launch (mid July)

Build up with more weather maps and disease information



## **Expected Results**



Innovation of the tool is that it doesn't need IT staff to add new data sources/modifications, everything can be done using UI admin. More Virtual Spaces can be created (ex.OPT...)

Target audience will be able to link climatic forecasts to specific health hazards

Strengthen operational readiness and resilience in relation to climate-related public health emergencies by facilitating access to evidence

View and compare climatic forecasts, disease risk maps, and other map layers such as flood risk mapping without requiring GIS experience.

## Thanks for your attention

QA

# GIS and risk mapping in climate change and health vulnerability & adaptation assessments



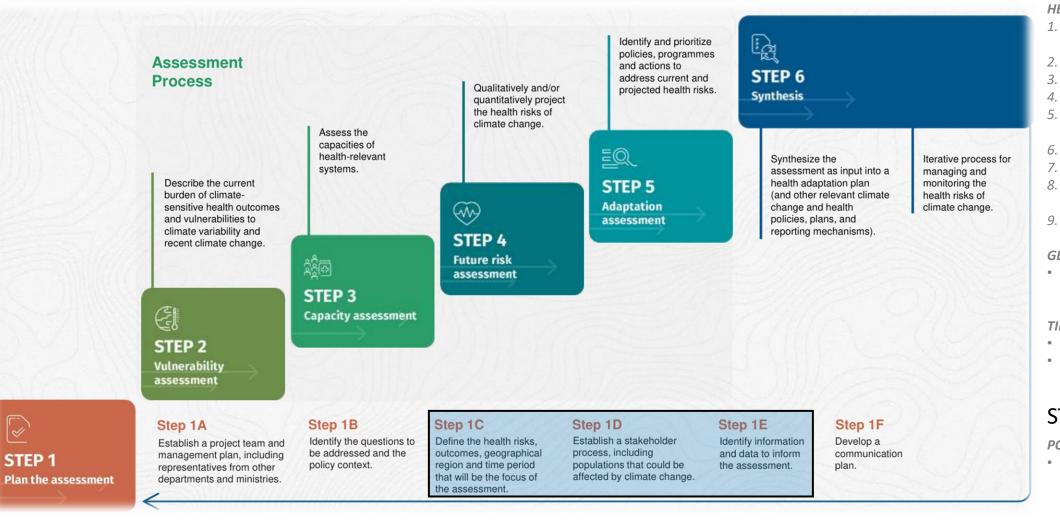
19<sup>th</sup> June 2024



Methodology and examples from Nigeria Climate Change, Health Vulnerability & Adaptation Assessment



## Planning the analysis



### STEP 1C

### **HEALTH OUTCOMES**

- 1. Injury and mortality from extreme events
- 2. Heat-related illness
- 3. Waterborne disease
- 4. Vector-borne diseases
- 5. Malnutrition and food-borne diseases
- 6. Respiratory illness
- 7. Zoonoses
- 8. Mental and psychosocial health
- 9. Noncommunicable diseases

### GEOGRAPHICAL AREA

 Full country but smaller regions can also be assessed

### TIME PERIOD

- Current is 1990-2020
- Projected future is 2020-2050

### STEP 1D

### **POPULATIONS**

 All populations in the country but not biasing away from the highly vulnerable rural communities



## Planning the analysis (cont.)

STEP 1E: Identify information and data to inform the assessment

**GIS Data** 

Validation data

## PEER REVIEWED LITERATURE

Sensitivity analyses, projections

### **HEALTH DATA**

The prevalence of climatesensitive diseases and the causes of morbidity and mortality

### **CLIMATE DATA**

Historical climate data, trends in temperatures, occurrence and intensity of extreme weather events

