POLICY BRIEF 2
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Climate Change on Eastern Africa's Mountains: The AFRICLIM High-resolution Ensemble Projections for Taita Hills, Jimma Highlands and Mt. Kilimanjaro

Adaptation for Food Security and Ecosystem Resilience in Africa

Integrating Results, Building Capacity and Implementing Adaptation Strategies

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Cover Page : Semi-open agricultural landscape in the Jimma Highlands, Ethiopia. *Photo: Claudia Capitani*

Overview

The mountains of Eastern Africa are highly productive agricultural areas supporting large populations, that are experiencing climate change. The steep climatic gradients and feedback between people, land, water and atmosphere in mountain areas, make it difficult to assess and model potential climate change impacts.[1]

Efforts to understand and then mitigate potential climate change impacts are limited by research gaps on long-term climate trends for Africa's mountain ecosystems.

Through the CHIESA project[2] the AFRICLIM high-resolution climate projections for Africa have been produced. These climate projections are derived from the downscaling of regional climate models for Africa that are driven by general circulation models.

AFRICLIM includes projections of key climate variables such as monthly predictions on temperature and rainfall and derived summary variables such as moisture indices and dry season length.[3]

1 Platts, P.J., Omeny, P.A. & Marchant R. (2014) AFRICLIM: High-resolution Climate Projections for Ecological Applications in Africa, *Africa Journal of Ecology*, 53,103-108

2 CHIESA- Climate Change Impacts on Ecosystem Services and Food Security in Eastern Africa http://chiesa.icipe.org

3 https://www.york.ac.uk/environment/research/kite/resources/

Findings from the AFRICLIM high-resolution ensemble climate projections for Taita Hills, Jimma Highlands and Mt Kilimanjaro

In Eastern Africa, a warmer climate with more intensive wet seasons is projected in the next decades.[1]

According to the AFRICLIM projections, by mid-21st century Taita Hills in Kenya, Mt. Kilimanjaro in Tanzania and Jimma Highlands in Ethiopia are projected to experience a mean annual temperature increase of between 2°C and 3°C by 2070 (Figure 1a), depending on the model and the severity of global climate change.

Rainfall is projected to increase in the Taita Hills and in Kilimanjaro (Figure. 1b), coupled with increased seasonality, while the Jimma Highlands are projected to be at risk of prolonged and more intensive dry seasons (Figure. 1c).

The latest high resolution climate projections for 2041–2070 predict: a hotter future with wetter rainy seasons and drier months for Taita Hills in Kenya; for the Mt. Kilimanjaro area in Tanzania, a hotter future with similar rainy seasons and variable dry months and in the Jimma Highlands of Ethiopia, the projections indicate a hotter future with more extreme dry and wet seasons[2].

1 CDKN (2014). The IPCC's Fifth Assessment Report: What's in it for Africa? Overseas Development Institute and Climate and Development Knowledge Network.

2 Platts, P.J., Omeny, P.A. & Marchant R. (2015). AFRICLIM 2.0: High-resolution Ensemble Climate Projections for Africa. https://figshare.com/articles/AFRICLIM_2_0_high_resolution_ensemble_climate_projections_for_Africa/1284624

