# Chasing the Hotspots: Integrating Climate Information from Earth Observations and Socio-economics to map Hazards and Vulnerability Hotspots in Malawi


Denis Macharia[a)], James Chiusiwa[b)], Manda Kingsley[c)], Madalitso Mwale[b)], Grace Koech[a)], David Ongo[a)], Faith Mitheu[a)], Africa Flores[d)], Wondimagegn T. Beshah[a)], Robinson Mugo[a)], Laurent V. Mtaroni[a)], Ashutosh Limaye[d)], Gwendolyn Artis[d)], Daniel Irwin[d)], Hussein Farah[a)]

[a)] Regional Centre for Mapping of Resources for Development, Nairobi, Kenya , [b)] Department of Disaster Management Affairs, Lilongwe, Malawi, [c)] The National Statistics Office, Zomba, Malawi, [d)]The SERVIR Coordination Office, NASA Marshall Space Flight Centre, Huntsville, Alabama, USA.

Contact: dmacharia@rcmrd.org


## 1. Rationale

Malawi has experienced severe impacts of climate change. In the last two decades, Malawi has experienced a number of adverse climatic hazards. The most serious ones have been dry spells, seasonal droughts, intense and unpredictable rainfall, riverine floods and flash floods. Some of these especially droughts and floods, have since increased in frequency, intensity and magnitude over the past decades, and have adversely impacted on food and water security, water quality, energy and sustainable livelihoods of most rural communities.

"Risk identification and vulnerability mapping is one of the components of the second policy priority area in the Disaster Risk Management Policy. To properly plan and implement disaster risk management programmes, identification of risk and mapping the vulnerability is very critical. Vulnerability mapping (including the products) will not just be important for DRR purposes only, but will also play a critical role in other development work, including in prioritizing areas where a lot of development work is to be undertaken for resilience building. As a country, Malawi currently lacks this kind of information and capacity and we expect that through the support and exercise we will be able to undertake our programmes better, while contributing to the attainment of the Malawi Growth and Development Strategy and the National Disaster Risk Management Policy." Mr. James Chiusiwa, Director, Disaster Risk Reduction, DoDMA

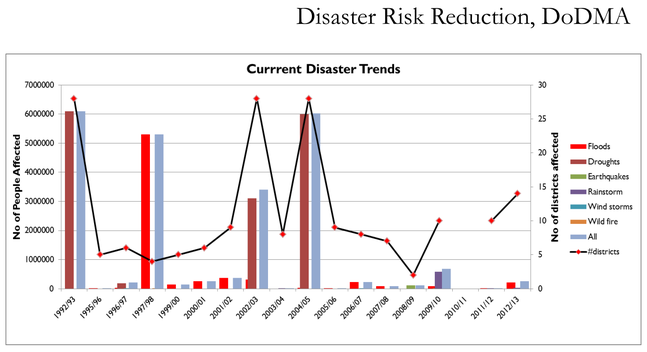



Figure 1: Malawi experiences frequent disasters that cause massive losses and damages.

## 3. Approach/Project Activities

**Analytical framework:** IPCC model of vulnerability as a function of exposure, sensitivity, and adaptive capacity.

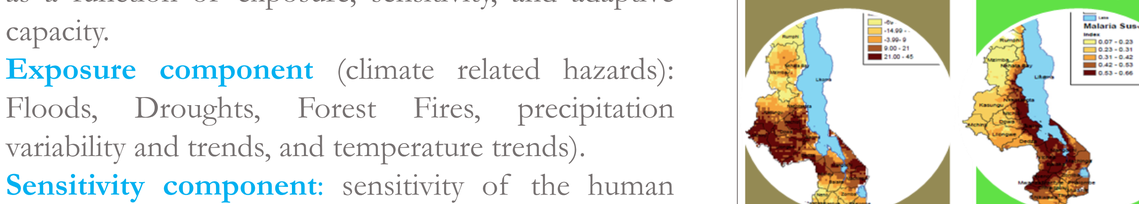
**Exposure component** (climate related hazards): Floods, Droughts, Forest Fires, precipitation variability and trends, and temperature trends).

**Sensitivity component**: sensitivity of the human population to hazards or perturbations (health, living conditions/standards, poverty levels, gender, agriculture and population, malaria).

**Adaptive capacity component**: factors that make a community/society anticipate, cope with and respond to change (e.g., education, access to markets, access to health services, livelihoods and alternative methods for food production (irrigation)).

