

6. Drivers and Determinants of Food Loss, Aflatoxins and Impacts on Nutrition and Health

This project aims to assess the key drivers and determinants of food loss and food safety, with a particular focus on aflatoxins in maize, and their impacts on nutrition and public health in Tanzania.

Research questions to be explored through this project include:

- What are the key agronomic and socioecological determinants of food loss, aflatoxin contamination and nutritional value of maize in Tanzania?
- How do CSA innovations influence aflatoxin contamination of fodder/feed for livestock and cow's milk?
- What are the implications of the food loss and aflatoxin exposure on children's stunting and women malnutrition?
- What are the main causes, aflatoxin contribution and current constraints to reducing maize post-harvest losses in Tanzania?
- What are the key targets for policy innovation?

Alongside the Household Vulnerability Survey, this research will collect maize samples from a subset of households across the agro-ecological zones. This research component will also focus on the CSA innovations promoted in the Farmer Field Schools established across eight villages by the EU funded GCCA+ programme.



Former Hon. Minister Dr. Charles Tizeba (centre), during the Tanzanian launch of the GCRF-AFRICAP programme

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Samples will be collected by trained in-county field and lab assistants, supported by project Postdoctoral Researchers from University of Leeds. Cattle forage, milk and manure compositional analysis, and aflatoxin contamination will be analysed in-country.

This project will additionally use climate projections to model key determinants for aflatoxin contamination, including temperature, humidity, soil and storage conditions. This research will assess these impacts on aflatoxin contamination of maize, at pre- and post-harvest stages, and validate model projections using existing available data and from empirical data gathered through the Household Vulnerability Survey.



Trialing methods for soil sampling

Across AFRICAP research, we will build on existing partnerships with the National Meteorological Agency, Agricultural Research Centres and Universities in Tanzania by:

- Jointly developing and running applied research projects
- Running and providing bursaries for Tanzanian and UK scholars to attend bespoke research training courses
- Developing and disseminating research outputs through joint research-policy forums

AGRICULTURAL AND FOOD-SYSTEM RESILIENCE: INCREASING CAPACITY AND ADVISING POLICY

GCRF-AFRICAP IS AN INNOVATIVE PROGRAMME OF WORK FUNDED BY THE UK GOVERNMENT'S GLOBAL CHALLENGES RESEARCH FUND.

AFRICAP is a 4-year programme focussed on increasing capacity and advising policy on 'Agricultural and Food-System Resilience' working in Tanzania, Malawi, Zambia and South Africa. AFRICAP focusses on improving evidence-based policy making and will identify and implement **evidence-based policy pathways for sustainable, productive, climate smart agricultural systems.**

AFRICAP was launched in Tanzania by Former Hon. Minister of Agriculture Dr. Charles Tizeba, on 19th September 2018.

Facilitated by the Economic and Social Research Foundation (ESRF), AFRICAP will collaborate with a range of delivery partners, working in the field to collect data, design and implement policy.

In addition, we will run policy engagement activities to co-design and communicate the research work, with the aim of translating it into effective policy pathways.

Through a series of collaborative projects, AFRICAP research in Tanzania will focus on the following six integrated research strands, involving study across national, regional and local levels:

1. Climate-Smart Food Systems Policy Evaluation
2. Climatology and Climate Change Science for Agricultural Development
3. Innovation and Intervention Approaches for Climate-Smart and Resilient Agricultural and Food Systems
4. Agro-ecological Evaluation of Climate-Smart Agriculture Practices
5. Household Vulnerability to Climate Change Across Agro-climatic Zones
6. Drivers and Determinants of Food Loss from Aflatoxins, and Impacts on Nutrition and Health

In-country work involves interdisciplinary research on farming systems, from soils and plant, nutrition and livestock sciences to ecology, climate, political and social sciences.

Local-level fieldwork will focus on Tanga Region.

Tanga Region is diverse, with multiple agro-ecological zones and all five of Tanzania's agro-climatic zones represented.

Tanga Region provides an interesting context in which to generate evidence to feed into District and Regional level planning, the National Climate-Smart Agriculture Learning Alliance and associated policy fora.

Within the uplands of Tanga Region, over the past ten years there have been two significant initiatives aimed at piloting Climate-Smart Agriculture (CSA) approaches:

- The CGIAR Climate Change, Agriculture and Food Systems (CCAFS) 'Climate Smart Village' in Lushoto District, and
- The Muheza District Eco Village project, implemented through the Integrated Climate Change Adaptation and Resilience Programme – led by the EU initiated - Global Climate Change Alliance+ (GCCA+).

These programmes collectively cover a broad range of trialled CSA practices and approaches to research design and innovation diffusion.

Case study investigation of these two CSA-programmes will complement broader study of agricultural and food system developments, climate, development and policy context in Region and beyond.

1. Climate-Smart Food System Policy Evaluation

This research will evaluate the extent to which the current environment and development policy landscape in Tanzania includes and enables the introduction of CSA approaches, which are critical in enhancing the resilience of the agricultural sector of Tanzania to the effects of climate change.

