UNIVERSITY OF
Southampton

BRECcIA

The next series of Small Research
Projects are launched

Multi–model approach to assess water resources availability and variability across Kenya, Ghana and Malawi.

Assessing water resources availability and variability is the first necessary step to address water and food security in regions relying mostly on rainfall for agriculture and drinking. The objective of this project is to assess water availability and variability in the drylands of Kenya, Ghana, and Malawi.

The overarching research questions are:

- Which modelling tools, spatial and temporal scale are needed for reliably assessing water availability and variability for water and food security in data scarce regions?

- How does the spatial and temporal distribution of water resources vary across and within Kenya, Ghana, and Malawi?

- How does the water availability and variability impact on water and food security and on the ecosystem services?

We rely on a wide series quantitative research methods (e.g., time series analysis, hydrological modelling, and uncertainty analysis) focusing on the hydro-meteorological variables which are key to assess water availability and are proxies for assessing food security (e.g., soil moisture, streamflow, evapotranspiration, and groundwater).

Team members:

- Daniela Anghileri - UoS
- Bernard Mingoungou - AGRHYMET
- Catherine Tlotlo Kerapetse - WaterNet
- Mawuli Dzodzomeyo - UoG
- Cosmo Ngongondo - UNIMA
- Mathews Tsirizeni - LEAD
- Sospeter Wekesa - TUK
- Oscar Kambombe - UNIMA
- Justin Sheffield - UoS
- Luke Olang - TUK

Ephemeral river in Kenya

Managing invasive shrub species for enhanced social livelihoods in Turkana drylands of Kenya

Turkana County is the largest, most arid and least populated county in Kenya. It experiences perennial drought, water / food scarcity and has a fragile ecosystem exacerbated by climate change drawbacks. Furthermore, its ecosystem is ravaged by a prolific invasive shrub species called Prosopis juliflora that extensively covers the county. This shrub has deep roots that outcompete other plants for water and aggravates the food-crop water stress in dryland ecosystems. It also grows into dense impenetrable thickets that cover other plant types and mostly scorches out the grasses that are vital for pastoralists' livestocks.

This SRP will quantify the spatial-temporal distribution of the shrub in Turkana County. It will further determine best practices of harvesting the shrub for human consumption (e.g. fuelwood and timber) and consequently reduce its growth. This project will have positive impacts on environmental restoration, increased livestock fodder and livestock products, and added local incomes from exploitation of the shrub.

Team Members:

- John Obiri - Masinde Muliro University of Science and Technology, Kenya
- Namenya Daniel Naburi - Masinde Muliro University of Science and Technology, Kenya
- Kaleb Mwendwa - Masinde Muliro University of Science and Technology, Kenya
- Jadu Dash - University of Southampton, UK
- Meryl Jagarnath - University of Southampton, UKFrancis Oloo - Technical University of Kenya
- Sosten Chiote - University of Malawi

Rural Turkana dwellings

Trends in climate variability, land use change, watershed governance and implications on food security in the dryland of Suam River Basin, West Pokot County, Kenya

In Kenya, it has often been easier for the central government to decentralize powers to the county governments than to ensure that the county governments have needed resources, capabilities and accountability necessary for river basin management. Drylands of Suam River basin in West Pokot County is highly vulnerable to climate variability and change risks such as droughts and floods, leading to high levels of poverty, land degradation and human conflicts that results from completion over scarce water and pasture with the neighboring Turkana and Karamoja communities in Kenya and Uganda. Livelihood transition as an adaptation strategy from pure nomadic to agro-pastoralism has also increase pressure on marginal lands and human conflict between the pastoralist and agro-pastoralist communities. The understanding of climatic and land use-cover change patterns, responsive changes in the social structures together with governance will lead to proper planning of pastoralist and agro-pastoralist activities, and land use management. The study will provide strong evidence from field experiences leading to capacity building and implementation of an oriented research to influence policy dialogue, decision making and investment priorities in the basin.
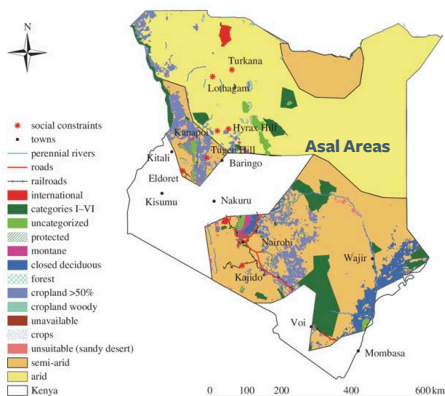
Team Members

