chiesa

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

Increasing Knowledge, Building Capacity and Developing Adaptation Strategies

POLICY BRIEF 11
May, 2015

Assessment of Climate Change Impacts on Water Resources and Water Provision

Pangani River Basin, Tanzania

icipe

University of Dar es Salaam

FORMIN.FINLAND.FI
MINISTRY FOR FOREIGN AFFAIRS OF FINLAND

Overview

CHIESA researchers from the University of Dar es Salaam investigated the impact of land use and land cover change, from 1987 to 2010 on stream flows upstream of Nyumba ya Mungu reservoir, Kikuletwa and Ruvu catchments. The aim was to provide evidence of land use/cover changes occurring in the catchments and their consequences on stream flows.

A combination of hydrological models was used to simulate stream flows under climate change and assess future demand scenarios by year 2060 in the upstream of Pangani River Basin.

A comprehensive analysis of climate variability impacts on seasonal water availability and access using a linear regression and multinomial model were completed for six villages along the Kilimanjaro research area.

Similar studies and a training workshop on the key principles of Intergrated Water Management (IWRM) and its role in climate change adaptation were also carried out in the Taita hills area.

Impacts of Land use/Land cover changes on stream flows in Pangani Basin

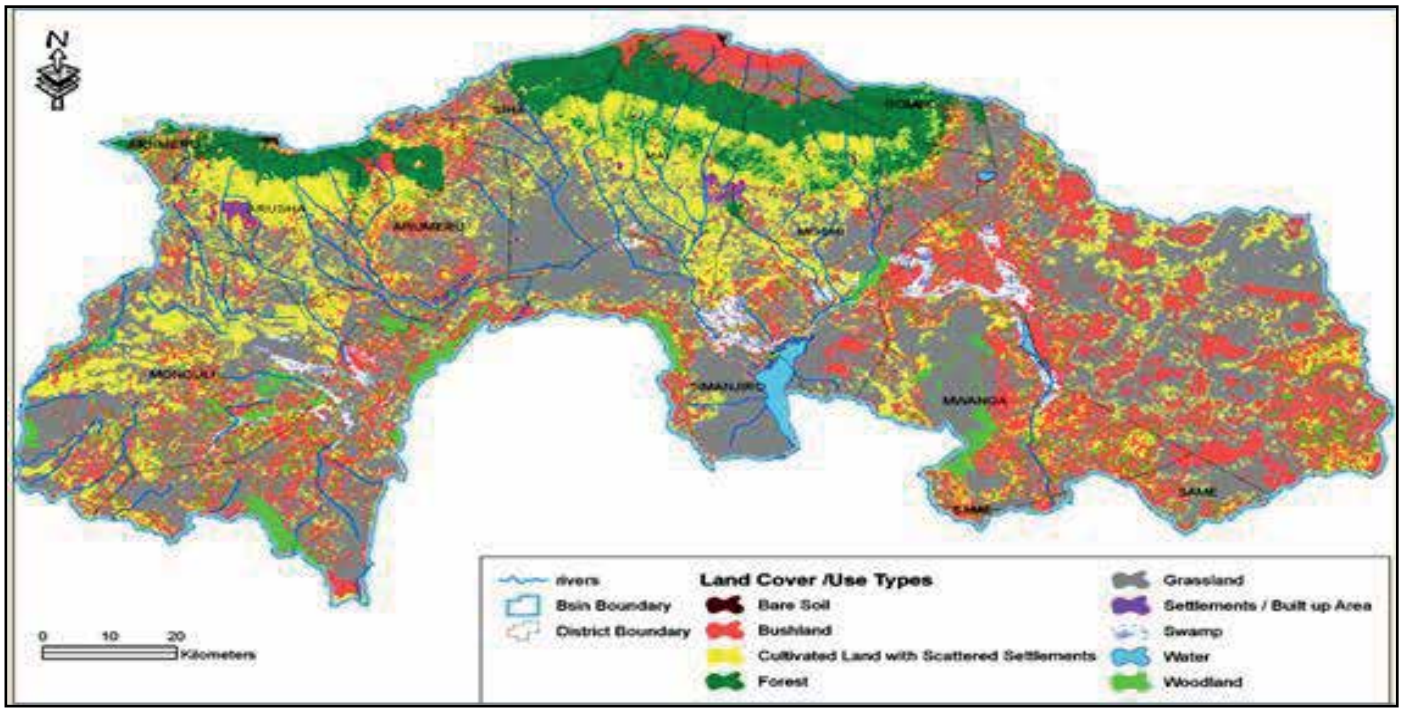

Figure 1 (a) Land use map 1987 of the Upper catchment of Pangani Basin

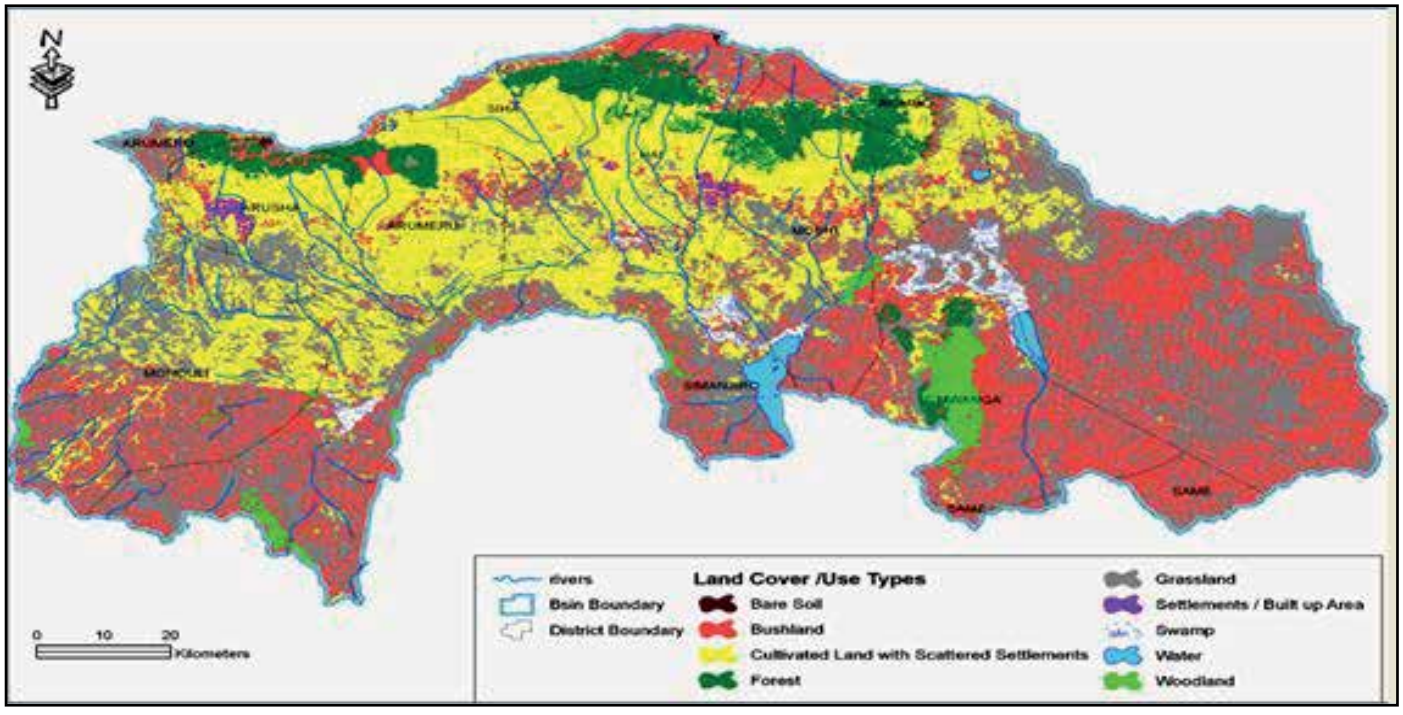

Figure 1 (b) Land use map 2010 of the Upper catchment of Pangani Basin

The results of land use/cover change analysis show that between 1987 (Figure 1a) and 2010 (Figure 1b) there was an increase in cultivation with scattered settlements and a decrease of vegetation such as forest, grasslands and bush land. Based on land use scenarios the model simulation showed that average river flows in Kikuletwa and Ruvu rivers has decreased. With increasing land use/cover changes among other factors affecting the hydrological regimes in the basin, the stream flows continue to be threatened to diminish and affect water provisions in the sub-basins and the basin at large.

