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CONTACTS:

Joseph M. Maitima
International Livestock Research Institute
P.O. Box 30709
Nairobi 00100, Kenya
Email: j.maitima@cgiar.org
Tel. +254-20-4223000
Fax. +254-20-4223001

Jennifer M. Olson
International Livestock Research Institute
And, Department of Geography
Michigan State University
East Lansing MI 48824
USA Tel: +1-517-432-9998

CLIP Project Research Personnel :

Gopal Alagarswamy, Jeff Andresen, David Campbell, Declan Conway, Ruth Doherty, Jianjun Ge, Ben Goodwin, Clair Hanson, Sarah Hession, Marianne Huebner, Brent Lofgren, Dave Lusch, Stephen Magezi, Joseph Maitima, Salome Misana, Nathan Moore, Sam Mugisha, John Nganga, Jennifer Olson, Bryan Pijanowski, Philip Thornton, Nate Torbick, Jing Wang, Pius Yanda.

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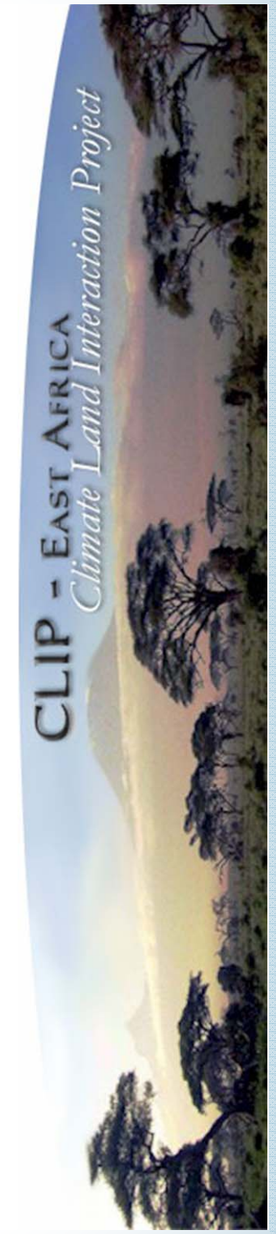

Implications of climate change on rangeland productivity in Kenya

CLIP POLICY BRIEF

Introduction

Kenyan rangelands cover nearly 70% of the country (figure 1) and are a home for millions of pastoralists and agro-pastoralists practicing agriculture mainly livestock keeping at small scale level. Rangelands in Kenya are characterized by a number of habitat structures ranging from open grasslands to closed woody or bushy vegetation with varying amounts and composition of grass cover and grass species respectively. The composition of grass species and the abundance of cover are dependent on a number of ecological conditions including; thermal regimes, rainfall amounts and duration of wet versus dry seasons, soil moisture content, and the phenology of the shrub and tree canopies in the area they grow (Tieszen *et al*. 1979). These ecological conditions are known to influence the type of species present in an area to one of two adaptations on photosynthesis commonly referred to as C_3 and C_4 photosynthetic pathways (Tieszen *et al*. 1979). Cooler, wetter and more shaded habitats tend to favour the C_3 grass species commonly referred to as tall grasses, while the warmer, drier and more open habitats tend to favour the C_4 species commonly known as short grass species. Both livestock and wildlife have preferences on which of the two types of grasses to feed on such that grazers like cows will prefer grazing lands with short grasses and browsers like goats will prefer areas with more bushy vegetation (Stewart 1972; Gangnon and Chew 2000; Cerling *et. al*., 2003).

A change in the environmental conditions described above will alter both the abundance and composition of grass species either to more of the short grasses or more of the tall grasses and *vice versa* depending on the way the environment changes. Where these alterations take place, there are serious impacts on grazing regimes as they may reduce or increase the preferred habitats for different herds. The change may also alter the amount of palatable or non-palatable grass species, presence of short grass species for grazers, and as well as the suitability of habitats for grazers and browsers. Currently there is an almost a linear distribution of grass species in East Africa (Livingstone and Clayton 1980) with the C_4 species more abundant in the lowland rangelands (figure 2) and C_3 species more abundant in the highlands a relationship that has favoured livestock and wildlife grazing in lowland rangelands.

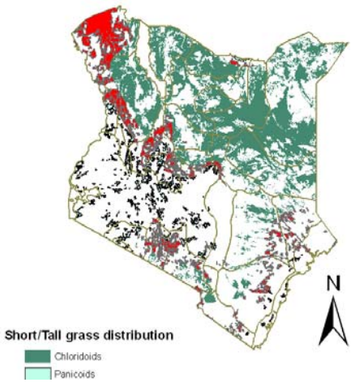

Figure 2 : Distribution of tall and short grasses in Kenya

Figure 1

Simulation results and implications on rangelands livestock feed resources

Climate Land Interaction Project (CLIP) results (http;//clip.msu.edu) show that there will be significant changes in most of Kenya's rangelands. These include changes to wetter conditions (figure 3), and changes to warmer /drier conditions (figures 4). Consequently the results indicate significant changes in vegetation cover in most of the Kenyan rangelands due the changes in environmental conditions. Most of the northern Kenya for example will be with more vegetation cover than present.

