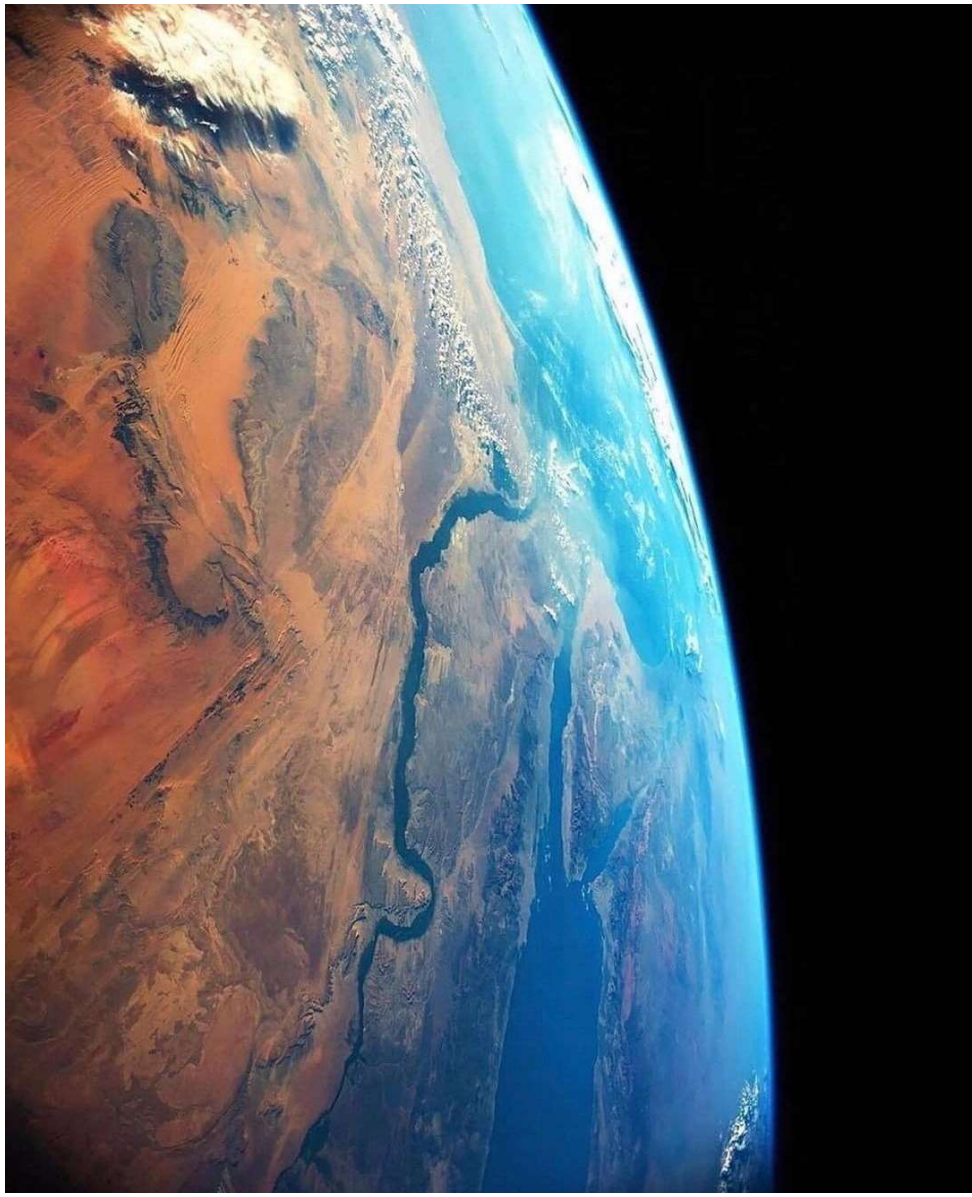
ICPAC

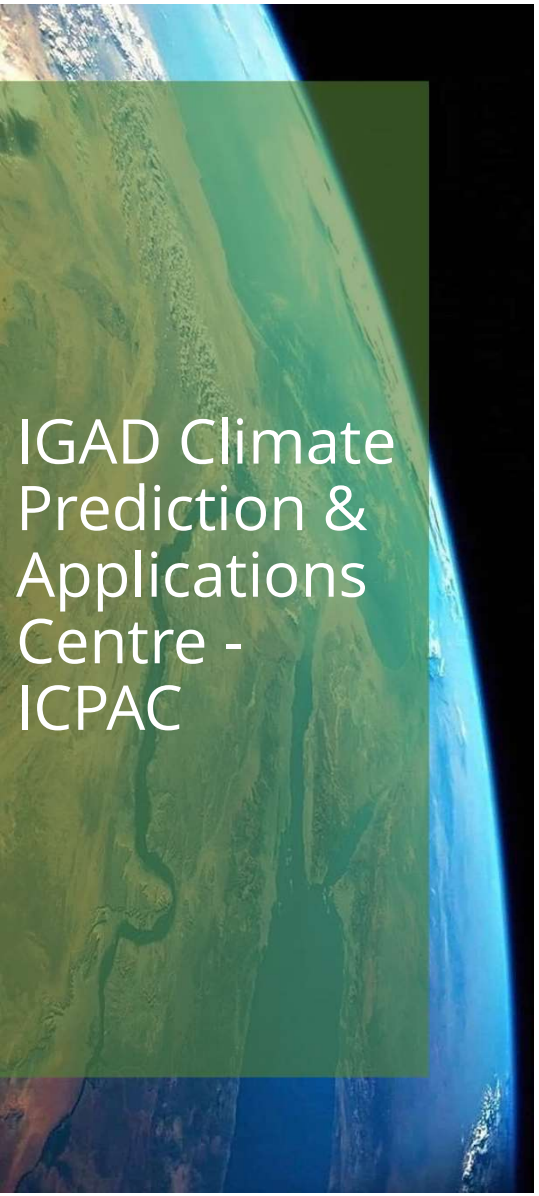
Locust Damage & Impact Mapping

AI in Improving Early Warning & Early Action in IGAD

Kenneth Kemucie Mwangi

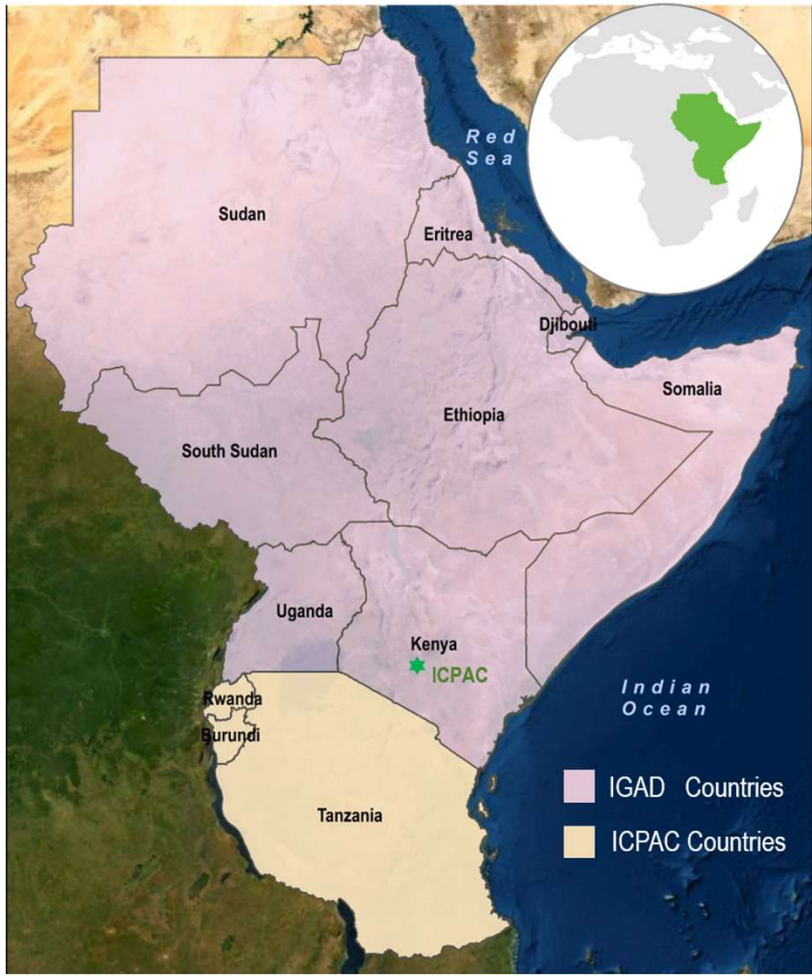
Project Lead & Early Warning Expert





IGAD Climate Prediction & Applications Centre - ICPAC

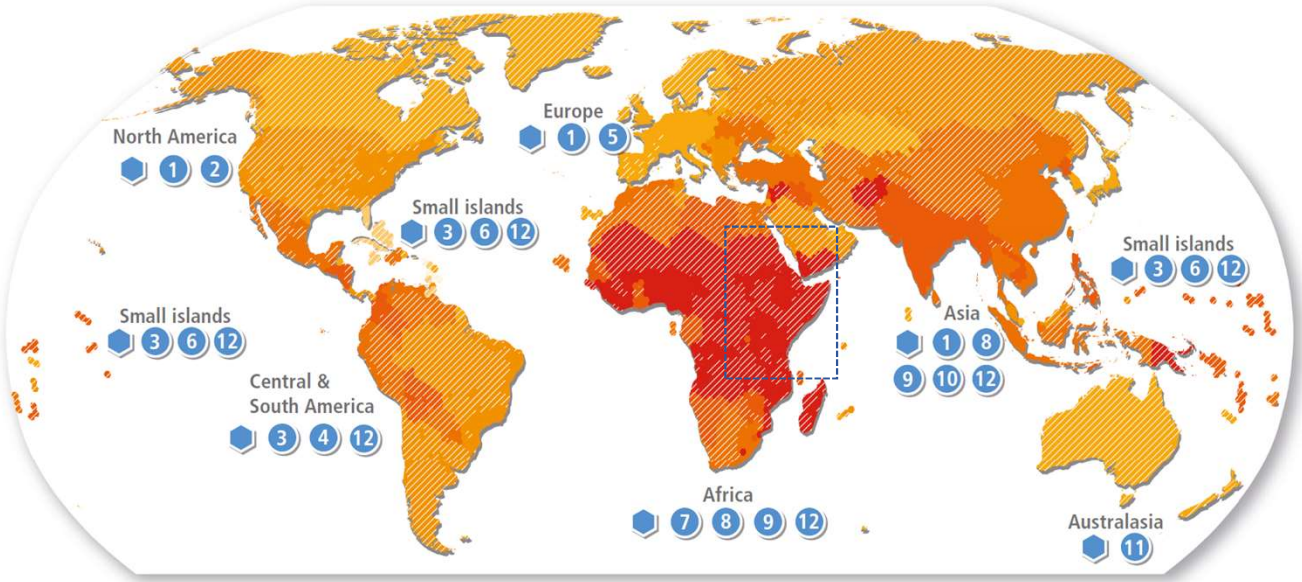
- Established in 1989 as the Drought Monitoring Centre, Nairobi (DMCN);
- 2007, the Protocol establishing the Centre signed & the name changed to **I**GAD **C**limate **P**rediction and **A**pplications **C**entre (ICPAC)
- ICPAC is a WMO Regional Climate Centre (WMO-RCC) for Eastern Africa.
- ICPAC is a member of AUC/NEPAD Network for Water Centres of Excellence.
- ICPAC has an Observer Status with the UNFCCC
- In the process of being accredited by Green Climate Fund – GCF to support implementing agencies



Climate Change Vulnerability of IGAD (IPCC 6 AR)

Observed human vulnerability differs between and within countries and strongly determines how climate hazards impact people and society

(a) Map of observed human vulnerability based on two comprehensive global indicator-systems using national data, plus examples of selected local vulnerable populations and Indigenous Peoples



