Uncertainty reduction in Models for Understanding deveLopment Applications – UMFULA project

IMPROVING CLIMATE INFORMATION FOR DECISION MAKING – UPDATE 4 (October 2017)

http://futureclimateafrica.org/UMFULA

UMFULA will generate higher quality, more useful information about the future climate and its impacts, and to make climate information more tailored and accessible to planners. The Malawi UMFULA team continues to research the demand for climate services and opportunities for using climate information in planning. In the last six months research visits led by several of our non-Malawi-based team members took place in June and July 2017.

ACTIVITIES SINCE APRIL 2017

1. Scoped the nature of climate information that is of particular interest to the agricultural sector.
2. Commenced pre-investigation of gender, decision-making and climate information needs among sugar outgrowers in Chikwawa, to be continued in November 2017.
3. Continued development of an open-access 'Water Evaluation And Planning' (WEAP) model to assess water availability under changing climatic and non-climatic factors. Model development is in consultation with and validated by key stakeholders across water resources, agriculture, hydropower and environment.
4. Developed a climate change profile for Malawi (comprising 2 page summary, brief and annex), based on discussions with the Department of Climate Change and Meteorological Services, who identified the preferred content and format for information.
5. Undertaken additional surveys on capacity with government staff to inform a multi-country analysis of institutional structures to address climate change.
6. Undertaking analysis of studies from Balaka, Machinga and Thyolo assessing resilience impacts of Conservation Agriculture practices in influencing maize yields in the 2015/16 El Niño drought.
7. Engaged tea sector stakeholders in Thyolo & Mulanje to identify climate metrics important for tea production and quality. Collating daily climate records to assess resilience of tea production to climate variability.
8. Maintained links with related projects and programmes (including the Global Framework for Climate Services) to ensure ongoing synergies & gained follow-on funding via GCRF-AFRICAP project (Leeds / LUANAR DARS).

PUBLICATIONS AND OUTPUTS (all available at www.futureclimateafrica.org/UMFULA)

Video clip-Role of capacity building for development and implementation of climate change adaptation programmes and policies in Malawi by Diana Mataya

MSc dissertation-Role of capacity building for development and implementation of climate change adaptation programmes and policies in Malawi by Diana Mataya (University of Leeds)

Video clip-UMFULA social science research, and investigations into the effectiveness of conservation farming in drought by Andy Dougill

Video clip-The role of land cover and climate change in flood mitigation by Emmanuel Likoya

Video clip-Approaches to climate change policy and adaptation in Malawi by Dorothy Tembo-Nhlema

Video clip-Applying decision-making under uncertainty approaches to water resources by Ajay Bhave

Briefing paper-How to understand and interpret global climate model results by Declan Conway, Katharine Vincent, Sam Grainger, Emma Archer van Garderen and Joanna Pardoe

Publication-Climate risk and vulnerability: A handbook for southern Africa (2nd edition) edited by Claire Davis-Reddy and Katharine Vincent

Publication- Evaluating climate models with an African lens by Rachel James, Richard Washington, Babatunde Abiodun, Gillian Kay, Joseph Mutemi, Wilfried Pokam, Neil Hart, Guleid Artan and Cath Senior

PLANNED ACTIVITIES

1. UMFULA's team meeting will be held in Malawi 28 Oct-2 Nov. Various activities are planned, including an open panel discussion on "How climate information can build a resilient Malawi", 3-4.30pm on Tuesday 2 November, Capital Hotel, in partnership with LUANAR and CISONECC
2. Collaborative discussion forum on the Lake Malawi Shire River Basin with decision makers from agriculture, hydropower and environmental sectors – Monday 6 November.
3. MSc dissertation research (Emmanuel Likoya) investigating attribution of extreme flood events in the Shire river basin to climate change and land use and cover change.

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From a clean slate to multiple options – eliciting user needs for climate information in Malawi

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Introduction

Identifying user needs is a prerequisite to be able to produce timely, tailored and targeted climate information. However, so far little attention has been paid to the process of how best to elicit and define those needs. We reflect on the evolution of approach taken in Malawi within the UMFULA project, where the aim is to generate climate information to inform medium-term (5-40 year) planning and decision-making around the water-energy-food nexus.