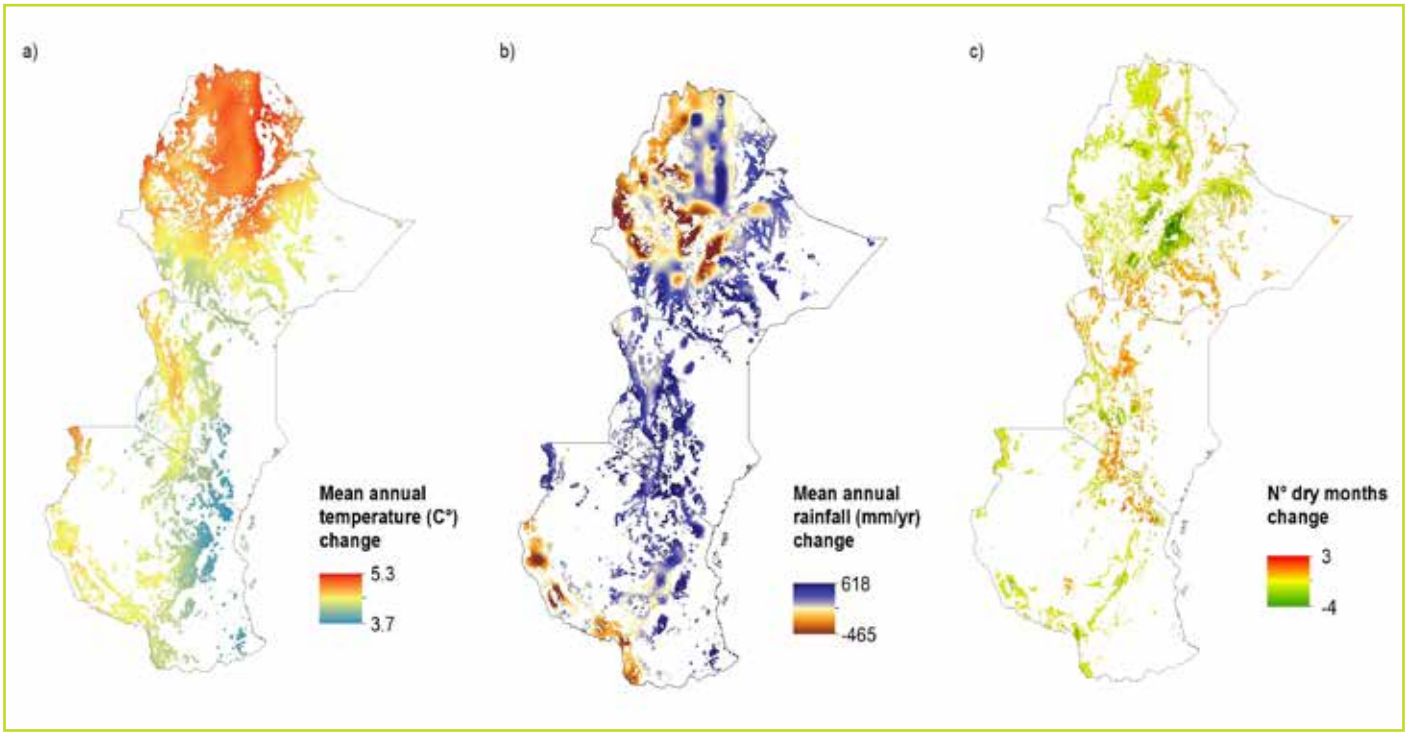
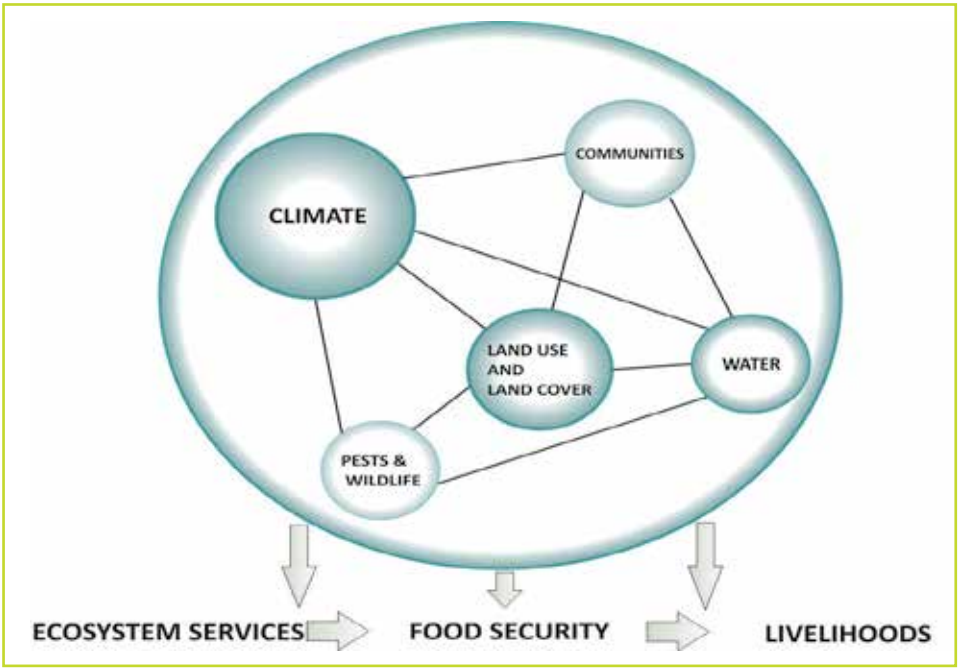