Relative vulnerability

- Very high
- High
- Medium
- Low
- Very low

Population density

- High
- Low

Examples of Indigenous Peoples with high vulnerability to climate change and climate change responses (4.3.8, 5.10.2, 5.13.5, Box7.1, 8.2.1, 15.6.4) and the importance of Indigenous Knowledge (Box9.2.1, 11.4, 14.4, Cross-Chapter Box INDIG)

Examples of local vulnerable populations | Examples of some aspects of vulnerability | Chapter references

1. **Indigenous Peoples of the Arctic** | health inequality, limited access to subsistence resources and culture | CCP 6.2.3, CCP 6.3.1
2. **Urban ethnic minorities** | structural inequality, marginalisation, exclusion from planning processes | 14.5.9, 14.5.5, 6.3.6
3. **Smallholder coffee producers** | limited market access & stability, single crop dependency, limited institutional support | 5.4.2
4. **Indigenous Peoples in the Amazon** | land degradation, deforestation, poverty, lack of support | 8.2.1, Box 8.6
5. **Older people, especially those poor & socially isolated** | health issues, disability, limited access to support | 8.2.1, 13.7.1, 6.2.3, 7.1.7
6. **Island communities** | limited land, population growth and coastal ecosystem degradation | 15.3.2
7. **Children in rural low-income communities** | food insecurity, sensitivity to undernutrition and disease | 5.12.3
8. **People uprooted by conflict in the Near East and Sahel** | prolonged temporary status, limited mobility | Box 8.1, Box 8.4
9. **Women & non-binary** | limited access to & control over resources, e.g. water, land, credit | Box 9.1, CCB-GENDER, 4.8.3, 5.4.2, 10.3.3
10. **Migrants** | informal status, limited access to health services & shelter, exclusion from decision-making processes | 6.3.6, Box 10.2
11. **Aboriginal and Torres Strait Islander Peoples** | poverty, food & housing insecurity, dislocation from community | 11.4.1
12. **People living in informal settlements** | poverty, limited basic services & often located in areas with high exposure to climate hazards | 6.2.3, Box 9.1, 9.9, 10.4.6, 12.3.2, 12.3.5, 15.3.4

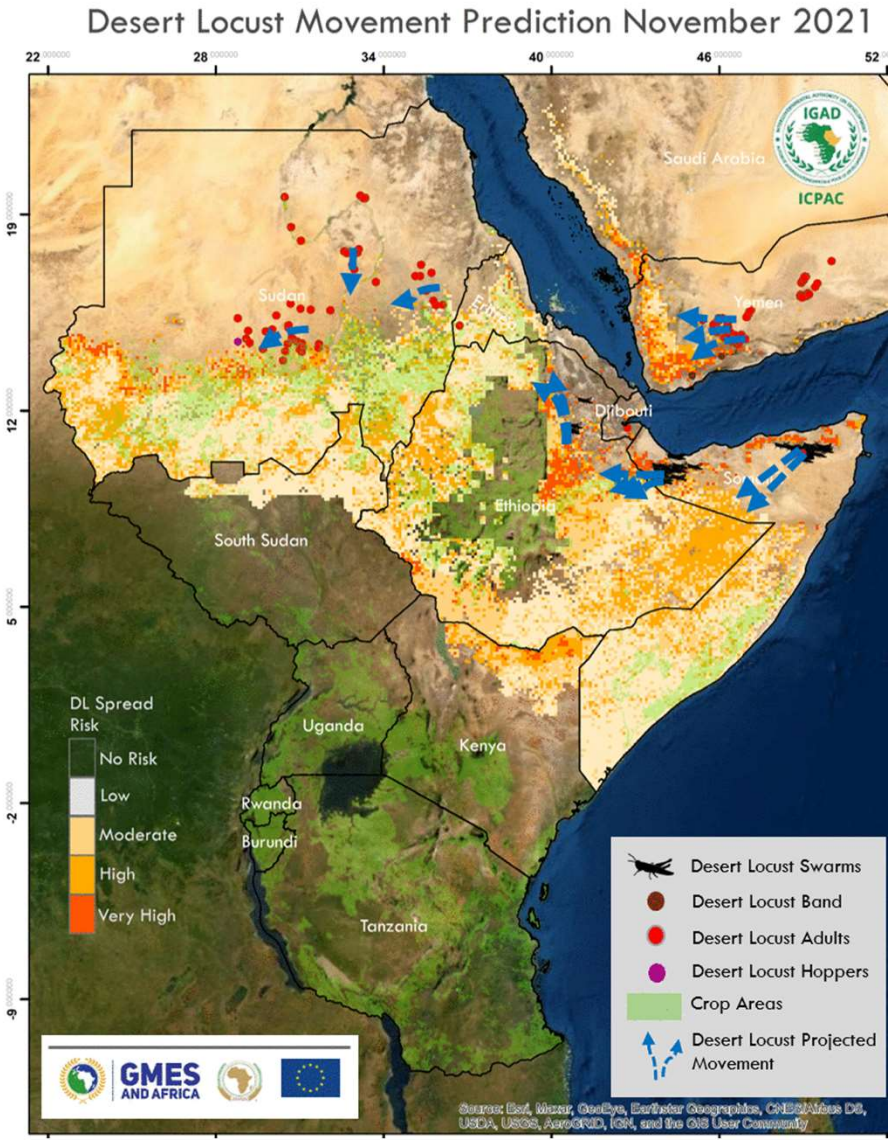
Climate Change Vulnerability of IGAD (IPCC 6 AR)