Method 1: Clean slate

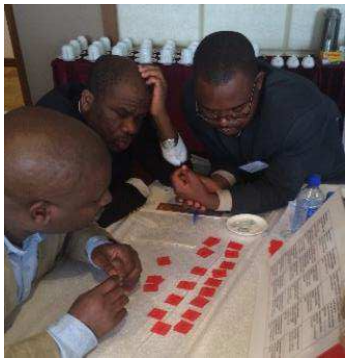
Rationale: To avoid science/ availability of information-bias.

Approach: User interviews to determine decision-making contexts, followed by workshop role playing of a parallel case study example with a selection of planning decisions across different timescales.

Finding: When applied to their own contexts, the resolution of potential needs was too general.

Challenge of the clean slate approach

The main challenge was poor resolution of needs: for example the clean slate approach identified interest in the increased occurrence of extreme events – but would not define the critical threshold for such events.



Method 2: Multiple options

Rationale: To increase resolution of information needs.

Approach: Multiple options informed by priorities and critical thresholds in the water and agriculture sectors. Metric options include those that currently exist, are possible to develop, or are impossible/ may never exist (but could inform proxies).

Finding: Investigating perceived utility and priorities is providing insights into specific parameters of useful climate information to inform planning.

Turning the clean slate approach on its head – multiple options

The climate metrics survey contains 31 potential options (plus space for additions) and requests priorities. It is being conducted with decision-makers in the agriculture and water sectors.

Factor
Probability of the rainy season being shorter in duration (and total rainfall declining)
Probability (and timing?) of dry spells within the rainy season – duration, severity, frequency of x threshold
Monthly rainfall totals
Number of days with heavy rainfall (over x mm per day)
Annual maximum rainfall amounts for various durations (1, 6, 12, 24, 48, 72 hours)
Maximum average intensities of extreme rainfall
Maximum consecutive dry days per season
Probability of temperatures exceeding x degrees – overall (in a season?)
Probability of daytime temperatures exceeding x degrees
Probability of daytime temperatures exceeding x degrees for y days in a row
Probability of night-time temperatures exceeding x

Conclusion

Our experiences of eliciting user needs highlight the importance of providing a meaningful context. This allows users to express their requirements and gauge the relevance of potential climate information. In turn this can inform development of effective climate services for planning.

Contact

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Role of Capacity Building for Development and Implementation of Climate Change Adaptation Programmes and Policies in Malawi

Diana Chanika Mataya, Katharine Vincent, Andrew Dougill

UNIVERSITY OF LEEDS

KULIMA INTEGRATED DEVELOPMENT SOLUTIONS

INTRODUCTION

To address capacity gaps, government, donors and NGOs have invested in different capacity building initiatives to enable adaptation in Malawi. However, there has been no rigorous academic assessment conducted to interrogate how the types, methodologies and designs of these capacity building initiatives influence the successful development and implementation of adaptation interventions in Malawi. This study addresses the gap in knowledge on the role and impact of capacity building on the development and implementation of climate change adaptation programmes and policies in Malawi.

METHODOLOGY

Qualitative data obtained was obtained from interviewing 12 government and non-government representatives of the National Technical Committee on Climate Change, and their supervisors.

Devastation of floods for humans, infrastructure and maize fields
Photo credit: Malawi PDNA, 2015

FINDINGS 1

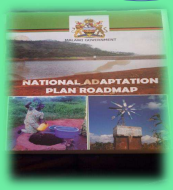
1. **Demand-driven training influences implementation more than supply-driven training** as it can be tailored to be context-specific, and targeted to the relevant people.

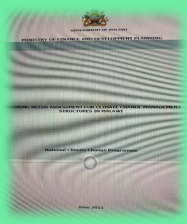
2. **Education and supply-driven training helps in design of interventions whilst demand-driven training helps in implementation of interventions.**

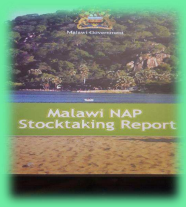
3. **Training effectiveness can be improved if**:
-Participants have inputs into the design and execution of training.
-Training needs assessments are undertaken.
-The training is tailored to the needs of participants.