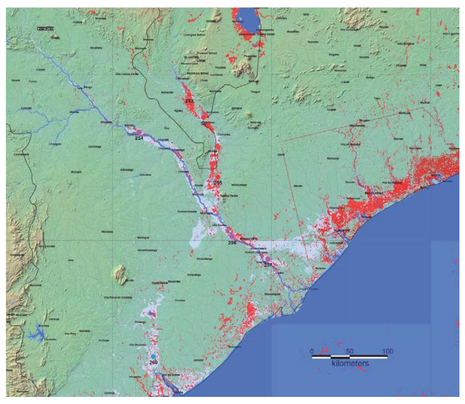
**Stakeholder engagement:** Worked with a co-development team of 20 experts from Malawi Govt. and NGOs.

**Capacity building:** Technical training on framework and mapping methods using the ToT concept.



Coordination and communication are integral components to ensure users ownership and acceptance of products and tools. The products and tools need to fit the mental models of users to increase their chances of being utilized. This makes stakeholder participation very crucial for a impact oriented result.

**Figure 2:** Floods in Malawi are a common phenomenon. In 2015, a 1 in 500yr flood affected >1M people, displaced >200, 000 and killed >100 people. The amount of destruction to the economy was enormous and resulted in government declaring a state of disaster in 15 out of the 28 districts. Left photo: temporary bridge to ease movement after the main bridge was washed away by floods, an d an image from DFO showing flooded areas in red color.



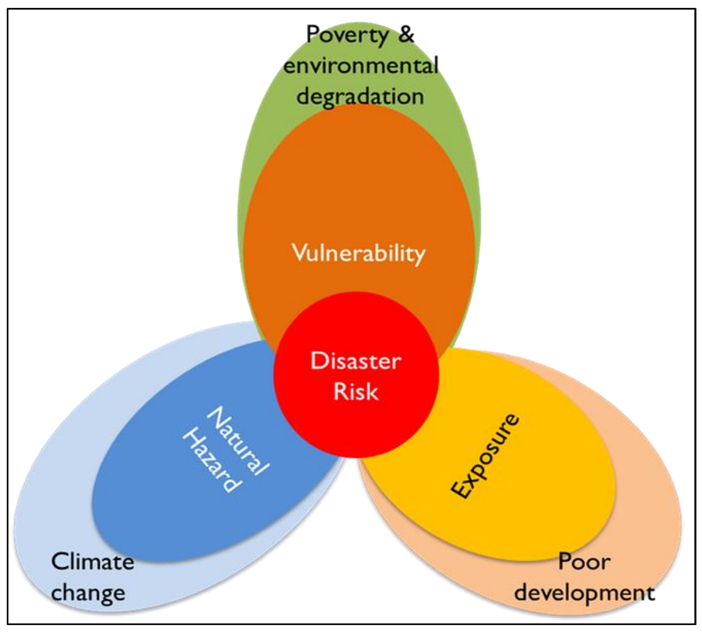




Figure 3a: Disaster risk is determined by the occurrence of a natural hazard (e.g., floods), which may impact exposed and sensitive populations or communities and the livelihoods they depend on (e.g, agriculture). Vulnerability is the characteristic of the population or the asset (element at risk) making it particularly susceptible to the damaging effects (e.g., type of building material). Climate change, poorly planned development, poverty and environmental degradation are all drivers that can increase the magnitude of this interaction, leading to larger disasters. Source: IPCC 2012

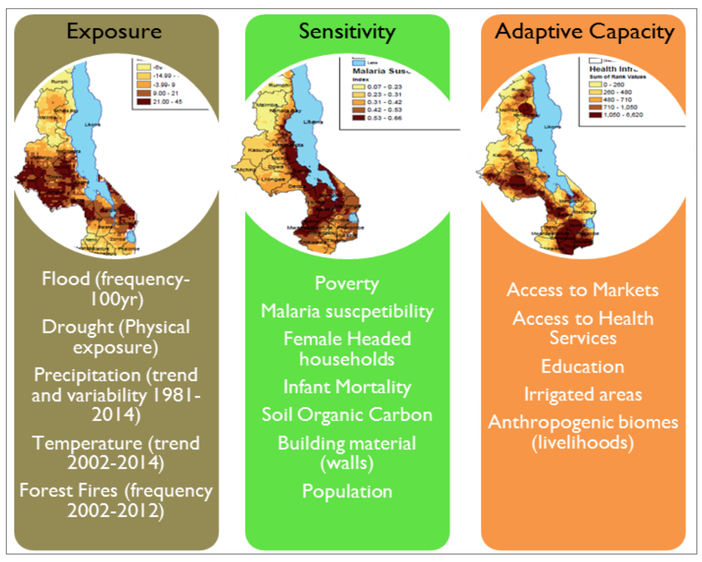



**Figure 3b:** A list of key indicators used to develop maps of the three vulnerability components. The indicators were grouped into the three vulnerability components. C) Stakeholder engagement events.