Friday, 22 September, 2023

Changing climate- a driver to Pests invasions

- Due to *Climate Change* more areas in Eastern Africa are suitable for migratory pets invasion and breeding
- Extreme events of floods and droughts are more frequent in the region
- Monitoring and prediction in form of **Early Warning Systems**
- Regional capacity building to support future preparedness and increase adaptation
- Data access, availability and processing capability enable quick situational analysis and response

Abubakr A. M. Salih, Marta Baraibar, Kenneth Kemucie Mwangi & Guleid Artan, Climate change and locust outbreak in East Africa. Nat. Clim. Chang. 10, 584–585 (2020). https://doi.org/10.1038/s41558-020-0835-8

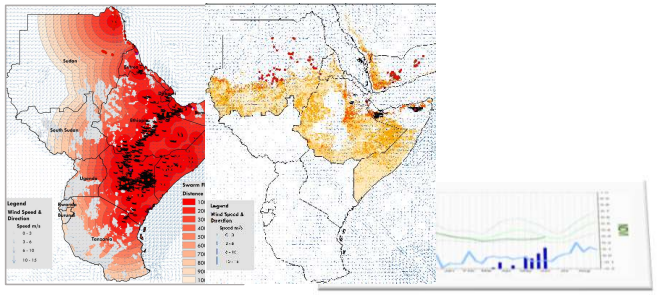


Solution – Robust Early Warning Systems

Alert System

- Monitoring Incidences
- Alert for Control
- Food Security & Livelihood Impacts

East Africa Hazards Watch



Empirical Relationships

Analysis Pest Locations

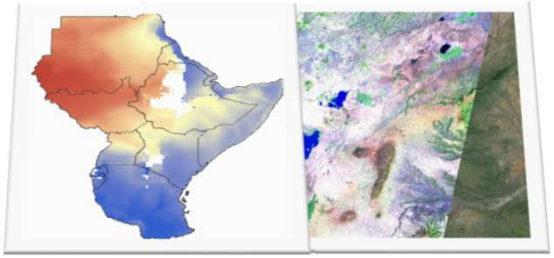
Data Integration

Modelling Risk Zones

Derive Indicators

Machine Learning

Breeding Areas



Interventions

Urgent Actions

Resources Mobilized

Long-term Plans

Cross-boundary Control

Livelihoods Interventions

Pesticide Application

Monitoring & Surveillance

Information

Situation Analysis

Risk Information

Crops Affected

Population Affected

Predicted Pest Movement

Impact Analysis

Processes

Ecological & Climatic Indicators