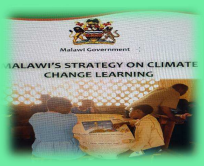
"When we are doing training internally, we have a chance where we contribute to the content of the modules, and most of the internal training are directly linked to the objectives of the programmes we are implementing as part of the donor funded programmes".
A government participant outlines the benefits of demand-driven training

Participants attending training
Photo credit: Climate System Analysis Group, University of Cape Town. April 2013









"In most of the training only 80% of my expectations are met. Other training lack substance on what practitioners do. It is full of theory".
An NGO participant describes training experiences

FINDINGS 2

Different training modalities have different objectives and can be used for different purposes Overall 50% of respondents had preference towards long-term education, 25% towards short term courses and 25% recognised the importance of using different modalities for specific needs. Whilst the first 2 training modalities are frequently used, there are others which are equally effective but are rarely used by practitioners such as e-learning, mentorship and reading research and publications such as the UN-CC: Learn. Low usage may indicate unawareness or challenges in accessing internet.

Participants recommended a combination of training approaches/tools/methods such as presentations, discussions, field practice, field visits, documentaries of best practices and expert talks with emphasis on tailored examples.

CHALLENGES AFFECTING TRANSLATION OF ADAPTATION TRAINING INTO PRACTICE

Challenges Relating to Training Design and Structure
-Supply-driven in nature, non-participatory delivery methods, lack of pre-training needs assessment which leads to non-tailored training.

2. Challenges Related to Participants
-Lack of direct link between training and the day to day work of participants.
-Some training is too theoretical.
-Pursuit of personal intentions and poor motivations for attending the training.

3. Challenges Related to Organisation Structure
-Lack of financial resources
-Bureaucracies, especially in government processes.
-Absence of enabling workplace environment which would allow junior officers to contribute innovative ideas to design of adaptation interventions.

CONCLUSION

These findings can be used to improve the design of training so that it effectively builds capacity to adapt to climate change in Malawi.

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Climate Information for Resilient Tea Production – CI4Tea

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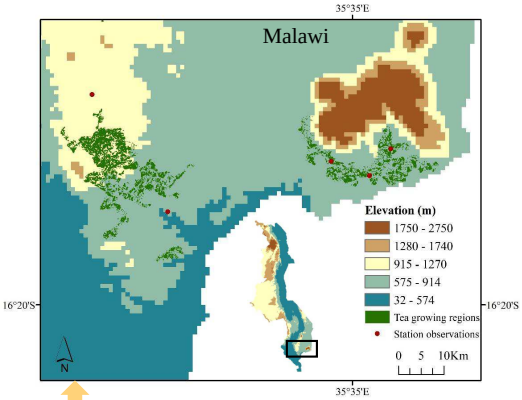
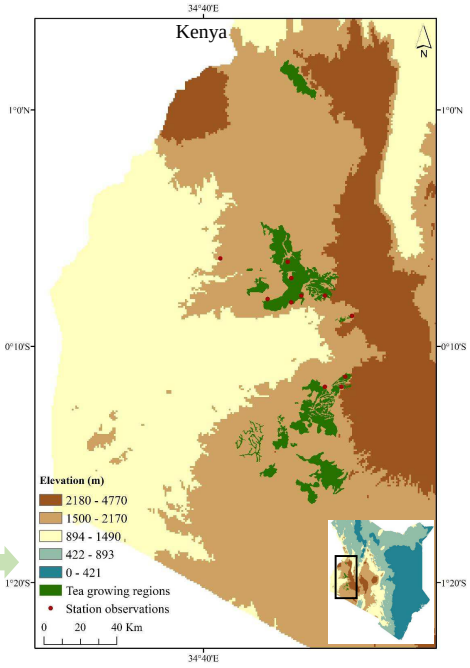
Tea is highly climate-specific plant, and the quantity and quality of tea production depends greatly on specific climatic characteristics. Climate change will alter tea production by affecting these characteristics. Tea is an important export commodity for Kenya and Malawi, where tea sector stakeholders understand the importance of factoring in the long-term risks of climate change. Therefore developing usable medium and long-term climate information that addresses the planning requirements of stakeholders is nationally and internationally important.

Aim

CI4Tea is a FCFA – ARF funded research project that aims to use a co-production oriented iterative process for producing tailored climate information for the tea producing regions of southern Malawi and western Kenya, and for exploring the potential for climate change adaptation options in the tea sector.