### **GREY LITERATURE**

Burden of climate-sensitive health outcomes and management approaches

### **COMMUNITY REPORTS**

Key vulnerability factors ethnographic and anthropological documents

## VULNERABILITY FACTOR DATA

Levels of population exposure factors, sensitivity, coping capacity

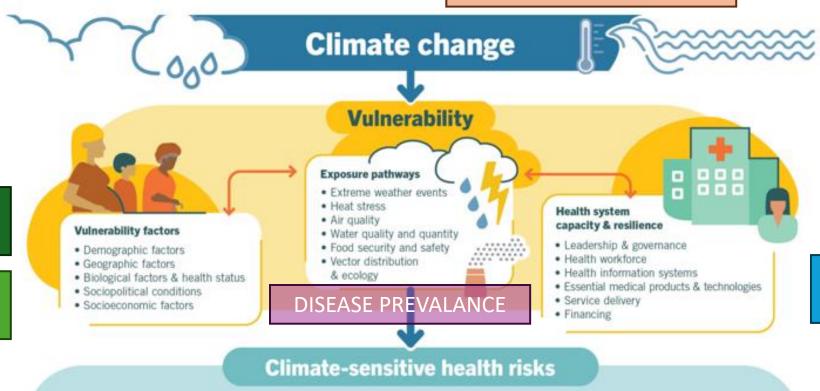


### Structure of the analysis

CURRENT AND FUTURE CLIMATE HAZARDS

**HEALTH CARE** 

**CAPACITY** 







**COMMUNITY** 

**VULNERABILITY** 

**POPULAITON** 

**EXPOSED** 

## Indicator selection and grouping



Gamble, JL et al 2016



Douglas Donnellan - foodtank.com



Areas are
differentially
exposed based on
local conditions. In
this example The
risks for
Waterborne
disease are very
different from
Malnutrition.

The climate influencing health outcomes are very different and so should vulnerability factors.

### **Health Outcomes**

	Waterborne Disease Risk	Malnutrition Risk
Climate Hazard Exposure Pathway	<ul><li>Rainfall seasonality</li><li>Average temperatures</li><li>Maximum temperature</li></ul>	<ul> <li>Annual Rainfall</li> <li>Drought</li> <li>Aridity</li> <li>Consecutive dry days</li> <li>Rainfall variability</li> </ul>
Community Vulnerability	<ul><li>Water stress areas</li><li>Flood sensitivity</li></ul>	<ul><li>Reliance on agriculture</li><li>Rainfed agriculture</li><li>Malnourishment index</li></ul>
Health system capacity	<ul> <li>Vaccination coverage</li> </ul>	<ul><li>Crop yield sensitivity</li><li>Food distribution networks</li></ul>
Disease prevalence	<ul><li>Cholera</li><li>Diarrhoea</li><li>Typhoid</li><li>Polio</li></ul>	<ul><li>Child stunting</li><li>Children underweight</li></ul>

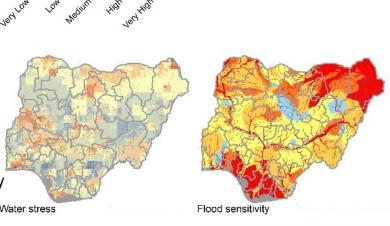
## Grouping indicators relative to health outcome

**Vulnerability Index** 

Community Vulnerability Indicators

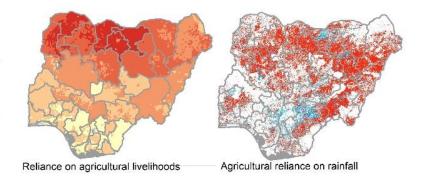
Water-borne

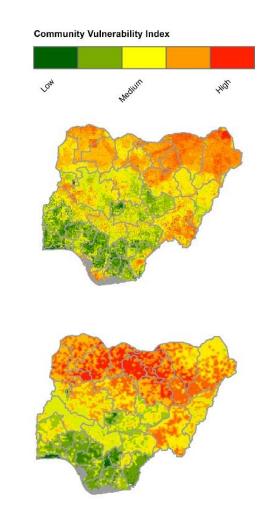
Areas were there is both significant flooding events as well as areas where there are high levels of water stress will be subject to contamination of water supplies as well as limited alternative water supply options.



Malnutrition/food

Malnutrition is driven be limited access to sustained and secure food resources. This can be forced in part by agriculture reliance on rainfall and the reliance on agricultural livelihoods in general.