Model pest behavior

Entomology

Spatial Analysis

Change Detection

Historical Analysis

Data

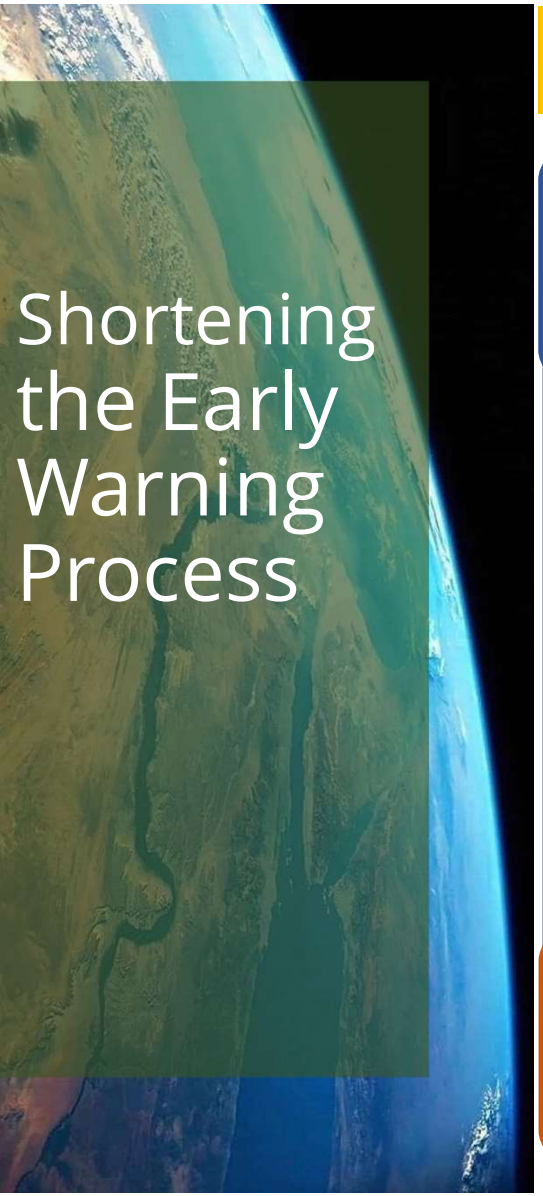
Satellite Data

Crop Maps

Pest Incidences

Weather & Climatic Forecasts

Control & Interventions



Shortening the Early Warning Process

AI in Enabling Easier to reproduce datasets

Getting data

class	lat	lon
positive		
negative		

Processed Labels (in Drive using dvc)

Coordinates

Earth Engine

Export task

Earth observation data (in public bucket)

Labeled dataset / features (in Drive using dvc)

Creating a model

tsai
state-of-the-art deep learning for time series and sequences

Labeled training data

Labeled evaluation data (in Drive using DVC)

Machine learning model architecture (PyTorch)

Trained model (in Drive using DVC)

Using the model

Input earth observation data

Trained model

Predictions

Map

AI in IBF Chain

- IBF is a process of quantifying uncertainty and gives risk matrix
- IBF-an extension of conventional hazard forecasting with factoring of socio-economic exposure and/or vulnerability
- Gives more insight for anticipatory action on disaster risk resilience, combining climate forecast information
- Tools for risk prevention and mitigation activities
  - Ensemble weather forecast ------> IGAD/ICPAC Google Project
  - Hazard modeling ----------> Risk Profiling for Anticipatory Action
  - Impact Calculation/Model
  - Model Error
  - Bayesian Analysis

