

Addressing the Impacts of Climate Change on Maize Production within East Africa Community through Policy Response

By Nancy Laibuni, and John Nyangena

Maize is the most important staple food crop in the East Africa Community and define the food security for majority of communities. As study commissioned by KIPPRA and UNECA demonstrate that maize production is highly vulnerable for climate change and variability with yields expected to decline significantly by 2045. Although on average the yields will be higher compared with the 1971- 2000 baseline, it will likely decline in most agro-climatic zones and affect overall food security situation. Kenya will record 50 per cent reduction in some climatic zones and 43 per cent increase for others, while Burundi and Rwanda will record between 72 – 10 per cent increases in maize yields. Climate change is expected to cause a shift in existing agro-climatic zones with area maize growing area becoming less suitable, while growing seasons in some areas will be lengthened thus affecting annual production. Spatial effects of climate change in the region is a wake up for policy makers to combine agricultural and trade policies to boost production and ease flow of cross-border food within the EAC region.

Introduction

This policy brief highlights the results of a study commissioned by the Kenya Institute for Public Policy Research and Analysis (KIPPRA) and the United Nations Economic commissions for Africa to understand the nexus between climate change, agriculture production and trade in the EAC.

There is growing consensus that agriculture has and will continue to suffer the worst effects of climate change including vulnerability. In particular, extreme climatic conditions in the form of droughts and floods and associated pests and diseases, land and soil degradation, water deficits and forage loss are already known to affect food security in most developing countries including those in the East Africa Communities. Given the centrality of agriculture and food production in the economy and livelihoods in these countries, climate change impacts on agriculture are bound to have profound consequences on agricultural

production, negatively impact agriculture dominated exports.

Report produced by the intergovernmental panel on climate change (IPCC) show that the east Africa region is warming faster compared with other regions of the world and by 2050, climate change will considerably affect crop yields in the region. Results of agriculture simulation show that compared to 2005 base year climate change will reduce by 2050 wheat yields by 22% while rice yields for rice will reduce by 14% and maize by 5%. Under this scenario, vast number of already poor communities who directly depend on agriculture for livelihoods will slip deeper into poverty and vulnerability. As a result, food availability will decline by 21% per person, thereby increasing the number of malnourished children.

The EAC comprising of Burundi, Kenya, Uganda, Rwanda and Tanzania has different agro-ecological zones, which favor production of different food & cash crops, and livestock. However, maize

is one of the most important staple food crops in the region whose availability is equated to food security. Tanzania is the region's highest producer of maize (with the largest fluctuations in production), followed by Kenya and Uganda in that order. Rwanda and Burundi produce comparatively small quantities of maize (Figure 1).

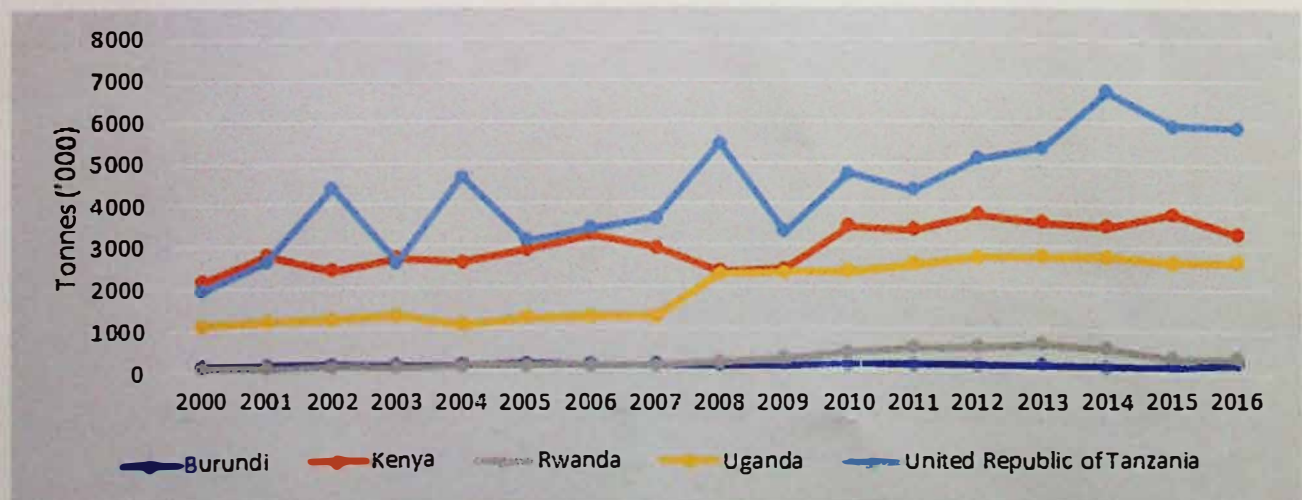
Generally, the EAC is a maize deficit region with consumption over stripping production, although deficits vary across the member states. This deficit is met through imports with the EAC member states as well as with the rest of the world.