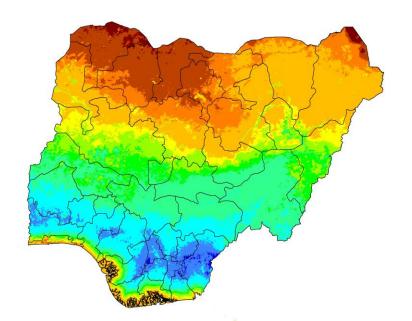




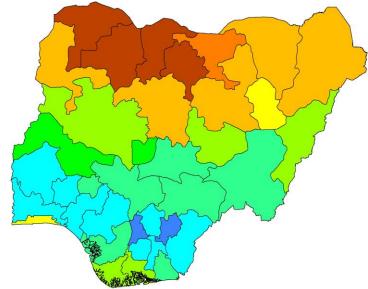
## Analysis steps 1 of 3

## Raster vs Vector

- Analysis Speed
- Calculation Changes
- Changing scales
- Geometry



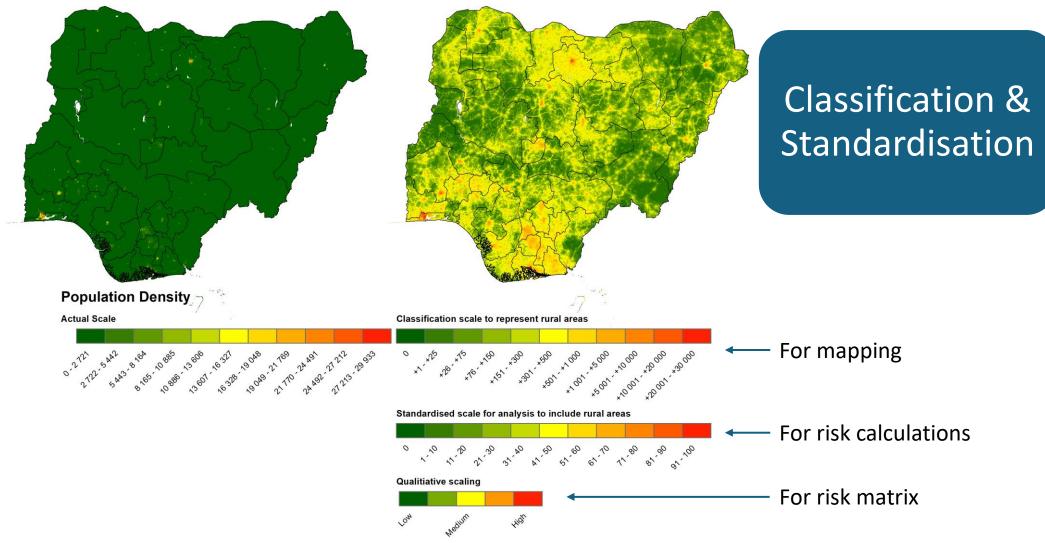
- Tends to be higher resolution
- Allows for scale changes and spatial statistics
- Can be harder to follow



- Easier to understand for decision makers
- Allows for policy planning
- Can't easily change presentation



## Analysis steps 2 of 3



• Scales and simplifies

Allows for direct

 Can bias away from undesired extremes

comparison

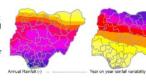
analysis



## Analysis steps 3 of 3

### **Historical health Risk**

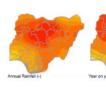
These climate factors as those that primarily impact caloric intake as controlled by crop yields and agricultural livelihoods. It therefore focuses on water availability factors.



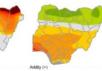












**Projected health Risk** 







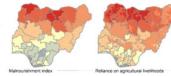




### Population is basis of exposure

Current (2020) population is estimated to be 208 million Middle of the road population scenario (SSP2) in 2030 is 240 million Business as usual population scenario (SSP5) in 2030 is 263 million. Both scenarios see an increase in rural an urban population but there is an increasing ratio of urban populations to rural populations.

Malnutrition is driven be limited access to sustained and secure food resources. This can be forced in part by agriculture reliance on rainfall and the reliance on agricultural livelihoods in



















Malnutrition is primarily driven by agricultural yields being insufficient to meet the caloric requirements for, particularly children. Agricultural yield sensitivity is therefore a wellbeing indicator highlighting areas more susceptible to yield shocks.



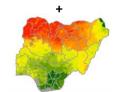
The prevalence rates of stunting in males and females as well as the rate of underweight children will be indexed to present the Malnutrition index.