The hydrological modelling of land use change using the Soil and water Assesment Tool (SWAT) model shows an increase in the magnitude of surface flow or overland flow which is directly associated with the change in land use cover type. The impact of land use on streamflows is noted that on 25th March, 1978 the peak flow for simulated flow hydrograph using the 1987 land use map was 2,161m3/s and for 2010 land use map was 2,183m3/s. Climate change and the future demand expansion will result to an annual unmet demand of 1,673.80mm^3 that will most affect the irrigation sector. Stream flows are expected to decrease by 5.3% in the basin and the annual demand will increase from 1,879.73mm^3 at present (2011) to 3,249.69mm^3 in the future (2060).

Impacts of climate change on livelihoods and relevant adaptation strategies

Water scarcity is apparent in the study areas due to unreliable rainfall; multiplicity of competing uses; degradation of sources and catchments. This threatens food security, energy production and environmental integrity and consequently there are water use conflicts between the different sectors of the economy.The climate change impact on water resources is the major challenge on the upstream of Nyumba ya Mungu reservoir. In some areas, less water leads to droughts and desertification, whereas in others too much water causes flooding. Following local peoples' perception, the major impact of climate change is drought with high frequency of occurrence. Other impacts include change in rainfall patterns and dry seasons disrupting the planting seasons and drying of water sources (Figure 1). The study area is vulnerable to climate change and its adverse effects are often felt by the poor communities due to their low adaptive capacity associated with limited financial resources, poor infrastructure, low level of education, dependence on natural resources and limited access to technology. Traditional techniques are the most common and account for more than 70% of the total irrigation schemes in the study area (Figure 3). These are usually characterized by locally improvised infrastructure, poorly constructed and temporary.and usually associated with significant water losses and low crop productivity.