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- Chengxiu Li - University of Southampton, UK
- Daniela Anghileri - University of Southampton, UK
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- Oscar Kambombe - University of Malawi

Chepareria area West Pokot by Everlyne Obwocha

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Determining resilience attributable bio-physical, social/gender, economic and political factors that influence Food and Water Security in ASALs of West Pokot and Turkana Counties-Kenya

Map Of Kenya Showing The Semi-Arid And Arid Lands

Food and Water Insecurity is a defining characteristic of the Dry Land Ecosystems in Kenya. ASALs in Kenya include expansive rangelands where pastoralism is mainly practiced and appproximately 10 million people there (See Map). Despite strategies for food security, deficits continue to recur in years of prolonged drought and floods. Several studies indicate that climate threats, degradation of natural resources, water scarcity, and conflicts are among the key drivers of food insecurity in Kenyan ASALs. People's livelihoods are affected ranging from structures and processes that include local institutions or customs that control access to assets e.g. land and water points. There is gender-based discrimination by different institutions that may take the form of policy and law that either enhances or undermines local livelihoods strategies. Resilience is built on flexibility, coping, community empowerment and stakeholder engagement. This in the long-term can help reduce frequent conflicts, famine, and instability and loss of life that is experienced within and between these counties. Thus the aim of this Small Research Project is (SRP) to determine the resilience attributable bio-physical, social/gender, economic and political factors that influence Food and Water Security in ASALs of West Pokot and Turkana Counties-Kenya.

Fish from Lake Turkana

Possible impact will be shown and described by:

- The availability of evidenced based data on water and food security to most Households and livestock.
- Mapped water and food insecurity areas using GIS.
- Reduced level of environment degradation and improved Forest/Tree cover.
- Adaptation of Sustainable Land Management in the two counties.

Team members

- John Obiri - BRECcIA Co-I MMUST
- Namenya Daniel - MMUST PDRA
- Agevi Humphrey - MMUST Scientist
- Sospeter Wekesa - Research Assistant-TUK
- Raphael Ongunya - Agriculturalist (MMUST)
- Jibril Mohammed - ASAL Stakeholders Forum-Online Consultation
- Andrew Omam - Research Assistant (KFS)

Armed guards protecting their fish, boats and cattle

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Assessing the contribution of soil properties on dry spell vulnerability and food insecurity in Malawi

In the context of extreme weather events, dry spells are increasingly affecting agricultural production. The effects are more pronounced in a country like Malawi that is heavily dependent on rain fed agriculture. In addition to meteorological inputs like amount of precipitation, site specific characteristics such as soil properties affect vulnerability of an area to dry spells, as they determine water availability in the root zone of plants. Therefore, this study maps and identifies areas vulnerable to dry spells in relation to soil properties and linking to agricultural production. The results of the study are expected to provide information that will help reduce vulnerability to dry spells by identifying areas suitable for crop production, and thus contributing to food security. Furthermore, the results will help policy makers, private and public institutions in formulating site-specific adaptation strategies and prioritizing adaptation investments to the most vulnerable dry spell hotspots.