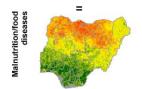
World Health Organization











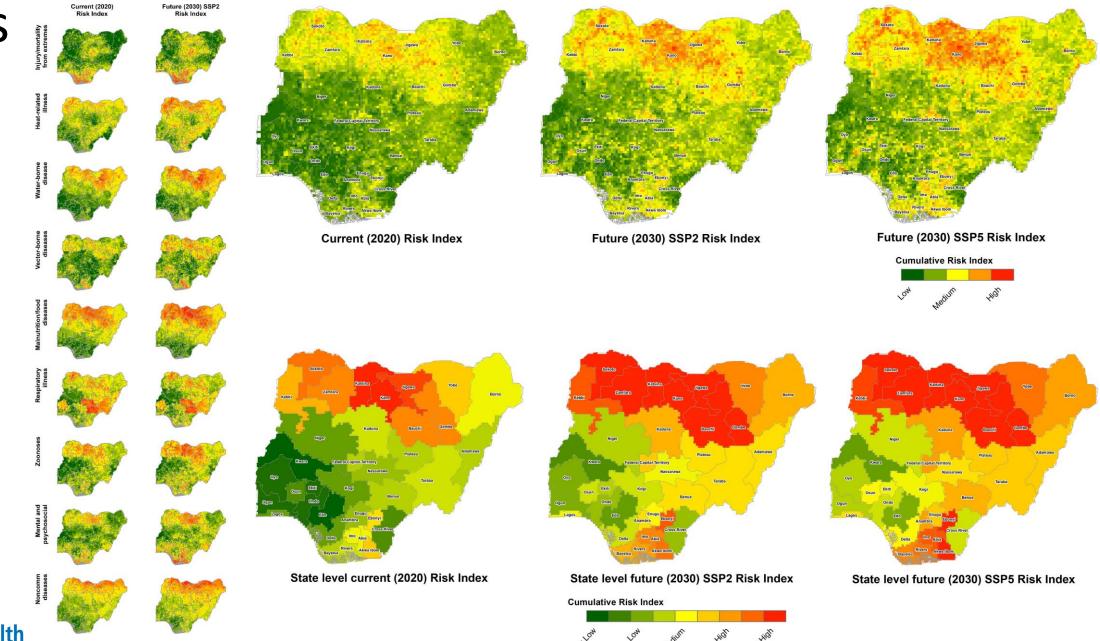








## Results





## Challenges

Challenge	Overcoming
Spatial Data availability	<ul> <li>Beg – make sure clients know that without good data the analysis will be meaningless. If that means getting a mistrial letter requesting data from national custodians, make sure you do that</li> <li>Use Proxies – Use trusted data that indirectly represents the missing indicator. Such as Infant Mortality Rate representing general health capacity</li> <li>Make new data – if you need accessibility to medical facilities, you can do a drive time analysis based on open street maps to faculties.</li> </ul>
Data inconstancy	<ul> <li>You are limited by your worst data. Try to exclude this, if possible, otherwise keep projection, resolution and format constant.</li> <li>Keep/create new meta data for all datasets</li> </ul>
Contextualizing general indicators to local context	<ul> <li>You will need knowledgeable local experts and/or literature to validate the findings.</li> <li>GIS can only go so far.</li> <li>Do regular sanity check ins that what is being presented makes sense</li> </ul>
Presenting complex data	<ul> <li>Keep it as simple as possible. Use standard legends (Red = bad and green = good) and be consistent</li> </ul>
Analysis gets too complex	Plan your analysis in detail beforehand and work within a standard framework



