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

Increasing Knowledge, Building Capacity and Developing Adaptation Strategies
While Climate Change is a global phenomenon, the magnitude of its impacts varies significantly across different regions. The International Panel on Climate Change (IPCC, 2007) suggests that climate change impacts will be most intense and adverse in sub-Saharan Africa, where inhabitants depend heavily on land-based resources, and have agriculture as a key economic sector.

Rural communities’ livelihoods and food security are supported by various ecosystem services such as provision of fresh water, regulation of floods, support of nutrient cycling and pollination, as well as enhancement of aesthetic experience. Climate change, coupled with human induced changes in land use and land cover, directly impacts the health of ecosystems and consequently that of ecosystem services. The result? Man’s very existence is threatened.

Multidisciplinary Research and Development Project

The Climate Change Impacts on Ecosystem Services and Food Security in Eastern Africa (CHIESA) is a four-year research and development project funded by the Ministry for Foreign Affairs of Finland and coordinated by the International Centre of Insect Physiology and Ecology (icipe) in Nairobi, Kenya.

As its name suggests, the key objective of the Project is to assess and share knowledge of the impacts of climate change on ecosystem services in the agro-ecological zones of mountain ecosystems in Eastern Africa.

CHIESA’s activities focus on four main pillars: research, monitoring, capacity building and development of adaptation strategies towards climate change impacts. These activities are undertaken by a multidisciplinary team of scientists from different East African and European universities and research institutes. Within its research component, the general areas of study are agriculture, hydrology, ecology and geoinformatics.

The ultimate goal of the CHIESA Project is to contribute to local and regional development by utilising scientific knowledge to design, develop and implement adaptation options and strategies. The project also builds the climate change adaptation capacity of East African research institutions, stakeholder organisations and decision-makers through research collaboration and training.

Enhancing on-the-ground capacity of stakeholders requires that the project will support various training activities (degree programmes, workshops and short courses) targeted to staff members of stakeholder organisations. CHIESA Project will as well engage local communities in planning, design and implementation of the identified adaptation options, and will widely disseminate project results and target awareness raising campaigns to the public.

Filling Critical Gaps in Knowledge

There is a general lack of information on the impacts of climate change on sensitive and unique mountain ecosystems and on their services, especially with regard to agriculture and food security in sub-Saharan Africa. This knowledge gap reflects an overall deficit of on-the-ground capacity to address climate change research and development there.

Available models and predictions on climate change impacts on agriculture and food security have not taken into account how crop diseases, insect pests and pollinators are affected by these impacts. Climate change and variation have impacts on pollinators, such as honeybees, as well as on insect pests, such as maize stemborer, which reduce the crop yields and affect food security.

Knowledge gaps are addressed in the following issues:

- Remote sensing and use of Geographic Information Systems in land cover and land use change monitoring and modelling
- Economic valuation and modelling of the benefits of ecosystem services
- Research on the climate change impacts on functional agro-biodiversity, food production and livelihoods
- Research on the interaction between conservation, maintaining biodiversity and habitats of arthropods in agricultural landscapes

Assessing climate change impacts on the geographical distribution and outbreaks of insect pests is one of the research components of the CHIESA Project.

Left: Larvae of the diamondback moth (*Plutella xylostella*) cause the most damage to cabbage and other crucifer crops worldwide. *Photo: Robert Copeland, 2012*

Right: A cabbage plant damaged by diamondback moth larvae. *Photo: Bruno Le Ru, 2011*
under change

Assessment of climate change impacts on water resources for rain-fed and irrigated agriculture

Adaptation strategies for changes in pollination services and insect pest management in agricultural systems.

CHIESA Target Areas

CHIESA project activities are implemented in the Didessa River Basin in Jimma Highlands, the Taita Hills and the Pangani River Basin found in Ethiopia, Kenya and Tanzania respectively.

The target areas represent samples of the East African Mountains agriculture/forest mosaics where the four selected key target crops (maize, crucifers, avocado and coffee) can be studied on farms with various scales of agricultural intensity, environmental settings and altitudinal gradients.

Ecosystem services and food security in the target areas are at risk due to the short-term and long-term impacts of climate variability and change. To complicate matters, the high human population density and growth increases resource competition between agriculture, forestry and biodiversity conservation.

Results and outputs from these three target areas will be disseminated to other projects, organisations and stakeholders working on climate change adaptation in other areas of Eastern Africa.

Beneficiaries of the Project

The beneficiaries of the CHIESA Project activities and outputs are first and foremost, the farming communities dependent on the ecosystem services of the target areas. The information and adaptation tools and options generated will directly help this group to manage climate change related risks and to implement adaptation strategies, especially women who typically are the key actors in maintaining food security.

Other beneficiaries are:

- Extension agents (agriculture, livestock, environment, forestry, and hydrology) who work with and train farmers to use the formulated adaptation tools. These agents also help to implement national climate change adaptation plans at the village level
- Government institutions which may use the outputs, such as localised climate models and vulnerability risk maps, for land use planning and policy formulation
- National research institutes, universities and NGOs in Eastern Africa benefit from the project results and capacity building through training and dissemination
- General public of the three target countries will benefit from the outputs of the project through dissemination and awareness raising campaigns using mass media and other communication networks.
Above: Map of CHIESA study areas. Assessments of climate change impacts are carried out in selected mountain ecosystems in Ethiopia, Kenya and Tanzania: the Didessa River Basin in Jimma Highlands (1,559–2,201 meters above sea level); the Taita Hills (840–2,167 m.a.s.l.); and the upper sub-catchment of the Pangani River Basin in Kilimanjaro (elevation range 702–1,689 m.a.s.l.).

Map by: P. Macharia Kabiro (icipe)

CHIESA Collaborators:

- Addis Ababa University, Ethiopia
- Climate Change Forum, Ethiopia
- Environment and Coffee Forest Forum, Ethiopia
- Environmental Protection Agency, Ethiopia
- Jimma University, Ethiopia
- National Meteorological Agency, Ethiopia
- Department of Remote Sensing and Resource Survey, Kenya
- Jomo Kenyatta University of Agriculture and Technology, Kenya
- Kenya Agricultural Research Institute, Kenya
- Kenya Forest Service, Kenya
- Kenya Meteorological Department, Kenya
- Kenyatta University, Kenya
- National Museums of Kenya, Kenya
- University of Nairobi, Kenya
- Ministry of Water, Tanzania
- Pangani Basin Water Office, Tanzania
- Selian Agricultural Research Institute, Tanzania
- Tanzania Meteorological Agency, Tanzania
- Tanzania Coffee Research Institute, Tanzania
- Tengeru Horticultural Research and Training Institute, Tanzania
- Tropical Pesticides Research Institute, Tanzania
- Association for Strengthening Agricultural Research in East and Central Africa
- Birdlife International (Africa)
- Food and Agriculture Organization of the United Nations
- IUCN Eastern and Southern Africa
- Regional Centre for Mapping of Resources for Development, Kenya
- University of Leeds, UK (Africa College)
- WWF US Ecosystem Services Group.
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