Team Members

- Ellasy Gulule Chimimba - University of Malawi
- Cosmo Ngongondo - University of Southampton
- Chengxiu LI - University of Southampton
- Henry Hunga - University of Malawi
- Daniela Anghileria - University of Southampton
- Francis Oloo - Technical University of Kenya
- Tendai Polite Chibarabada - Waternet
- Levis Eneya - University of Malawi
- Maurice Monjerezi - University of Malawi

*A dried maize field in Balaka (2011 -12 crop season)
Photograph: Oxfam*

Building capacity for food and water security policy Kitui and Wajir counties of Kenya

I will be addressing the challenge of policy uptake within food and water security, focusing on Kitui and Wajir counties of Kenya. In the Kenyan context there are a number of policies addressing food and water security in the drylands. In the context of the current devolved system of governance, county governments are now required to develop their own food and water security policies. This process has been slow. Some of the challenges have included policies not being implemented and others not based on scientific evidence. Moreover, a number of policies have been developed by external consultants who provide expertise and draft policies without creating institutional memory within the local organizations. This project seeks to address this by investigating the capacity gaps county level policy makers face and developing interventions to address them. This will be done through engagement with policy makers at both county and national level .

Team

- Fiona Ngarachu - Kenyatta University
- Daniel Naburi - Masinde Muliro University of Science and Technology
- Claire Bedelian - International Institute for Environment and Development
- Tendai Chibarabanda - Waternet
- Kate Vincent - Kulima
- Chris Shisanya - Kenyatta University

Image: Road water harvesting in Kitui county, which could be scaled up with appropriate policy interventions

Aims and potential impact of Resilience SRP

Using applied community based anthropological field methods, my research project aims at generating information that will help understand why communities supported with food and water security interventions via NGOs and government are not developing resilience to food and water related shocks in Malawi. Prospective impacts of this research will be achieved through stakeholder engagement throughout the study to provide them an opportunity to learn and understand socio-economic and cultural dynamics that affect adoption and use of resilience interventions; suggesting recommendations based on the findings to policy stakeholders on designing and implementation of interventions in tandem with local needs and aspirations to enhance efficiency in resource allocation towards the interventions; as well as providing a platform for stakeholder engagement (together with community members) to allow dialogue based on research findings for stakeholders to discuss and agree on feasible designing and implementation of resilience interventions to increase their effectiveness and sustainability.

Early Career Researchers involved

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Assessing wellbeing outcomes of women Shea processors in Northern Ghana

Women picking up shea nuts

Shea production in the drylands of northern Ghana help reduce poverty through local sale and exports. It as well increases food security among the population by providing income for subsistence. The Shea tree has characteristics that make it a resistant crop to climate variability and change, and its genetic diversity gives it high spontaneous adaptive capacity and enables domestication. For women in the West Gonja district of northern Ghana, the sale of Shea - processed or unprocessed, is integral to women's generation of cash income.

This study aims to understand the gendered division of labor within the Shea market value chain, focusing on how the specific roles of women from nut gathering, crushing, processing into oil and/or for sale locally and internationally as well as only picking for large scale buyers, influences the wellbeing of the women who are the primary source of the raw material in Shea production (Shea nut).

Team Members

- Gertrude Frimpomaa Owusu - University of Ghana
- Rahinatu Sidiki Alare - University for Development Studies (Navrongo)
- Moses Asamoah - University of Ghana
- D. Yaw Atiglo - University of Ghana
- Caesar Agula - University of Ghana

Co-I Mentors

- Samuel Codjoe - University of Ghana
- Laura Lewis - University of Southampton
- Mawuli Dzodzomenyo - University of Ghana
- Katherine Vincent - Kulima Integrated Development Solutions

