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Climate Change Impacts on Ecosystem Services and Food Security in Eastern Africa

Increasing Knowledge, Building Capacity and Developing Adaptation Strategies

POLICY BRIEF 12
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Photo: Brigitte Nyambo 2013

TRADITIONAL WEATHER FORECASTING: PRACTICES, CHALLENGES AND OPPORTUNITIES

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Overview

Unpredictability and uncertainty associated with conventional agricultural weather forecasts intensify food insecurity in many parts of East Africa. Rural communities in the region rely on indigenous knowledge that involves the use of environmental and biological indicators for weather forecasts to cope with weather variability risks. CHIESA examined the use of traditional weather forecast knowledge and dissemination practices along the altitudinal plains of Mount Kilimanjaro from Kisangesangeni village Miwaleni Springs (700-900 m.a.s.l.), on the lower part to Maruwa-Nduoni (1900-2100 m.a.s.l.), Kirua Vunjo on the upper part of the area. A combination of participatory research approaches and household surveys were used to explore: local perceptions on the impacts of climate change and weather variability on their livelihoods; the application and reliability of weather forecasts; indigenous knowledge-based weather forecasts (IKFs) and conventional weather forecasts (SCFs). In addition the study also explored the current methods used to communicate weather forecasts and the possibility of integrating both the indigenous and the conventional methods of forecasting.

Impacts of climate change on livelihoods of local communities

The perceived impacts of climate change are shown in Figure 1. A rich diversity of livelihood activities exists across the area with crop production (86%) and livestock keeping (7.2%) reported as the main activities. The communities have adapted to this change in a variety of ways as shown in Figure 2.

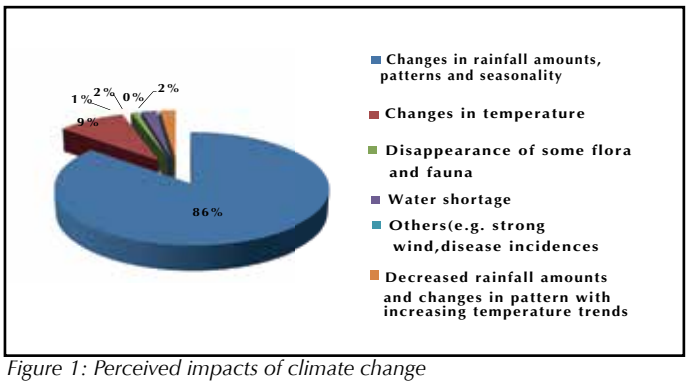

Figure 1: Perceived impacts of climate change

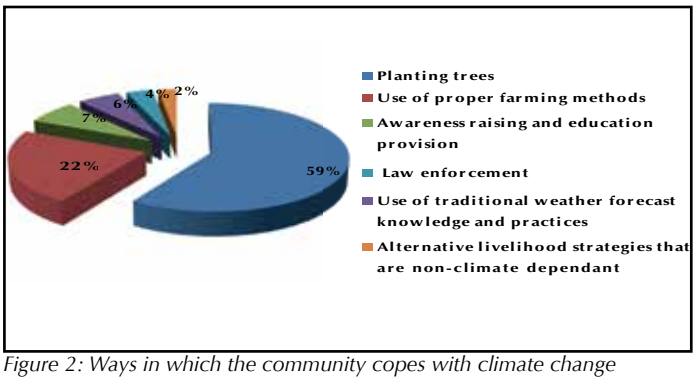

Figure 2: Ways in which the community copes with climate change

Indigenous knowledge-based weather forecasts practices

• **Phenological changes of certain plants**: Fruiting, flowering, and shedding of leaves of indigenous trees from November to January is used to predict the onset of Masika rains in February to May and in August and September for the onset of the Vuli rains October to December. Migombapori (*Vangueria infausta* Burch species) (Figure 3) appears once a year, grows within a short period and starts sapling in January indicating the onset of Masika rain within a month. Drying of the plant indicates the onset of rain in less than a week after which it decomposes and remains dormant in the soil until the next season.