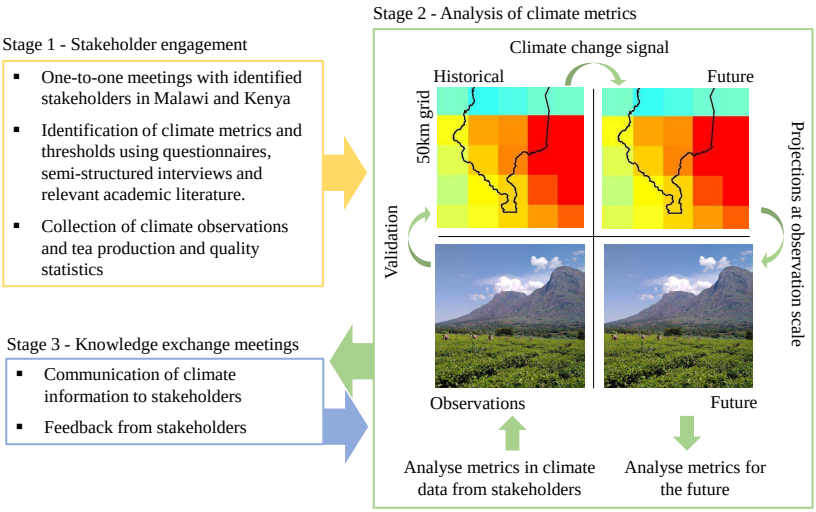


Mulanje and Thyolo are the two major tea growing regions in southern Malawi. Tea is grown at an altitude of 600-1200 m.a.s.l. Mean monthly rainfall ranges from 18-402 mm and temperature from 18-24°C.



The highlands west of the rift valley is the major tea growing region in western Kenya. Tea is grown at an altitude of 1500-2150 m.a.s.l. Mean monthly rainfall ranges from 31-175 mm and temperature from 11-17°C.

Methodology framework



Method

- Stage 1 – Stakeholder engagement for identifying key climate metrics and relevant thresholds affecting tea production and its quality.
  - One-to-one meetings held with identified stakeholders in Malawi and Kenya.
  - Identification of climate metrics and thresholds using questionnaires, semi-structured interviews and literature on tea production and quality.
  - Collation of daily climate observations from tea estates for Stage 2 of the method.
- Stage 2 – Analysis of identified climate metrics for observation stations using 29 bias corrected CMIP5 model simulations (50km grid for RCP8.5) and CP4-Africa simulations (4.5km grid).
  - Downscaling of CMIP5 model simulations at tea estate scale i.e. for the point observations available; using 'cumulative distribution function transform' (CDF-t) approach.
  - Preparing CDFs and analyses of identified climate metrics and thresholds for the observed period (1981-2010; could be different based on the data availability).
  - Presenting methodology and preliminary results for the observation period at stakeholder meetings for feedback.
  - Medium-term (2021-50) and long-term (2070-99) projections of climate metrics w.r.t. historical simulations (1981-2010).
- Stage 3 – Communicating climate information to tea sector stakeholders and gather feedback to identify adaptation options.

Current status

- We held one-to-one meetings with tea stakeholders (June 2017) to introduce the project.
- We are analysing stakeholder responses to questionnaires seeking information on specific climate metrics, thresholds for specific variables, and important months for tea quantity and quality.
- We have decided the climate data analysis method based on CDF-t which provides future climate information at point observation.
- We are chasing further climate observations from stakeholders to enhance the value of our research.

Future work

- Discuss the utility of chosen method with stakeholders and present results for the observed period. We will also elicit their preferences for communicating results on potential future changes for climate metrics and underlying uncertainty.
- Incorporate the feedback from the stakeholders into our analysis.
- Explore the potential for landscape-scale adaptations such as irrigation, shade trees, soil and water conservation, use of new varieties etc.

UTZ Better farming Better future · Finlays Since 1750 · Ethical Tea Partnership · KULIMA Integrated Development Solutions · KALRO Kenya Agricultural & Livestock Research Organization · Jomo Kenyatta University of Agriculture and Technology · Lilongwe University of Agriculture and Natural Resources · LUANAR · University of Leeds · Met Office · UKaid from the British people · NERC Science of the Environment · Future Climate for Africa

Expert-elicited climate narratives to characterize uncertainty in regional climate change

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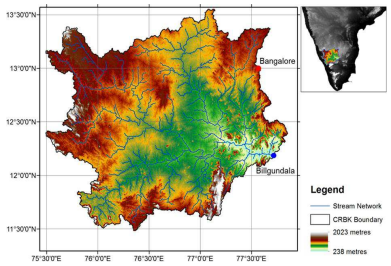
Summary