Analysis of National Seed Policies for Malawi (2018) and Kenya (2010): implications for water and food security resilience building in drylands
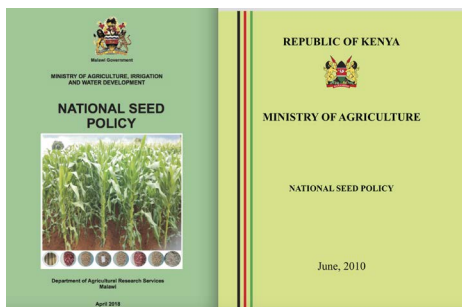
In agriculture seed has the highest ability to limit production and this has been complicated by climate variability. Two seed systems, formal and informal, exist in Malawi and Kenya. The formal seed system is mainly comprised on the multi-national companies where as the inform seed system is traditionally managed by farmers with some support from Farmer Organisations and NGO's. The formal seed sector only supplies 20% of the seed planted by farmers mostly maize compared to 80% from the informal system. Since 2010, African

governments through COMESA and SADC have moved towards regional integration of the seed industry through harmonised policies and regulation system. The recent policies that have been developed with regional integration in mind have not recognised the informal seed sector giving it minimal attention and not regulated. The research would like to understand the events that have led to this situation, who were the champions of the change and how could they be influential for future changes? what was the evidence used to make the shift? is the current policy able to build resilience among smallholder farmers? Capacity to implement and the potential Impact of the policies will also be assessed together with the coordination of the various stakeholders within the policy system. Cross country comparisons between Malawi and Kenya will be done and lessons drawn from both countries for policy design and implementation improvements. The research will be critical for future policy reviews within the agriculture sector and other sectors to ensure greater inclusion and policy impact.

Team Members

- Henry Hunga (Lead Researcher) - University of Malawi, Malawi
- Fiona Ngarachu (Co-Researcher) - Kenyatta University, ,Kenya
- Frank Musa (Co-Researcher) - University of Malawi, Malawi
- Tendai Chibarabada (Co-Researcher) - WaterNet, Zimbabwe
- Genevieve Agaba (Co-Researcher) - University of Southampton, UK
- Kondwani Makoko (Co-Researcher) - Department of Agricultural Research , Malawi

Mentors

- Mangani Katundu
- Christopher Shisanya
- Kate Schreckenburg

Comparative analysis of mainstreaming climate information services used for water and food security in the drylands of Malawi, Ghana, and Kenya: supply versus demand

Climate variability has greatly affected livelihoods in many part of sub-Saharan Africa where 90% of the agriculture is rain-fed. The impacts are more pronounced among the most vulnerable groups within the affected communities due to their low adaptive capacity to climate shocks. Intra-gender differences have also been known to shape the adaptation options and adaptive capacity of communities. Over 75% of the African population resides in rural areas with the agriculture sector (crops and pastoralism) contributing between 10% and 70% of national GDPs. The impact of climate variability has been more visible in Arid and Semi-Arid Lands (ASALs) covering up to 66% of Africa's land and home to more than 200 million people. Maize harvest losses due to drought are significant, up to 27%, 25%, and 7% for Malawi, Kenya, and Ghana respectively. Agro- and hydro-meteorological information provided on a seasonal and decadal time-scales can improve integrated farm and water resources management through proper timing and timely decision-making in climate sensitive sectors. Although there is strong evidence that Climate Information Services improves early warning and farm calendar planning there exist institutional and implementation challenges in most African countries. Other challenges include lack of co-production and co-management of climate information services among different sectors. This is due to weak linkage between the supply side and the demand side. In addition, the research work on CIS has mostly been towards impact assessment-driven methods (science first) and not generating information for adaptation decisions (policy first). The research project will assess: the existing institutional, implementation and governance arrangements, type of products produced (supply side) and how they are transmitted to end users (demand side), how the CIS products inform

extension delivery and decision making on a seasonal farm calendar basis, link to existing resilience building agricultural interventions, and level of CIS integration into development planning at national and local government level to build household water and food security.