However, these changes will vary from place to place also vary in intensity of change between places. Further more human activities like overgrazing and vegetation clearance may accelerate the process or mitigate the impacts as in the case of tree planting. These changes will have obvious impacts on rangelands productivity and may reduce their usefulness as grazing areas or their suitability as pasturelands. These will adversely affect the livelihoods of those who depend on livestock for food and as source of income.

The whole of northern and eastern Kenya are rangelands areas and land use is mainly grazing, wildlife conservation in national parks, and cultivation in the currently wetter areas. Whether land is used exclusively for grazing or for mixed crop – livestock production is partly dependent on the cultural/ economic interests of the main ethic group occupying the area. The herd size (livestock numbers) and structure (composition of goats, sheep, cows etc,) varies from place to place and ethnic group to ethnic group, but they are not dependent on ecological productivity potential.

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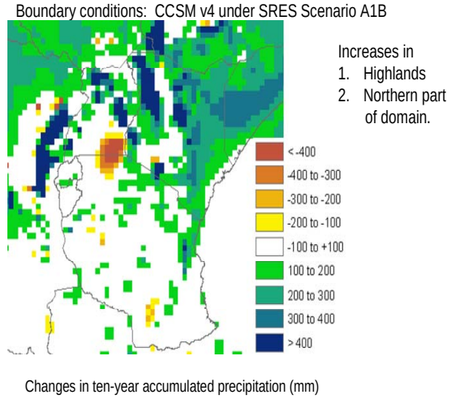

Figure 3 : Impact of future global climate change (2000 to 2050) on precipitation

Importance of rangelands agriculture to Kenya's economy

Rangelands play an important role in livestock production and wildlife conservation in Kenya, both of which are critical to Kenya's economy as they are key to supporting livelihoods and generating foreign exchange earnings through trade and tourism. Livestock production is an important component of the Kenyan economy, with estimated value of 13 million cattle, 7.6 million goats, 5.8 million sheep and 30 million chickens in 1999. It contributes to about 10% of GDP (Republic of Kenya, 2002) and 30% of the farm gate value of agricultural commodities. Fifty percent (50%) of Kenya's livestock is produced in ASAL lands which cover about 70% of the total Kenya surface area and which provides a home to over 25% of the total estimated 35 million Kenyan population.

In these areas, the sector provides 90% of all employment opportunities and 95% of income (Republic of Kenya, 2003).

Implications of climate change on Rangelands

1. Warmer temperatures lead to accelerated phenology in nearly all cases, shortening the growing season.
2. In some cases, the effects of warmer temperatures are offset by the impact of increasing precipitation (e.g, NE Kenya). In these areas, vegetation amounts and surface water may increase, and species composition may change. There may be impacts on soil (erosion, weathering).
3. In other cases, there is insufficient additional precipitation to offset the higher temperatures. In these areas, vegetation production and surface water availability will decline. Species composition may change.
4. The distribution and intensity of pests and diseases will change.

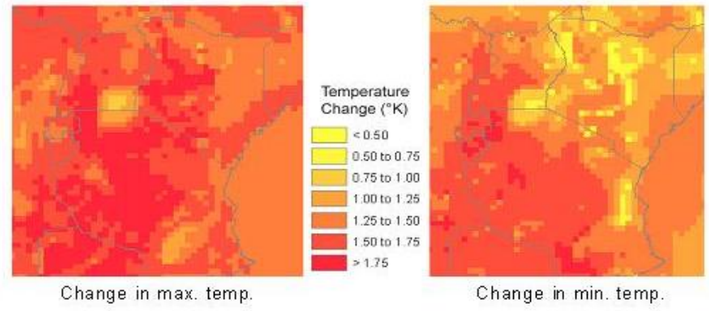

Figure 4 : Impacts of global climate change (2000 to 2050) on temperature

Key Messages

1. Climate change is likely to alter the distribution and composition of grass species in northern, eastern and coastal Kenya and impact heavily on the productivity of grasslands.
2. Population growth and rapid urbanization have increased demand for livestock products in Kenya and other developing countries. To meet this demand there is a need to adapt livestock production practices to climate change.
3. There will be greater dependence on the use of forage in shrubs and trees (browses) in livestock feeding as grass cover reduces in abundance due to climate change. However, this use should be done with adequate climate change adaptation measures to avoid adverse local and international environmental effects.
4. Projected changes will reduce movement of livestock from place to place due to increased vegetation cover, wetter conditions and therefore likely to result into overgrazing in localized places.
5. Wetter conditions might increase livestock and human disease outbreaks, higher densities and spatial distribution of disease vectors, and crop pests thus hindering communities from taking advantage of increased water availability.
6. The spatial variability of climate change impacts within the rangelands is likely to create un equitable distribution of feed resources and therefore increase competition for pastures among different user groups.