However, in 2005, the EAC Customs Union came into force to facilitate cross border agriculture trade by enabling flow of food from areas with surplus to those experiencing deficits. The EAC has a three-band custom external tariff (CET) with a minimum rate of 0 percent (raw materials and capital goods), middle rate 10 percent (intermediate goods), and 25 percent (finished/manufactured or processed goods). There are exemptions to the CET, where third countries importing to the EAC are charged above the set CET. These products designated as sensitive products are mainly agricultural including milk and cream, wheat, rice and maize and require protection from competition given their economic and social importance to the EAC economies. Through manipulation of policies has emerged an important tool for adapting agriculture to climate change, few studies have provided empirical evidence to back their effectiveness.

Projected Rainfall patterns in East Africa Community

Rainfall is the most important climate parameter in maize production. Results of the coordinated regional downscaling experiment (CORDEX) multimodel ensemble model showed that changes in rainfall patterns is the main parameter-driving climate change in EAC. Under RCP 4.5 scenario, the precipitation will vary differently across space and seasons. The December, January and February (DJF) season will experience high amounts of rainfall of about 1000 mm in the southern part of EAC, while the northern part will have depressed annual rainfall of up to 100 mm. During March, April May (MAM), most of the EAC will be expected to receive high precipitation. The June July August (JJA) season will experience limited amount of precipitation expected in the region except Uganda and western parts of Kenya. During October November December (OND) only northern Kenya around Lake Turkana are expected to receive depressed rainfall. Annual precipitation is projected to be high in most parts of EAC at above 2000 mm with the north and eastern Kenya being the only areas expected to receive less than 400 mm. In Burundi, precipitation changes are projected to reduce by between a percentage changes ranging from 26-2 per cent compared to the 1971-2000 baseline. At the same period, Kenya will experience reduction in precipitation ranging between 20-6 percent, Rwanda between 36-5 per cent, Tanzania between 2-43 per cent while that for Uganda will be between 22-5 per cent. Similar patterns are expected for the end century in all seasons. Notably, the magnitude of expected precipitation will be expected to be less at the end

Figure 1: Maize production in East Africa Community



Source: FAO, 2017

century (2071-2100) as compared to mid-century (2016-2045). Since agriculture production in EAC is predominately rainfed, projected decreased rainfall will have considerable effect on maize production and make communities food and insecure.

Projected Impacts of climate change on maize yields in East Africa Community

Results of the Agricultural Production Systems Simulator (APSIM) showed that across the EAC region, indicate that maize production remains variable in different agro-ecological zones (ACZ) in the region. This is because of differences in the distribution and onset of rainfall, which determine the performance of maize at different stages of maturing. Thus, in 2045, projected climate change decreased maize yields in some of the ACZ whereas in others, it will lead to increased yields (Table 1). It is worth noting that there exist other factors that influence crop production such as varietal specifications, edaphic (soil), biotic, physiographic and socio-economic factors.

Table 1: Effects of climate change on maize yields in East Africa Community (tons/ha)

| Country | Baseline (1971 -2000) | RCP4.5 (2016 -2045) |
|----------|-----------------------|---------------------|
| Kenya | 0.51 - 3.29 | 0.0 - 4.7 |
| Uganda | 0.81 - 2.95 | 1.1 - 3.3 |
| Tanzania | 0.85 - 1.66 | 0.5 - 2.9 |
| Rwanda | 0.17 - 1.45 | 1.6 - 4.0 |
| Burundi | 1.28-1.54 | 2.2-4.0 |

According to the table, although the entire EAC will have positive yield increases, Burundi and Rwanda would gain more from climate change in the mid-century. The minimum yield in these countries will increase from 1.28 t/ha in the baseline to 2.2 t/ha while the maximum will increase from 1.54 t/ha to 4.0t/ha.

Overall, in the mid-century, maize deficits in EAC will grow and the region will resort to imports. Toward 20145, population growth in EAC is projected to grow by between 2.65 and 3.7 per

annum, while per capita expenditure will grow by between 1.12-fold and 5.28-fold. Consumer prices are also expected to increase by between 3.51-fold and 5.71-fold per annum. Import and export prices are expected to increase by 2% per annum for all the countries. Due to associated changes in demand and supply in the different countries overtime, demand for commodities is expected to rise and so is supply. In countries where demand exceeds supply, imports for specific commodities can be from EAC or rest of the world. In cases where supply exceeds demand, individual countries will export to EAC or rest of the world (RoW) depending on the most profitable option.