AI techniques for event probability

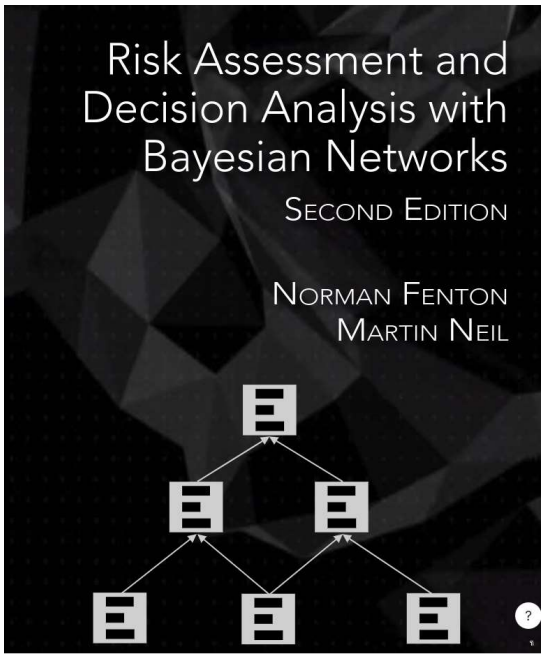
AI for Impact Based Forecasting

Bayesian (Risk and Decisions) Analysis

Probability interpretations in two major perspectives: frequentist and Bayesian

Frequentist limited by observed frequency.
Bayesian incorporates prior beliefs and subjective opinions

Bayesian Networks for risk and decision analysis



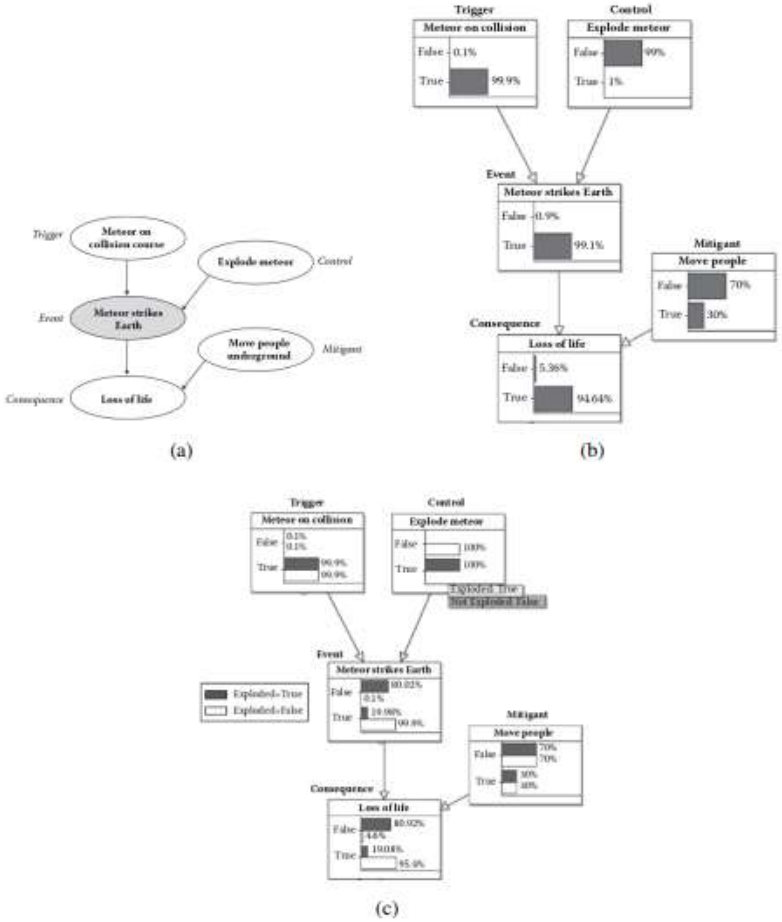
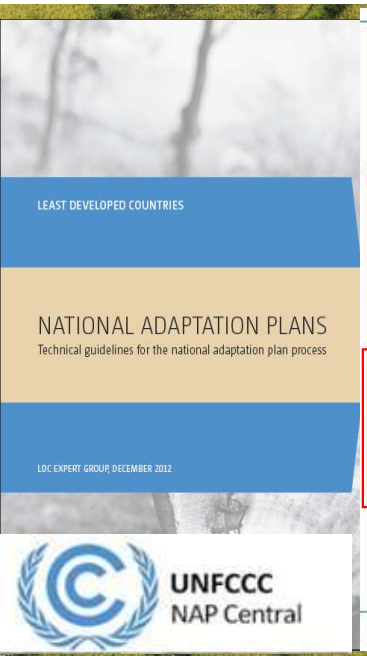


