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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 3
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Land Cover Change Scenarios in the Taita Hills

What Will 2030 Look Like?

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Introduction

If current trends persist, it is expected that agricultural areas will occupy 60% of the study area by 2030. Model simulations indicate that agricultural expansion is likely to take place predominantly in lowlands and foothills.

The replacement of shrublands and woodlands in favour of croplands expected in the next few years is likely to reduce the vegetation cover protecting the soil against the direct impact of rainfall, resulting in accelerated soil erosion.

Due to the limited availability of non-agricultural land in the highlands, new cropland areas are being set up in areas with low precipitation and higher temperatures. The continuity of this trend is likely to drive agricultural lands to areas with a higher water demand for irrigation.

What can we do about it?

Soil and water conservation practices, such as the usage of terraces for cropping, are crucial for reducing the impacts of agricultural expansion and climate change.

The restoration of indigenous forests would contribute to improved soil protection and preservation of water resources.

Finally, projects aimed at the construction of small-scale water harvesting structures could highly benefit farmers, especially those in the lowlands.

Remote Sensing and GIS for Land Cover Change Studies: What are the Pros and Cons?

Geographic Information System (GIS) is a technology for creating, storing, analyzing, and managing spatial and temporal data associated with their attributes. Remote sensing (RS) is the acquisition of information about an object or phenomenon without making physical contact with the object, usually through a satellite or an aeroplane. GIS and RS are widely used today for observing changes in land cover all around the world.

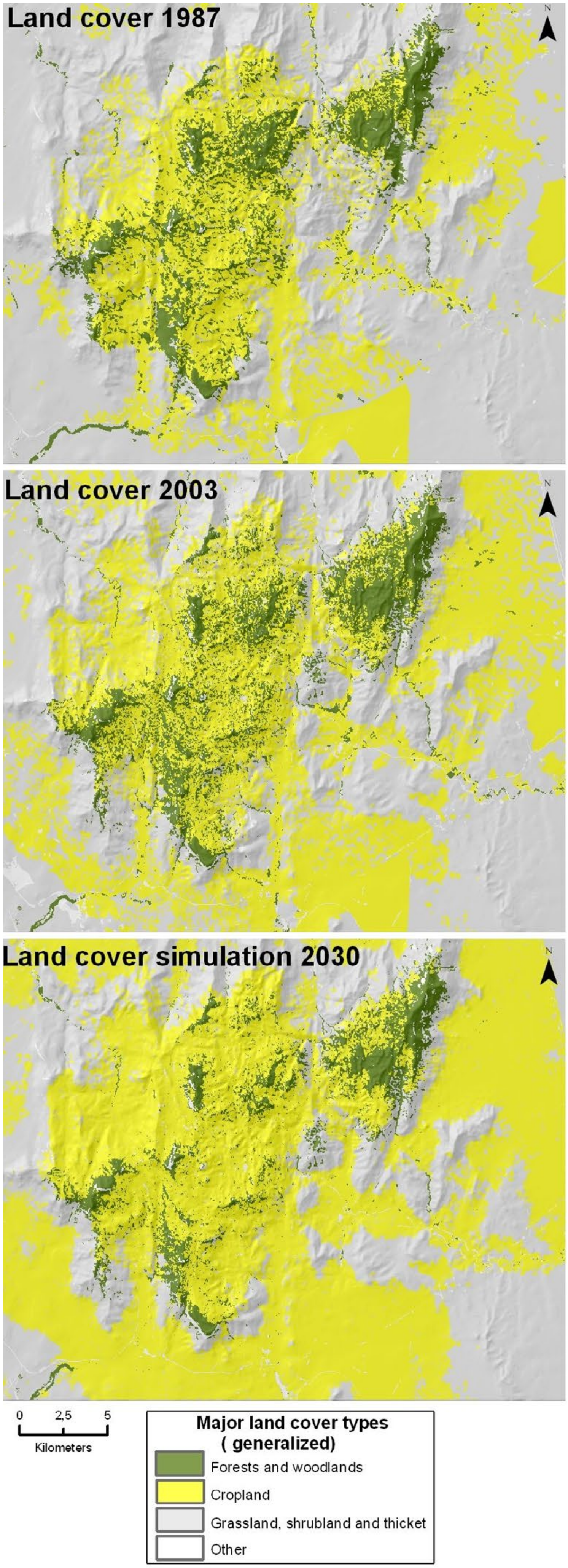
The advantages of RS + GIS approach compared to more traditional methods (e.g. field surveys, literature reviews, map interpretation and ancillary data analysis) are numerous far outweigh any disadvantages. For example, it is possible, with RS, to map unreachable locations such as very steep mountain slopes, like are present in CHIESA study areas.

RS offers a practical and economical means to study land cover changes, especially over large areas. Due to the potential capacity for systematic observations at various scales, RS and GIS methods extend possible data archives from present time to over several decades back, making land cover change detection possible. Some field work is still required, however, but mostly to collect in-situ measurements, and to validate the results.

Despite the tremendous advantages RS has over traditional methods in land cover mapping, a clear understanding of its limitations is necessary.

Three main considerations arise when using results of land cover mapping from RS imagery:

• How well the chosen classification scheme represents the actual vegetation composition



• How effectively images from RS capture the distinguishing features of each mapping unit within the classification, and

• How well these mapping units are delineated in the classification process.

Nature is always more complex than any classification scheme, and just as dynamic, so every land cover map is bound to have some degree of uncertainty and error. Fortunately, this error can be estimated.

In the CHIESA Project, RS data used include satellite images, aerial photographs, hyper-spectral imagery and laser scanning.

Each of these have their own application; satellite images are excellent for mapping land cover change over large areas, aerial photographs are good for examining very fine visual details in vegetation and mapping built-up environment, whereas hyper-spectral imagery is well suited for vegetation studies down to species level. Laser scanning can be used to study fine details, for example, in topography and vegetation structure and height.

Recommendations

These days, selections of imagery and open source GIS and RS software are freely available on the internet, and for this fact, should be utilized more. Even a basic computer can be used for analysis.

While most limitations have been reduced or eliminated, there still remain some hiccups in utilization of the RS and GIS for land cover studies on a large scale in Eastern Africa. Sadly, a huge nowledge gap or lack of capacity for local researchers to undertake such studies tops the list of problems.

In this respect, CHIESA has made significant strides in building capacity of African partners and stakeholders to acquire, process and analyse RS data and to apply these data for environmental modelling. However, more still needs to be done; considerable efforts should be made at the national level to strengthen teaching and research in RS and GIS.

A view from Vuria, the highest point in Taita.

WP2 - Land Use and Biogeophysical Information

In this work package, remote sensing using satellite imagery and airborne remote sensing data will be applied for land cover mapping and change detection.

Geographic Information Systems (GIS) will be used for deriving geospatial datasets for remote sensing data processing, and for modelling the ecological, agricultural and hydrological variables.

Appropriate infrastructure (hardware and software) and the skills for geospatial data processing are required for remote sensing and GIS, data management, analysis and linking up the outcomes with climate change. Both infrastructure and skills are currently inadequate in the region.

This WP will build capacity for such work and develop the geospatial datasets needed in the other WPs.

In summary, WP2's main outputs are:

• To acquire and produce key geospatial (topography, hydrology, climate, etc.) and remote sensing (land use/ land cover, change detection and modelling future LU/LC scenarios) datasets covering the area of interest

• Establish a web-GIS platform accessible to all stakeholders for data and metadata sharing and dissemination of results, and

• Capacity building of African partners to acquire, process and analyse geospatial and remote sensing data and to apply these data for modelling.

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.

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