Role of agriculture policy in boosting maize production

EAC countries can deploy an array of policy instruments to boost maize production and bridge the gap resulting from climate change. Within the African Union (AU) level, the Comprehensive Africa Agriculture Development Programme (CAADP) framework and the Malabo declaration calls for countries to invest at least 10 per cent of their budgets in agriculture and attract more than 8 per cent of foreign direct investment FDI into agriculture. This will reduce the cost of inputs while area under maize irrigation will be expanded. If EAC countries fully implement this policy option, maize production will grow by an average of 5 per cent, per capita income will rise by more than 3.5 per cent while the GDP will grow by an average of 6 per cent. Under these conditions, Burundi will export 220 thousand metric tons of maize to Rwanda while Uganda will export 1700 thousand metric tons to Kenya. No maize will be imported from Rest of the World (ROW) to the EAC region.

Effects of trade policies on household welfare

If the EAC common external tariff (CET) tariff is increased in addition to the agricultural policy, it will lead to higher commodity prices. This is because the trade policy will restrict international trade and narrow trade within the EAC region. In effect, this means that the purchasing power in the individual partner states will be depressed as local production will not be enough to meet demand.

This indicates that increasing tariffs though meant to improve local production in the region end up hurting consumers and producers as the region is not yet self-sufficient and countries will be forced to import. Overall, the mean per capita welfare for the EAC will decline to US\$ 4.88. With trade restrictions, per capita welfare for all the countries declines table 2. Trade patterns within the EAC will change with the combined effects of trade and agriculture policies. Tanzania will be a net exporter of maize. Kenya will import maize from Uganda.

Table 2: Baseline, agricultural and trade policy and climate change per capita change in welfare in the mid century

| | Baseline welfare change (US\$) | Agricultural policy welfare change (US\$) | Trade and Agric policy welfare change (US\$) |
|----------|--------------------------------|---|--|
| Burundi | 9.11 | 12.19 | 8.66 |
| Kenya | 6.06 | 8.50 | 1.40 |
| Rwanda | 7.62 | 11.12 | 1.75 |
| Uganda | 3.44 | 8.67 | 1.86 |
| Tanzania | 13.49 | 18.18 | 10.74 |
| Mean | 7.94 | 11.73 | 4.88 |

What are the Policy Implications?

Considering the study findings, EAC countries have an opportunity to avoid the adverse effects of climate change on maize production through the following;

- (i) Produce based on comparative advantage: the EAC countries should identify their comparative advantages in production of various grains taking into account expected shifts in ACZs. This will enable countries with surplus production sell to those experiencing deficits.

- (ii) Pursue right agriculture policies: Countries need to invest in improving agricultural productivity by allocating at least 10% of their GDP according to the Malabo declaration to the agricultural sector to increase production. This will help bridge the existing yield gaps.
- (iii) Adopt responsive trade policies. Partner States need to avoid in-ward looking trade policies, which hinder agricultural trade such as export bans and embargos. In the past, individual countries such as Kenya and Tanzania have introduced trade bans, and other forms of trade embargos to restrict

trade. Such moves lead to losses in welfare as commodity prices are likely to increase.

- (iv) Review existing tariff regime: High CETs are counter-productive and may not achieve the desired results especially in a region that is not self-sufficient in grain production. There is need to review them downwards to make them less punitive while at the same time implementing production enhancing policies.

This policy is based on a forthcoming KIPPRA Special Paper on Climate Change, Agricultural Production, Trade, Food Security and Welfare in East African Community and Working Paper 20/2017 - 28/2017

About KIPPRA Policy Briefs

KIPPRA Policy Briefs are aimed at a wide dissemination of the Institute's policy research findings. The findings are expected to stimulate discussion and also build capacity in the public policy making process in Kenya.

KIPPRA acknowledges generous support from the Government of Kenya and the Think Tank Initiative of IDRC, who have continued to support the Institute's activities over the years.

For More Information Contact:

Kenya Institute for Public Policy Research and Analysis
 Bishops Road, Bishops Garden Towers
 P.O. Box 56445-00200, Nairobi
 Tel: 2719933/4, Cell: 0736712724, 0724256078
 Email: admin@kippra.or.ke
 Website: <http://www.kippra.org>
 Twitter: @kippra.kenya