

# chresa

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

*Increasing Knowledge, Building Capacity and Developing Adaptation Strategies*

**POLICY BRIEF 2**

September, 2013



**Effects of Climate Change on Habitats and Biodiversity**

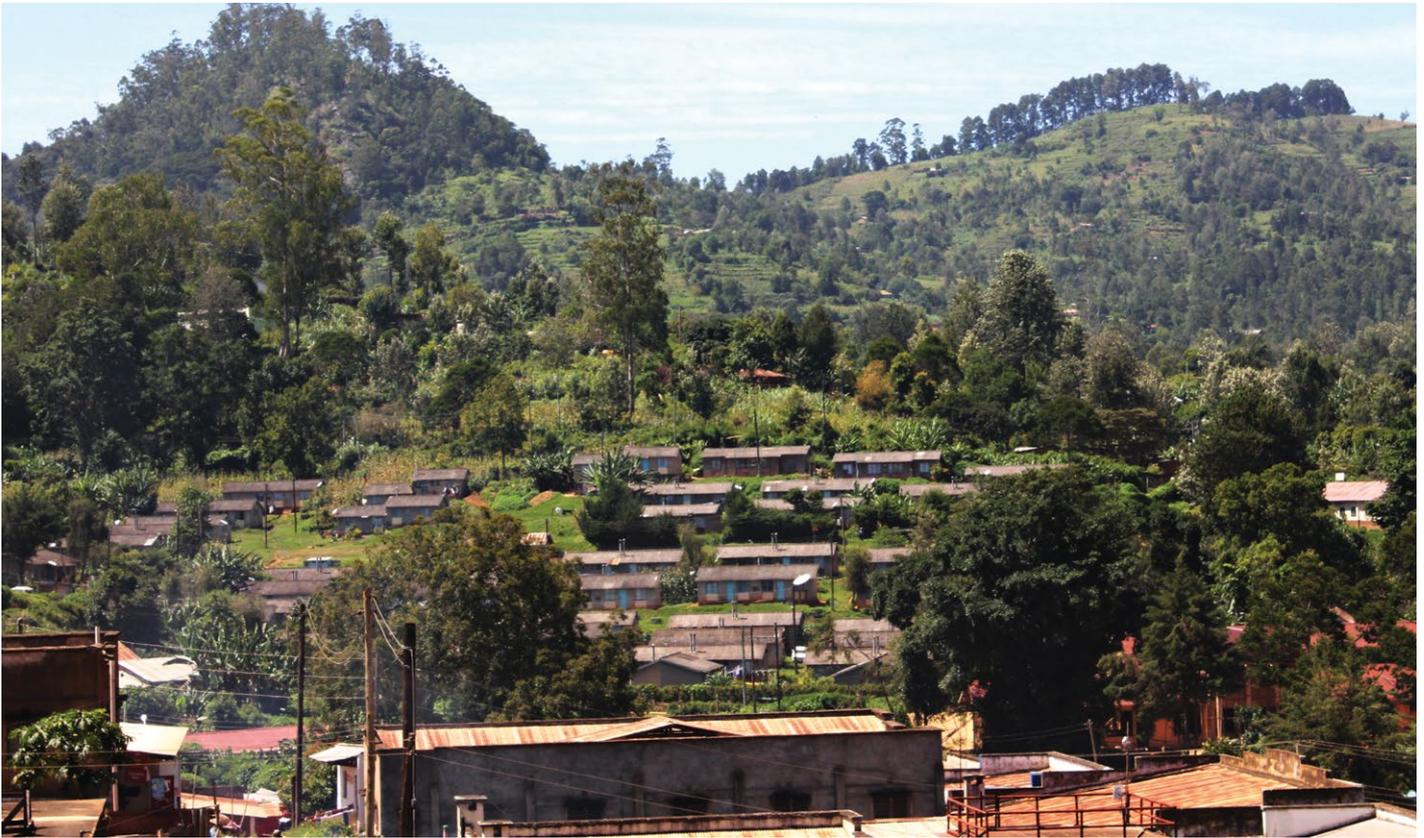
*Creating Knowledge for Future Planning and Policy*



**icipe**



**MINISTRY FOR FOREIGN  
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*Wundanyi Town, with lush green hills in the background.*

### Introduction

Africa is potentially the most severely affected continent by current global climate change. The 4th Assessment Report of the Intergovernmental Panel on Climate Change underscored the need for research on climate-change adaptation to ensure sustainable food security and development. The economy of East Africa is heavily dependent on rain-fed agriculture, particularly in the region's mountain areas. These mountain areas are characterized by very steep climatic moisture-balance gradients that result in a mosaic of landscapes that support densely populated rural areas, as well as provide a range of ecological and economic goods and services that support the national economies.