Research questions to be explored through this project include:

- To what extent Tanzania is considering CSA as a suitable approach to make the agriculture sector resilient to the effects of climate change and to address food security and economic development?
- How are the international framings of CSA reflected in Tanzania's key policy processes in terms of the practices, technologies and implementation tools that are advocated?
- How consistent and compatible are CSA ambitions across relevant sectoral policies in Tanzania?
- What are the main drivers for CSA policy development in Tanzania? Who are the key actors involved and what is their level of participation and influence in the final policy decisions and approaches to implementation?

Through a combined approach of desk-based literature review and key-informant interviews, the project will explore the processes by which policy is made and implemented in Tanzania, in order to understand which actors and what priorities are shaping adaptation and mitigation actions.



Tea plantations in the Usambara Mountains

2. Climatology and Climate Change Science for Agricultural Development

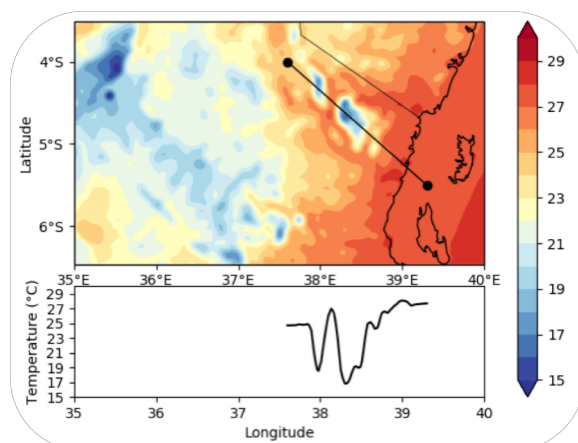
At the national level, work thus far has examined how well current high-resolution climate model captures key aspects of Tanzania's present day climate, including:

- Temperature fluctuations
- Onset of seasonal rainfall
- Rainfall levels
- Extreme rainfall events

Next, future climate model predictions will be accomplished with the use of a high-resolution, convecting-permitting model.

We will examine the impacts of future climate change on climate indicators most relevant to the main food crops in Tanzania, and the mechanisms behind observed changes. Findings from this research will help understand whether Tanzania's climate will become more or less favourable to staple food crops, supporting adaptation planning to future climate change.

Using the diverse orographic landscape of Tanga Region as a case-study, we will explore the effectiveness of the latest climate models to predict the climate at the regional level in Tanzania. This will support examination of the impacts of climate change on the different agro-climatic zones, such as whether agro-climatic zones will expand, contract or shift in location.



Example of a climate transect across Tanga Region

3. Climate-Smart Agriculture Innovation and Intervention approaches

This project focuses on the social science dimensions of CSA innovation and intervention in Tanzania.

The following research questions will guide the research:

- What does climate-smart innovation look like?
- How are interventions (e.g. CSA programmes) being framed, designed, tested and implemented; why, and by whom?
- How effective, efficient, equitable and legitimate are CSA interventions perceived to be?
- What social and institutional arrangements and opportunities exist to stimulate learning and knowledge creation on CSA?
- What barriers to learning and knowledge creation remain and why?

At national level, the project will explore how CSA-related policies may be adapted to best suit the priorities of smallholder farmers. Specifically, looking at how CSA intersects with gender – exploring the priorities and constraints faced by male and female smallholders and the socio-cultural norms that shape their agricultural decisions.

Across the eight GCCA+ programme villages and CGIAR-CCAFS 'Climate Smart Village' of Tanga Region, **research methods will include:**

- Semi-structured key informant interviews with Regional (Tanga) and District (Muheza and Lushoto) authorities, donors and programme/project implementers
- Questionnaires and social network analysis to examine farmers' information sources, socio-economic attributes and adoption of agricultural practices and processes of agricultural innovation
- Semi-structured interviews and focus-group discussions with a subset of farmers to examine their communication and understanding of agricultural innovations



Soil samples, ready for analysis

4. Agro-Ecological Evaluation of Climate-Smart Agriculture Practices

This project will examine the impact of CSA initiatives on a number of key performance indicators, using an agro-ecological systems lens.

Research will focus on the Farmer Field Schools established across the eight villages by the EU funded GCCA+ programme in Muheza District.

The project brings together multidisciplinary researchers to develop and implement a suite of biophysical methods that will examine how CSA innovations impact the following:

- Soil structure and moisture retention, carbon storage and availability of key nutrients (N,P,K)
- The effect of soil structure and nutrients on crop production and forage quality
- The biodiversity of species that are both beneficial and harmful to maize and intercrop production

Biophysical samples will be collected by trained in-county field and lab assistants, supported by project Researchers from University of Leeds. Soil traits and plant assays (including mycorrhizal fungi root colonisation) will be analysed in-country.



Participatory research with farmers

5. Household Vulnerability to Climate Change Across Agro-climatic Zones

This research aims to evaluate the vulnerability and resilience of farming households, their agriculture production systems, and food and nutrition security to climate change. Sampling will take place across the agro-climatic zones of Tanga region, aligning with the climate science project component.

A Household Vulnerability Survey has been designed to collect data on household demographic information, employment, assets, crop and livestock production systems, post-harvest practices, gender, household nutrition, aflatoxin awareness and household responses to climate shocks.

We aim to sample approximately 400 households in Tanga Region.

Basic anthropometric measurements of women and children aged 2-5 years old in the households will also be collected, to measure levels of malnutrition.



Tree Nurseries in the Usambara Mountains