Figure 3:Migomba pori (*Vangueria infausta* Burch species).
Fasco Chengula (2014)

•**Behaviour of specific insects**: One of the most reliable indicators of forthcoming rainfall is the movement of: Safari ants (*Dorylus wilverthi*) or Siafu in Swahili (Figure 4a); Nondo which are big black ants that prey on brown ants (Figure 4b); Msora/Mkokye or white termites (*Pogonomyrmex* spp.) in large numbers coming out of their nests to forage and spittle bugs (*Machaerotidae* spp) that appear on trees.

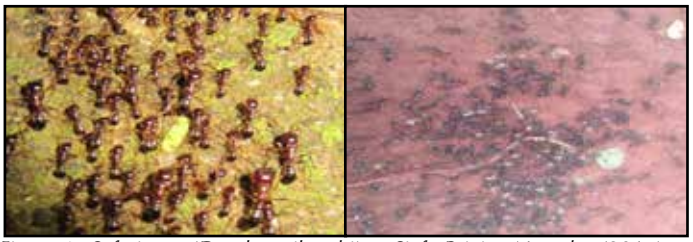

Figure 4a:Safari ants (Dorylus wilverthi) or Siafu Brigitte Nyambo (2015).
Figure 4b:Black Moisture ants Nondo in Chagga (Lasius spp.)
Fasco Chengula (2014)

•**Relative amount of snow and cloud cover on Mt. Kilimanjaro**: Snow and clouds on Kibo and Mawenzi peaks (Figure 5) and spotting of natural fires and heavy clouds on Ugweno and the Pare Mountains in January is a good indicator of abundant rainfall and a corresponding good agricultural year.

Figure 5: Snow and cloud coverage on Kibo and Mawenzi peaks
Brigitte Nyambo (2014).

•**Behaviour of certain birds:** The singing of Ndekrefa (Malachite Sunbird); Dudumizi (White-browed Coucal); Motutu, Mpalangala (Red winged starling) and Leleki after a prolonged drought would indicate imminent onset of a good rainy season.

•**Astronomic features:** The appearance of the moon in a crescent shape, mbawa or nyimbulimbuli (thunder and lightning); solar eclipse would indicate the onset of rains. Appearance of the rainbow or mkoryi (Figure 6) in the midst of a rainy season would indicate that rainfall would temporarily or permanently stop.

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•**Animal behaviour:** Migration of crabs from streams to higher ground; goats and dogs making noise at night, the continuous croaking of frogs and sighting of Lemurs; (*Lemuriformes)* or Ngaagya/Komba are all indicators of rainfall.

Figure 6: Mkoryi (Rainbow). Fasco Chengula (2014)

Farmer's perception on application and reliability of weather forecasts

The methods of weather forecasts used by the communities in the study area are shown in Fig 7.

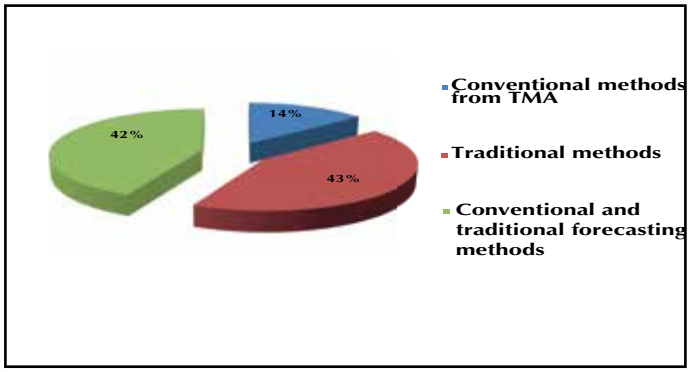

Figure 7: Weather forecasting methods used by respondents

More than 45% of all respondents perceive the weather forecasts from Tanzania Meteorological Agency (TMA) as not reliable; 25% were not sure while only 26% perceived them as reliable and useful.

The weather forecasts provided by the agency are difficult to understand even to the agriculture officers tasked with interpreting the information for the farmers. There is a great need for reliable weather information for farm level decision making and to ensure food security at household level.
The current unreliable weather forecasts in Tanzania were attributed to:

•Shortage of weather stations and forecasting equipment.
•Lack of a central forecasting office hindering the installation of meteorological equipment.
•Inadequate enhanced surface and upper air observations for comprehensive monitoring of weather and climate.
•The high cost of running weather stations.