Strategies to cope with the climate change impacts are likely to include a combination of adaptive management (e.g. reforestation for carbon sequestration projects, biofuel production) and risk management (e.g. choice of alternate crop types or varieties) options. It is crucial that these management decisions are informed by analysis on the response of ecosystems to climatic change, upon local environmental knowledge and direct evidence of how communities respond to climate change. Creating knowledge that integrates such insights into future planning and policy is a central goal of the CHIESA WP4.

Predictive scenarios (economic, social and climatic) can be used to define a series of futures. WP4 will develop and apply novel modeling methods to assess how such predictive scenarios can best be used for environmental forecasting on East African mountains.

### What do we know so far?

Ecosystems and the services they provide (e.g., timber, water, carbon storage, nutrient cycling, soil formation) are crucial for livelihoods and national development,

particularly in East Africa where people's livelihoods connect strongly with their environment. Challenges to this relationship in the form of climate change, land-use transformation, population growth & migration, and complex global environmental policy are rapidly accelerating. Population growth together with socio-economic development unavoidably results in strong resource competition between agriculture, forest and biodiversity conservation, water provision and carbon sequestration. The goods and services provided by ecosystems are under particular threat in East Africa's mountain ranges and the associated lowland catchments.

A core finding of CHIESA will be on how societies, landscapes and ecosystems have responded to climate change both currently and under different climate futures. Greater frequency of uncharacteristic weather extremes in recent years, tentatively linked to anthropogenic global warming, is also disrupting the traditionally predictable alternation of dry and rainy seasons. This unpredictability wreaks widespread havoc on crop yields and on the social structure of subsistence farmers. Intensive land use similarly poses unique threats to ecosystems and livelihoods, severely challenging the adaptive capacity of plants, wildlife, supporting ecosystem services and the rural communities depending on them.

Further drying due to global warming could make vast areas of African farmland unable to support even a subsistence level of food crops such as maize and millet by 2050. Even using sophisticated climate models, uncertainty continues about whether East Africa will become wetter or drier and how seasonal distribution of rains will change.

### What can we do about it?

CHIESA WP4 will integrate available records of past environmental change in East Africa. This will enable accurate



*Picturesque hills in Ethiopia*

documentation of past and present ecosystem-environmental relationships, and quantify the rate and timing of ecosystem shifts due to changing environmental conditions. WP4 is developing methods to extrapolate site-specific data on present ecosystem and environmental conditions to the landscape scale, for example, by applying models to link ecosystem distributions in the present and future under alternative climate-change and human interaction scenarios.

This combination of research at the interface between ecosystems, livelihoods, conservation and climate change will assess impacts on livelihoods in the vital economic

sectors, support viable ecosystem services and aid agricultural planning and policy. This is done within the target CHIESA research areas, and more generically across Eastern Africa to impact rural and urban livelihoods.

Another of WP4's outputs will be to produce a pool of scholars, working within National Research organizations, with the trans-disciplinary skills and sensibilities necessary to understand how climate, environment and human society interact. This enhanced knowledge base will inform environmental policy and ultimately lead to enhanced social and ecological well-being.



*Participants during CHIESA-sponsored Earth Observation (EO) Course in May, 2013. The primary aim of the course was for students to develop an understanding of how EO data and products can be utilized to assess vegetation status and trends across spatial and temporal scales, in the context of climate and land use change.*

## 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 Afrotropical 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.

## WP4 - Assessment of Impacts on Biodiversity and Habitats

WP4 explores the effects of climate and land cover change on biodiversity and habitats. The speed and variability of forecast environmental change has complex implications for agricultural productivity via pollinator species, agricultural pests and their natural enemies, and thus severely challenges the adaptive capacity of rural communities.

Moreover, biodiversity itself may be crucial for promoting the resilience of habitats to changes in climate and land use, and in providing vital ecosystem services such as potable water, nutrient and carbon cycling.

Addressing these issues requires integration of biological research, conservation planning and rural development, brought together by the development and application of state-of-the-art modelling techniques. Regional climate projections will be generated under a range of IPCC emissions scenarios and GCM (global circulation model) boundary conditions. These data, and associated uncertainties, will be provided to other work packages so that climate change impacts on ecosystem services can be assessed.

Distributional information for flora and fauna will be collected at each CHIESA transect, and more broadly across the Eastern Afrotropical Biodiversity Hotspot.

Impacts of climate change will be assessed for key species (e.g., maize, coffee, crucifers and avocado) and their immediate trophic links (e.g., stem and berry borers).

On a macro-ecological scale, predicted ecosystem shifts / habitat transitions will be assessed and reported in the context of internationally recognised frameworks. For mixed forest-crop ecosystems and specific forest crops (e.g., avocado), changes in carbon storage and sequestration rates under different climate and land use scenarios will be modelled.



For more information about the CHIESA Project, contact:

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