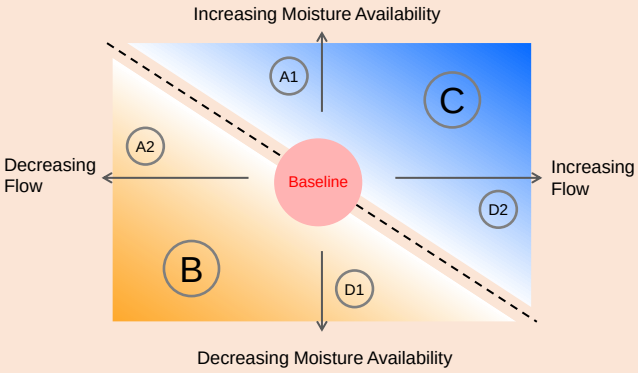
Knowledge about future climate change can inform adaptation decisions, but local rainfall projections are deeply uncertain. We used structured expert elicitation to construct qualitative narratives which describe physically plausible future rainfall changes at the regional scale. We applied this method to the Indian Summer Monsoon (ISM) in the Cauvery River Basin in Karnataka (CRBK), Southern India. We further aim to apply a similar approach in the Lake Malawi Shire River Basin (in FCFA-UMFULA). In India, experts identified two key drivers of ISM rainfall for the region; moisture availability over the Arabian Sea and strength of the low-level westerly flow. We developed six climate narratives as a function of the two drivers with the experts. Observed and re-analysis data showed that they account for almost 70% of the rainfall variance, indicating the usefulness of this relatively flexible and quick method to construct climate futures.

Objectives

- Develop a novel methodology that uses structured expert elicitation to identify key processes influencing regional rainfall to construct climate narratives: qualitative physical descriptions of plausible future evolutions of regional climate
- Assess the influence of drivers underlying the expert-derived climate narratives using observed and reanalysis data



Climate Narratives and Underlying Key Processes



Experts elicited two key drivers resulting in six climate narratives for the 2050s. The red circle indicates current baseline conditions. The diagonal dashed line divides the narratives into two areas; increasing rainfall (blue) and decreasing rainfall (yellow)

Narrative	Key Processes										Precipitation Change
	Arabian Sea/ Indian Ocean SST	Global Warming	Horizontal Tropospheric Temperature Gradient	Himalayan Snow Cover	Anthropogenic Aerosol Forcing	ITCZ movement northwards	Strength of Westerly Jet	Extent of irrigation	Influence of dry Northerlies	Influential Tele-connections	
A1	↑	↑	↑	↓	↓	↑	↑	↓	↓	La Niña	↑
A2	↓		↓	↑	↑	↓	↓	↑	↑	El Niño EQUINOO	↓
B	↓		↓	↑	↑	↓	↓	↑	↑	El Niño EQUINOO	↓
C	↑	↑	↑	↓	↓	↑	↑	↓	↓	La Niña	↑
D1	↓		↓	↑	↑	↓	↓	↑	↑	El Niño EQUINOO	↓
D2	↑	↑	↑	↓	↓	↑	↑	↓	↓	La Niña	↑

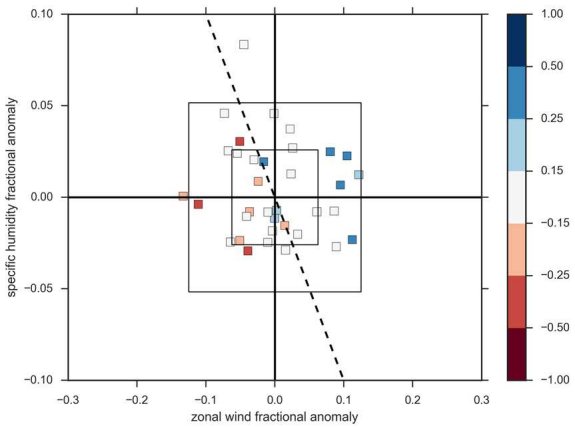
Key processes governing the Indian summer monsoon, including their expected future direction of change (increase, decrease or no change) for each climate narrative and expected precipitation change (includes large and small changes). Acronyms: ITCZ - Inter Tropical Convergence Zone; EQUINOO - Equatorial Indian Ocean Oscillation.