# GIS and risk mapping in climate change and health vulnerability & adaptation assessments

Côte d'Ivoire experience using GIS tools

Dr. Etienne KOUAKOU

### **OUTLINE**

✓ STUDY AREA

✓ METHODOLOGICAL REMINDER

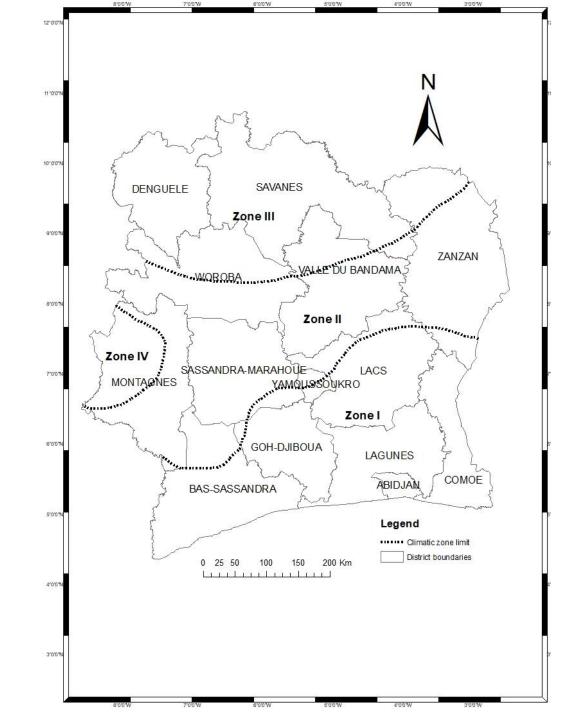
✓ CURRENT RISK : DIARRHEAL AND MALARIA

✓ FUTURE RISK : DIARRHEAL AND MALARIA

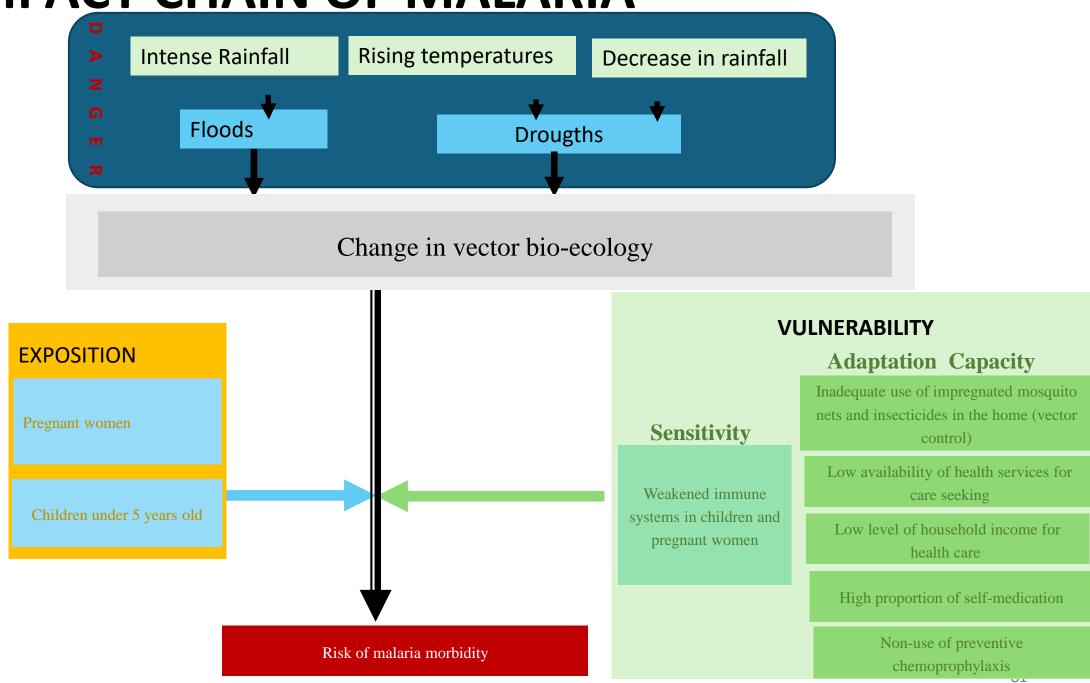
# METHODOLOGY

## **STUDY AREA**

STRENGTHENING THE INTEGRATION OF CLIMATE
CHANGE ADAPTATION INTO DEVELOPMENT
PLANNING IN COTE D'IVOIRE



## **IMPACT CHAIN OF MALARIA**



## **DATA COLLECTION**

TYPE OF DATA	DESCRIPTION
Climate	Temperature and Rainfall
Sanitary	incidence of malaria and diarrhea
Population	Characteristics (age range, proportion of pregnant women, children, youth, Elders)

## RISK CALCULATION

#### **Step 1. Standardization**

$$X_{i, 0 \text{ to } 1} = \frac{X_i - X_{Min}}{X_{Max} - X_{Min}}$$

#### Step 2. Weighting and aggregation of indicators

	Disease	Measured indicators	Weight
Danger	Malaria	Annual rainfall (mm)	X
		Average annual temperatures (°C)	у
	Diarrhea	Annual rainfall (mm)	Z