## 2. Objectives

- To develop a hazards and Vulnerability Atlas, geodatabase and a web visualization tool for Malawi
- To train national experts on methods of developing hazards and vulnerability maps

## 4. Earth Observations and Other Inputs

Earth Observation datasets: Precipitation (CHIRPS), Temperature (MODIS), Forest Fires (MODIS), Flood Frequency (modeled from DFO's MODIS archives) were used in combination with Household level datasets compiled by the Malawi National Statistics Office. Landscan population density for 2012 and other EO datasets from CIESIN (NASA supported project) and flood inundation data from E01 were also used.

## 5. Results

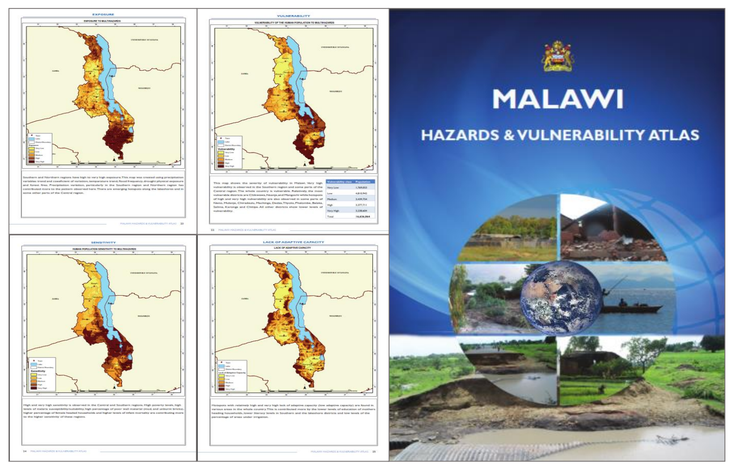



**Figure 4:** National level hazards and vulnerability maps have been developed. An atlas has been compiled and a Geodatabase created. All products are available on the SERVIR ESA Geoportal and through the Malawi Spatial Data Portal.

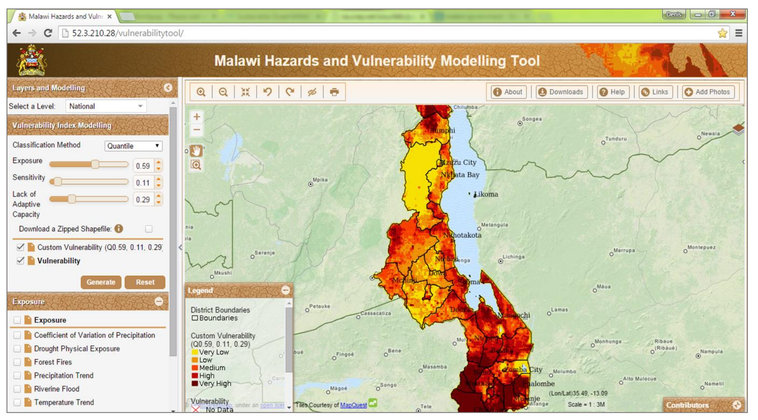



**Figure 5:** A user friendly web tool has been developed by SERVIR ESA to facilitate data access, products dissemination and end-user ability to interactively download data and/or model vulnerability domains and upload georeferenced field photos during disaster periods to aid rapid response. http://52.3.210.28/vulnerabilitytool/.

- 70 stakeholders (individuals) trained in 3 training workshops
- 4 climate adaptation tools developed
- 2 stakeholder awareness workshops held
- 17 agencies engaged (Govt. and NGOs)
- More than 50 data layers generated
- $62, 000 leveraged from private sources (UNDP)

## 6. Outcomes/Anticipated Impacts

- Improved targeting of resilience building activities (DRR) in Malawi
- Improved technical capacity to integrate climate data and socio-economic information to map vulnerability hotspots
- Improved access of hazards and vulnerability information through the web visualization system

## 7. Project Partners

Government of Malawi, Department of Disaster Management Affairs, Survey Department, Department of Climate Change and Meteorological Services, National Statistics Office, Ministry of Agriculture, United Nations Development Programme, World Food Programme, World Bank.

## 8. Project End Users

Department of Disaster Management Affairs, Survey Department, development partners (USAID, UNDP, World Bank, WFP), Academic institutions and the general public.