Team members

- Henry Hunga (Lead Researcher), University of Malawi, Malawi
- Daniel Namenya (Co-Researcher), Masinde Muliro University of Science and Technology, Kenya
- Yaw Atiglo (Co-Researcher), Ghana University, Ghana
- Frank Musa, (Co-Researcher), University of Malawi, Malawi
- Gertrude Owusu (Co-Researcher), Ghana University, Ghana
- Eunice Shame (Co-Researcher), LEAD-SEA, Malawi

Mentors

- John Obiri, Musinde Muliro University of Science and Technology
- Mangani Katundu, University of Malawi
- Gilbert Ouma, University of Nairobi

Land cover changes and runoff assessment at sub-basin level: A SWAT + application in the drylands of Malawi

The study aims to use geospatial data to quantify catchment runoff as well as determine the effects of agricultural lands on water quality and quantity across lake Chilwa basin in Zomba catchment of southern Malawi. There is limited understanding of hydrological implications of land use dynamics on water quality and quantity at sub catchment level. The project will lead to better management of lands and water resources for improved livelihoods among the local communities through the use of an integration of a hydrological SWAT + model, remote sensing and some traditional water quality testing. A concise conclusion on variations of catchment waters enhances planning and management of water resources. The quality of water speaks directly to the quantity safely available for food production. An interdisciplinary collaborative research for an impactful research for all stakeholders thus intended beneficiaries and researchers is the broader aim of the study.
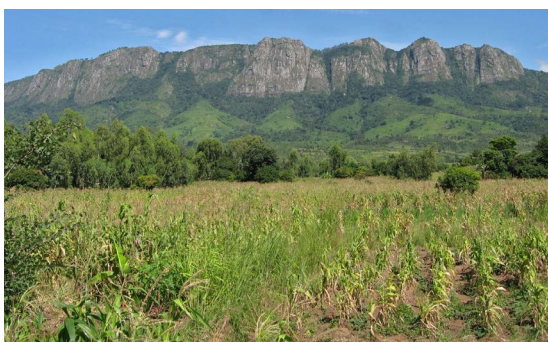
Team Members

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- Chengxiu Li
- Oscar Kambombe
- Tendai Polite Chibarabada

Co-Is
- Prof. Jean-Marie Kileshye-Onema
- Prof. Maurice Monjerezi

Zomba Plateau

Capacity building and variability in the drylands of Ghana and Kenya

This research and research capacity building project takes a community-engaged approach to researching equity, resilience and livelihoods within the context of land restoration interventions in Ghana and Kenya. We are working in Talensi district in Upper East Region of Ghana and Kitui County in Kenya. With stakeholders we aim to co-design and co-produce research that will inform land restoration policies and strengthen land restoration interventions. As part of our commitment to research capacity building we are facilitating participatory research skills training workshops for local researchers and development practitioners. This includes the workshop we held from 3-6 June in Bolgatanga, Ghana. The workshop participants, which included stakeholders from government and NGOs, directly contributed to our project's scoping phase as participants engaged in data collection using the tools (e.g. transect walks, semi-structured interviews, natural resource mapping,) that we provided in-class instruction on.

Team members

- Matt Kandel
- Genevieve Agaba
- Fiona Ngarachu
- Yaw Atiglo
- Meryl Jagarnath
- Rahinatu Alare
- Thomas Addoah

On-farm transect walk with workshop participants

Participants with workshop completion certificates

An assessment of flooding from dam releases and its impacts on diarrhea disease and microbiological contamination of water sources and vegetables in selected dryland areas in Northern Ghana

Bagre Dam

The annual scheduled release of water from the Bagre Dam on the White Volta in the Northern parts of Ghana results in significant downstream damage to farmlands and property with attendant public health issues. For the past two decades, such water releases have resulted in livelihood losses among affected communities. This aim of this study is to assess the impact of this perennial flooding on microbiological contamination of water sources and field vegetables using laboratory sample testing of pre and post dam release and diarrhoeal disease patterns and adaptive behaviors in affected communities in the Upper East Region of Ghana, which happens to be the entry point of the White Volta. The study hopes to generate evidence that could inform policy (e.g. quantifying the potential benefits of constructing a 'holding' dam to retain water releases within Ghana), identify adaptive behaviors could serve as improved resilience strategies in affected communities and make recommendations on water safety management to improve public health outcomes.