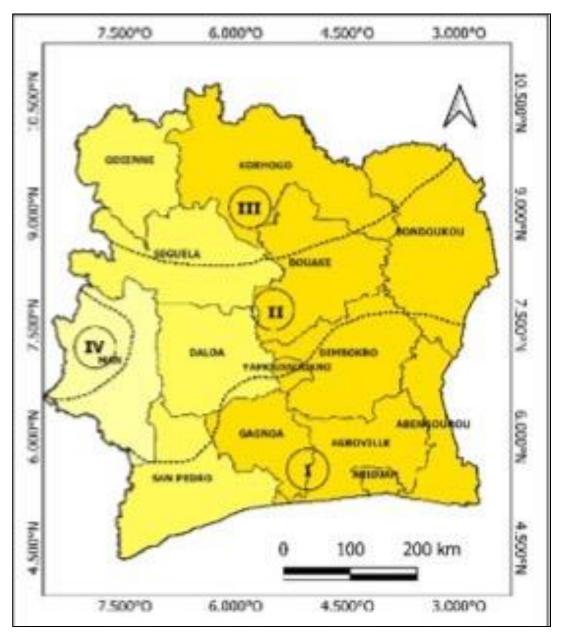
$$IC = \frac{(I_1 * w_1 + I_2 * w_2 + ... I_n * w_n)}{\sum_{1}^{n} w}$$

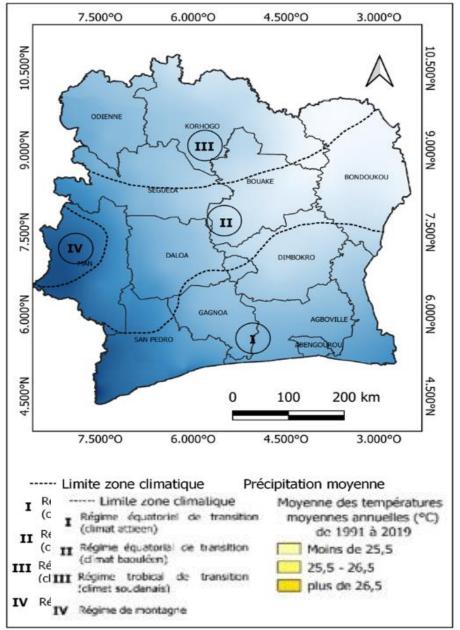
#### Step 3. Risk calculation

$$Risque = \frac{(Danger*W_D) + (Vuln\acute{e}rabilit\acute{e}*W_V) + (Exposition*W_E)}{W_D + W_V + W_E}$$