Example of a Climate Narrative – Narrative B

Narrative B describes future evolution of the ISM for a scenario of decreasing moisture availability and decreasing strength of flow coming towards southern India. Under these conditions, precipitation is expected to decrease due to the underlying plausible processes of cooling of sea surface temperatures of the Arabian Sea, weakening of the Westerly Jet, increase in anthropogenic aerosol forcing in the northern hemisphere (particularly in northern India), increase in irrigation in the Indo-Gangetic Plain which cools the land surface and decreases overall monsoon circulation, and greater influence of the El Niño and Equatorial Indian Ocean Oscillation teleconnections. Land use change and its effect on soil moisture content and evapotranspiration are expected to impact the spatio-temporal distribution of precipitation, which, although uncertain, is expected to be different compared to current conditions.

Climate Analysis

- We assessed the relative importance of expert-derived drivers for rainfall in the Western Ghats using observations and reanalysis data.
- We used proxies for the two drivers; specific humidity over the Arabian Sea for moisture availability and wind velocity for flow into the Western Ghats
- Figure: Percentage anomalies of specific humidity and low-level wind for ERA Interim (1979-2013) for July-August compared to a baseline period (1981-2005) Boxes represent 1σ and 2σ and colour represents corresponding observed precipitation



- 1:1 dashed line divides the plot into two; one with generally higher and one with generally lower rainfall than baseline, consistent with the expert judgment

Conclusion

We have developed a novel method of deriving climate narratives using structured expert elicitation to characterise uncertainty. Analysis using observed and reanalysis data shows that the experts' judgement on key drivers fits well with empirical relationships and provides support for the use of expert-derived climate narratives to inform impact and adaptation assessments and wider application of this approach.

This research was partly funded by the UK's ESRC Centre for Climate Change Economics and Policy (ES/K006576/1) and the Leeds Social Sciences Institute seedcorn funding for social sciences/STEM collaborations. The authors also gratefully acknowledge the participation of the eight climate scientists in the expert elicitation

Gender and decision-making among sugarcane outgrowers in Malawi

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Sugar – water dependent employment and livelihoods

Sugar is among Malawi's top three agricultural export earners, and is an important source of employment in the sugar producing regions. Because of heavy work, mainly men are employed. Sugarcane production in Malawi requires irrigation, and large-scale irrigation developments on communal lands have enabled smallscale farmers, including women, to enter sugarcane outgrower schemes in the Chikwawa district in southern Malawi. Illovo sugar is the main sugar producer in Malawi and runs the only sugarcane mill in the area. The produce from the outgrowers is bought and milled by Illovo. 762 farmers are members of Kasinthula Cane Growers Association (KCGA), a farmers association producing sugarcane on 1475 ha of irrigated lands developed in four phases between 1997 and 2012.

Land ownership, management and decision-making

Under the authority of local chiefs, the communal land is leased by the Shire Valley Cane Growers Trust (SVCGT), established by the government to run the sugarcane scheme in Kasinthula on behalf of the farmers. Kasinthula Cane Growers Limited (KCGL) was formed to manage all agricultural, financial and human resources operations. Most of the work is carried out by staff or contractors, whereas the farmers are responsible mainly for weeding, fertilizer application and gap-filling. Decisions are taken by the Board of Directors, which includes representatives from KCGL, SVCGT, KCGA, Illovo, government, businesses and local chiefs. Solely administrated by the farmers, KCGA receives a Fair Trade Premium that is used for education, health care and infrastructure within the nearby communities.

Gender and decision-making

Women are under-represented in the decision-making processes at all levels (Table 1). Farmers vote for representatives to partake in the Board of Directors. Despite increased awareness of gender issues and efforts to include more women in decision-making at different levels, the progress is slow (Table 1).

Table 1. Number of male and female in categories of involvement

Power to influence management decisions ↑

	Male	Female	Trend
Board of Directors	7	3	N.A.
KCGL Management level 1-4	8	1 (level 4)	→
KCGA Executive Committee	6	4	→
KCGA Sub Committee	22	4	→
KCGA Members (farmers)	515	247	→
KCGL Permanent staff	427	34	→
KCGL Seasonal staff	182	0	→

Current challenges for gender equality in decision-making

Women's education levels throughout society are significantly lower than men's, which contributes to the lack of women at management levels. Meanwhile, the number of women who take over the membership in the scheme increases slightly. Young men often migrate for work, or in marriage, a husband traditionally moves to live with the wife's family, and subsequently in generation shifts, the land lease is signed over to the remaining daughters. KCGA reruns elections if none or few women are voted for. However, more women than men are illiterate and withdraw if nominated or elected. Current research aims at exploring the factors behind inequalities in the decision-making processes, from the level of household to the Board of Directors in the Kasinthula outgrower scheme.

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