Correlation between Indigenous weather forecasts and Seasonal Climate Forecasts

The community (86% of the respondents) perceives a correlation between IKFs and SCFs. The indicators of rain such as flowering trees, behaviour of insects and birds, wind movements and temperature increase in February match with the TMA weather forecast of rain in March. According to the agency, alterations in air and surface temperature; patterns of wind and pressure in the global and local climate systems trigger several changes in the behaviour and life patterns of biological organisms such as plants, animals and insects, thus providing scientific explanation to the indigenous weather indicators.

However the indigenous knowledge that has been embraced and used by communities for generations is on the verge of extinction because it is not documented. Instead it has been passed down generations using oral tradition. The value of IKF to the present generations has thus been decreased making it difficult to correctly remember weather patterns in the past so that variations are noted and errors reduced.
Neither the indigenous knowledge-based forecasts nor the conventional forecasts are error-free. Therefore integrating the two sciences by exploiting the best attributes of each appears to be the best option towards improving future weather forecasts.

Current communication pathways for weather forecasts

Conventional weather forecast produced by TMA is communicated through a range of channels: Mass media; mobile phones; websites and cards. Local communities access it mainly through radio.

However since the agency uses technical language to package and disseminate the information neither farmers nor agricultural extension workers can fully interpret and use it effectively.

In the past, IKFs forecasts were formally communicated through traditional public meetings that are no longer organized. However, 41.1% of respondents revealed that community networks such as social gatherings are still used for information exchange including informal chats on weather trends mostly among elders.

Recommendations

To improve future weather forecast and communication the CHIESA project recommends:

- A comprehensive review of Tanzania's provision of meteorological services alongside indigenous knowledge.
- Integrating strengths of both the indigenous and conventional forecasts to address current weather forecasting challenges.
- Investing in detailed studies on indigenous forecasts with scientific bases to establish a comprehensive database which will provide a scientific basis for integrating both methods.
- Policy support to improve the nature and availability of weather forecast information and to strengthen partnerships for sharing and using climate information in the country.

What is CHIESA?

The Climate Change Impacts on Ecosystem Services and Food Security in Eastern Africa (CHIESA) is a four-year research and development project aimed at increasing knowledge on the impacts of climate change on ecosystem services in the Eastern Afromontane Biodiversity Hotspot (EABH).

CHIESA is funded by the Ministry for Foreign Affairs of Finland, and coordinated by the International Centre of Insect Physiology and Ecology (*icipe*) in Nairobi, Kenya.

Through research and training, CHIESA will build the capacity of research communities, extension officers and decision makers in environmental research, as well as disseminate adaptation strategies in regard to climate change. The general areas for environmental research are in agriculture, hydrology, ecology and geoinformatics.

CHIESA activities focus on three mountain ecosystems in Eastern Africa, namely Mt. Kilimanjaro in Tanzania, the Taita Hills in Kenya and Jimma Highlands in Ethiopia. The project consortium monitors weather, detects land use/land cover change, and studies biophysical and socio-economical factors affecting crop yields and food security.

The project also builds the climate change adaptation capacity of East African research institutions, stakeholder organizations and decision-makers through research collaboration and training.

Together with local communities, the project will develop, test and disseminate climate change adaptation tools, options and strategies at the farm level.

Further, CHIESA provides researcher training for staff members of the stakeholder organizations, enhances monitoring and prediction facilities by installing Automatic Weather Stations, and disseminates scientific outputs to various actors from farmers to policy-makers.

Work Package 8: Dissemination of main results and their application

Dissemination of project results and findings constitute the WP8. To ensure sustainability of these results, CHIESA undertakes training of project partners and stakeholders, including farmers from the communities in the target areas. CHIESA's proposed channels of result sharing combine interactive dissemination outlets and extension approaches, coupled with modern communication technologies. These include:Training material such as manuals and posters Meetings; Field days; electronic media; Village resource centres; e-mail publications and discussion groups.

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