Team Members

- Mawuli Dzodzomenyo - University of Ghana
- Moses Asamoah - University of Ghana
- Duah Dwomoh - University of Ghana
- Chengxin Li - University of Southampton
- Sam Codjoe - University of Ghana
- Gertrude Owusu Domfeh - University of Ghana
- Joy Obando - Kenyatta University
- Jim Wright - University of Southampton

Co-I Mentors
- Sam Codjoe - University of Ghana
- Joy Obando - Kenyatta University
- Jim Wright - University of Southampton

Water harvesting technologies as resilience strategy for sustainable water and food security in dry land areas of Ghana

Over-reliance on rainwater for agriculture and domestic use is threatened by climate change/variability and other environmental stressors and drylands are most susceptible due to single maxima, short, limited and unpredicted rainfall patterns which affects water availability and utilization. Water harvesting and management systems are therefore vital resilience strategies for sustainable water and food security in dryland areas with the ultimate goal of improving food and water availability. This study aims to assess the utility and duration of harvested water use for irrigation and domestic purposes, and its implications for public health and crop productivity in the Upper East Region of Ghana. Study results will be used to inform policy on technology desirability, local innovation and adoption, resilience options and scaling up of good practice among smallholder farmers as an intervention strategy to meet community resilience for year-round cultivation and use.

Team Members:

- Mawuli Dzodzomenyo - University of Ghana
- Moses Asamoah - (University of Ghana
- Duah Dwomoh - University of Ghana
- Yaw Atiglo - University of Ghana
- Gertrude Owusu Domfeh - University of Ghana
- Jadu Dash - University of Southampton
- Jim Wright - University of Southampton

Co-I Mentors:

- Jadu Dash - University of Southampton
- Jim Wright - University of Southampton

Women fetching water from a well - Wayne Miranda

Food Beliefs and Food Security amidst Climate Change in Drylands of Northern Ghana

This research aims to understand the implications of food beliefs for food security amidst climate change impacts in dryland communities of Northern Ghana. Food beliefs refer to individual and societal concepts about food preferences. The study seeks to employ participatory learning and action to investigate how people's local food beliefs and cultural norms change or how the navigate their livelihoods to maintain their food beliefs to ensure food security in a changing climate.

An expected outcome is to inform agricultural and food policy and decision makers in the Northern Savanna agroecological zone to incorporate local food beliefs into food security programmes and interventions. Another expected outcome is to facilitate engage community members to identify challenges and opportunities associated with the local food belief systems and to encourage attitudinal and behavioural changes to consider the impacts of climate change on community food security.

Team Members

Lead

- D. Yaw Atiglo

Co-I Mentors

- Prof Samuel N. A. Codjoe
- Prof Laurie Lewis

Co-I Investigator

- Dr Mawuli Dzodzomenyo
- BRECcIA GH ECRs:
- Moses Asamoah
- Getrude Owusu Domfeh

Stakeholder Partners

- Rahina Alare
- Caesar Agula

Other stakeholders

(one from each from sampled community) will be actively engaged throughout the research period

Spatial climate change vulnerability assessment of livelihoods in the drylands of Ghana, Kenya and Malawi

This research aims to explore the vulnerability of agricultural and rangeland production system livelihoods to climate variability and change across the gradient of dryland socio-ecological systems (i.e. dry sub-humid, semi-arid and arid) in Ghana, Kenya, and Malawi. This study will quantify vulnerability indices in terms of exposure, sensitivity and adaptive capacity to identify where populations are most at risk (hotspots) and the potential factors that contribute to climate change vulnerability under different socio-ecological systems, and the implications for food and water (in)security. This information will help policymakers target climate adaptation policy in drylands. The overall impact of this work is to inform regional solutions to tackle food and water insecurity challenges under climate variability and change, with Malawi, Kenya and Ghana acting as leaders in their specific regions of southern, eastern, and western sub-Saharan Africa.

Team Members

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Matt Kandel - University of Southampton
Henry Hunga - University of Malawi
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Chris Hill - University of Southampton
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John Obiri - Masinde Muliro University of Technology

Vegetable garden in Malawi

Borehole in Malawi

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