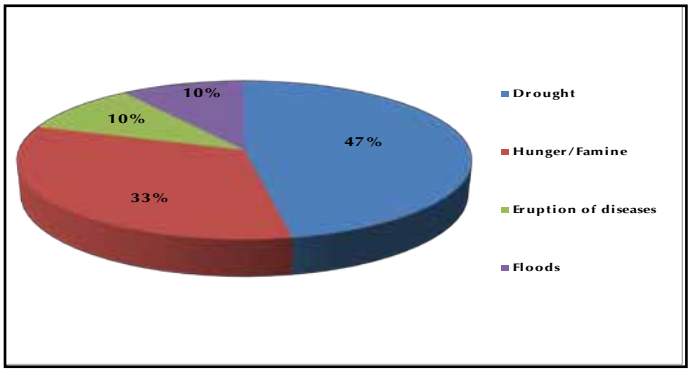

Figure 2. Impacts of climate change on Livelihoods

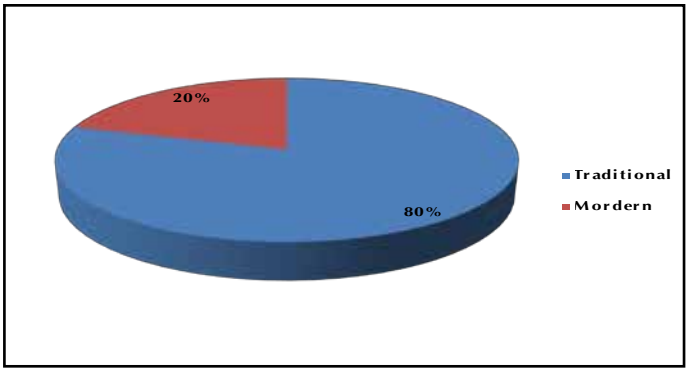

Figure 3: Common irrigation techniques used in the study area

Capacity building on Integrated Water Resource Management (IWRM)

The key stakeholders of the project: Water User Associations, policy makers, farming community and NGOs representatives attended a short training course with a focus on:

1. The importance of securing water for people, agriculture and environment.
2. How environment is affected by water use?
3. How IWRM can improve the performance of the agriculture sector?
4. Relation between water availability and livelihoods and well-being.
5. How changes in water resource management affects the men and women;minority groups and those with special needs?
6. Gender and Equity in Water Management
7. Water Use and Conflicts
8. Institutional Aspects on Water Management

Recommendations

Based on the key research findings, CHIESA recommends:

1.Implementation of IWRM at river basin level because water is a limited resource that is essential for economic growth; environmental and social well-being. Managing this resource requires balancing the interests of the diverse user groups while avoiding conflict. Promoting coordinated water resources management in a basin that is open to all stakeholders will not only resolve conflicts but will bring benefits to the basin and the stakeholders.

2.Promotion of efficient irrigation methods such as drip irrigation and adoption of good farming practices is critical to ensuring sustainable use and management of the water resources for sustaining various economic activities that require water as an input.

3. Investing in the Capacity Building of the Water Users Associations and other stakeholders in water resources management and implementation of initiatives and policies.

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.

WP6 : Assessment of Impacts on Water Provision

In WP6, the impacts of climate and land cover change on water resources and water provision are studied. Climate change will impact upon water provision services directly by shifts in precipitation amounts, variability and intensity; potential evapotranspiration, and indirectly by changes in land cover and soil properties. It will aggravate the water stress currently faced in some countries, while others that do not currently experience water stress will become at risk of water stress.Irrigation may help in water demand, but it is dependent on the conservation of forests to maintain water resources for supplying water for domestic and industrial uses, including hydropower.

chiesa

For more information about the CHIESA project , please contact:

The Project Coordinator - CHIESA
icipe – African Insect Science for Food and Health
P.O. Box 30772–00100 Nairobi, Kenya
Email: chiesa@icipe.org
Telephone: +254 (20) 863 2000
Website: http://chiesa.icipe.org

CHIESA Lead Partners:
University of Helsinki (Finland), University of York (United Kingdom),
University of Dar-es-Salaam (Tanzania), Sokoine University of Agriculture (Tanzania).

All photos used are courtesy of, and remain property of, CHIESA.

icipe

University of Dar es Salaam

FORMIN.FINLAND.FI
MINISTRY FOR FOREIGN AFFAIRS OF FINLAND