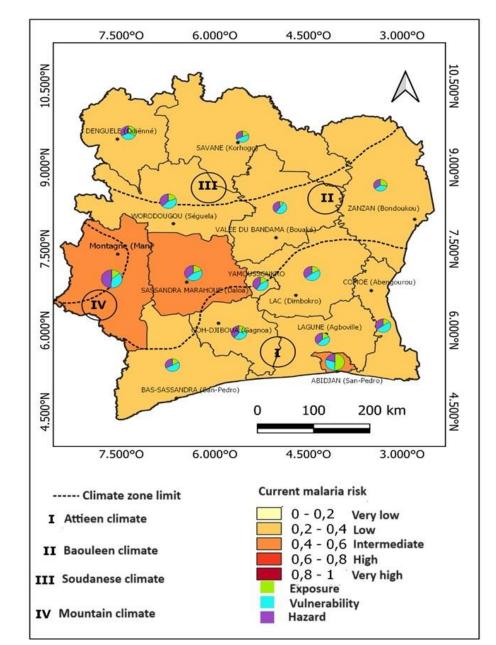
# RESULTS

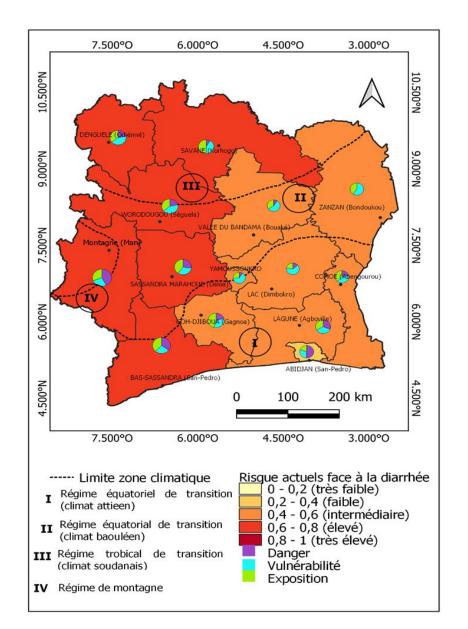
## Rainfall and temperature variations



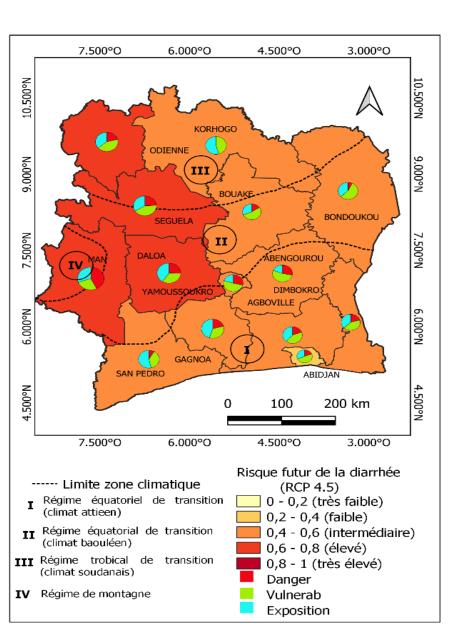


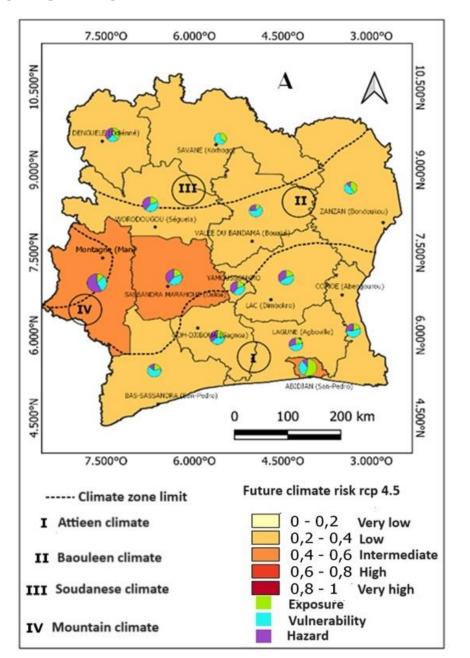
## Current risk of diarrhea and malaria





## Future risk of diarrhea and malaria







## WHO Technical Webinar Series



https://www.who.int/teams/environme nt-climate-change-andhealth/climate-change-andhealth/country-support/webinars



Date & time (CEST)	Topic*
24 <sup>th</sup> April 2024	Getting started: climate change and health vulnerability & adaptation assessments
30 <sup>th</sup> April 2024	WHO as an Accredited Implementing Entity of the Adaptation Fund; Accessing AF funding for Climate Change and Health
15 <sup>th</sup> May 2024	WHO Operational Framework for building climate resilient and low carbon health systems
12 <sup>th</sup> June 2024	Developing a Health National Adaptation Plan: Introduction
19 <sup>th</sup> June 2024	GIS and risk mapping in climate change and health vulnerability & adaptation assessments
10 <sup>th</sup> July 2024	Climate resilient and environmentally sustainable health care facilities
17 <sup>th</sup> July 2024	Quantitative approaches for Vulnerability & Adaptation assessments: sensitivity analyses and projecting future health risks of climate change
18 <sup>th</sup> Sept 2024	Integrating health in NDCs and LT-LEDS
25 <sup>th</sup> Sept 2024	Developing a Health National Adaptation Plan: Quality criteria for HNAPs
16 <sup>th</sup> Oct 2024	Conducting a gender analysis for climate change and health vulnerability & adaptation assessments

## THANK YOU!

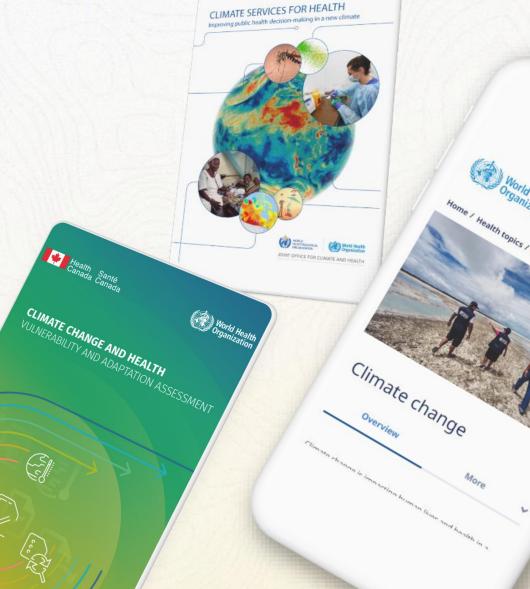
#### **Environment, Climate Change and Health**

https://www.who.int/teams/environment-climate-changeand-health

#### **Climate Change**

https://www.who.int/teams/environment-climate-changeand-health/climate-change-and-health

Email: healthclimate@who.int



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