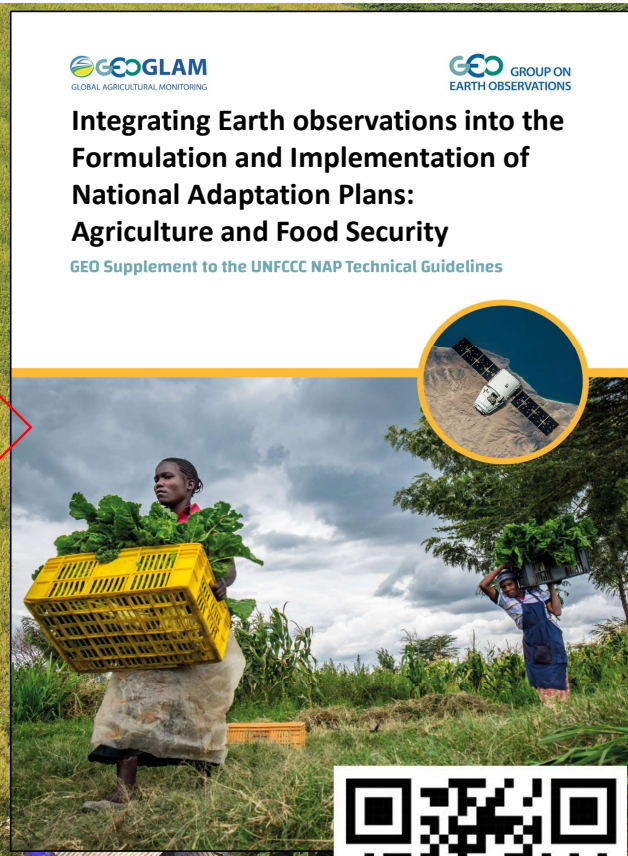
Figure 4: (a) Meteor strike risk modelled in BN as DAG (b) Initial risk of meteor strike based on conditional probability (c)The potential difference made by hypothetical anticipatory action, image from Fenton and Neil [9]



UNFCCC
NAP Central

Laying the Groundwork and addressing gaps	A.1. Initiating the NAP process
	A.2.: Stocktaking
	A.3.: Addressing Capacity Gaps
	A.4.: Development Needs and Climate Vulnerabilities
Preparatory elements	B.1. Analysing Current & Future Climate
	B.2. Assessing Climate Vulnerabilities and Adaptation Options
	B.3. Review and Appraisal of Options
	B.4. Compiling, Communicating NAPs
	B.5.Integrating NAP into Development, Planning
Implementation strategies	C.1. Prioritizing CCA in National Planning
	C.2. Long-term Implementation Strategy
	C.3. Enhancing Capacity for Planning, Implementation
	C.4. Promoting Coordination and Synergy
Reporting, Monitoring, Review	D.1. Monitoring the NAP Process
	D.2. Assess Progress, Effectiveness, Gaps
	D.3. Iteratively Update NAPs
	D.4. Outreach and Reporting on Progress

Focus on technical and institutional resources required for the successful implementation of NAPs



"The focus on agriculture and crop monitors is particularly timely given the importance of food systems in NAPs, and the potential that this offers in meeting the Secretary General's call for access to early warning systems by all by 2025.

The technical details in this supplement will be useful to the countries as they envision implementation of their NAPs including through relevant programmes under the Green Climate Fund, and other channels, related to food systems and climate information and early warning systems"

Chair of the Least Developed Countries Expert Group (LEG)

https://earthobservations.org/documents/cc_wg/GEO_NAP_Supplement_final.pdf

GEOGLAM
Global Agricultural Monitoring

@G20_GEOGLAM
www.geoglam.org

IGAD

ICPAC

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

GDA esa

GEOGLAM
Global Agricultural Monitoring

To collaborate is to solve it with different tools
AI is sharpening the tools