Figure 1. AFRICLIM high-resolution ensemble climate change projections for the late-21st century in Ethiopia, Kenya and Tanzania (RCP 8.5 worst case scenario). Changes compared to the baseline are shown for a) Mean annual temperature (C°), b) Mean annual rainfall (mm/yr), and c) Number of dry months. Source: AFRICLIM 3.0 (https://www.york.ac.uk/environment/research/kite/resources/)

Possible implications of the changing climate as predicted by the AFRICLIM projections



Climate drives the Water-Energy-Food nexus through complex interactions and feedback mechanisms (Figure 2). These interactions can affect ecosystem services delivery, and therefore food security both directly in terms of food availability and stability and indirectly in accessibility and utilisation, and ultimately the entire livelihood system (in terms of health, education and social services).

Figure 2. Simplified representation of interactions between climate, land use and cover (particularly forests and cropland), water, pests, wildlife and human communities. The combination of these interactions can affect ecosystem service delivery, and therefore food security and livelihoods.

Climate related impacts have already been observed on the Eastern African mountains and under the current projections the following may be expected:

Unpredictable seasonal patterns →
- Increased crop failure and post-harvest diseases
- Drop in livestock productivity
- Social disruption and conflicts

More frequent extreme rainfall & drought events →
- Decreased agriculture and livestock productivity
- Destruction of infrastructure such as roads and bridges
- Deforestation, land degradation and landscape diversity loss

Increased rainfall and temperature →
- Shifing (upwards and downwards) of plants and animals (both domestic and wild)
- Changes of agro-ecological zones (generally upward shift from the lowlands) and consequent change of crop suitability
- Increase of maize suitability at high elevations; possibly leading to increased highland exploitation and overpopulation
- Changes in availability of non -timber forest products such as medicinal plants
- Potential increase in human-wildlife conflicts
- Increase of disease outbreaks at different elevations
- Decreased capacity for natural control

Recommendations for policy makers

1. This new future climate data has become freely available here AFRICLIM 3.0 (https://www.york.ac.uk/environment/research/kite/resources/) and can be used to investigate potential climate change impacts, and for investigating climate change adaptation strategies, particularly in mountainous areas where regional scale data may be largely irrelevant.
2. The establishment and maintenance of meteorological stations in the mountains should be supported to ensure better development of climate models.
3. Promote more knowledge exchange between instrumental monitoring of climate changes, models and traditional systems for climate observation.
4. Results from this enhanced understanding of changing climate-community interactions could be used to engage communities in developing climate monitoring and alert systems.
5. In areas of high agreement of the different models and understanding of changing climate-community interactions, climate-smart policies could be developed to support communities that are more resilient to future climate change.

REFERENCES

Capitani, C., K. Mukama, B. Mbilinyi, I. Malugu, P. K. T. Munishi, N. D. Burgess, P. J. Platts, S. Sallu, and R. Marchant. 2016. From local scenarios to national maps: a participatory framework for envisioning the future of Tanzania. Ecology and Society 21(3):4 http://dx.doi.org/10.5751/ES-08565-210304

About AFERIA

The Adaptation for Ecosystem Resilience in Africa (AFERIA) is a two-year project to disseminate and communicate research results, insights and interactions of climate change and food security developed from a previous research and development project (CHIESA-Climate Change Impacts on Ecosystem Services and Food Security in Eastern Africa).

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

The AFERIA project disseminates research findings on climate change impacts and implement adaptation technologies such as drip irrigation, roof rain water harvesting, conservation agriculture, farm forestry and insect pest management to the partner organisations and beneficiary communities in different agro-ecological zones in the highlands.

The project cooperates closely with national and local organizations in Ethiopia, Kenya and Tanzania to reach out to the smallholder farmers, especially women and special needs groups.

In addition, through communication and advocacy, AFERIA supports policy decision-makers in making rational and evidence based decisions on climate change adaptation to enhance food security and ecosystem resilience in the target areas.

Objective: Improved food, nutrition security, and livelihoods of small-scale farmers in Eastern Africa.

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Adaptation for Ecosystem Resilience in Africa

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