Climate change poses a threat to food security
Business as usual is not an option for Africa

Africa’s food production systems are already among the most vulnerable production systems because of extensive reliance on rainfall. Recurrent droughts and floods affect both crops and livestock. The capacity to adapt in Africa is relatively low due to persistent poverty and poor access to finance and technology.

Agriculture in Africa will face significant challenges in adapting to climate changes, as negative effects of high temperatures and altered rainfall patterns can become increasingly prominent. Climate change will amplify existing stress on water resources in Africa, which are a key constraint on the continent’s continued economic development.

African ecosystems and their services are already being affected, and future impacts are expected to be substantial. Main drivers of these changes are anthropogenic land use change (such as the expansion of agriculture and livestock grazing) in interaction with natural climate variability and anthropogenic climate change, overexploitation of resources and habitat degradation resulting in loss of biodiversity. Economies and livelihoods of African countries will increasingly experience challenges from existing stressors.

Changes in the way food production systems are managed and how ecosystems used are needed to be able enhance economic development.

The context

Climate change does not happen in isolation and understanding the context is crucial to be able to assess the impacts and formulated appropriate adaptation strategies. The patterns of climate risk reflect not only the trends in climate, but also exposure and vulnerability of people, communities, societies, sectors and ecosystems.

People who are socially, economically, culturally, politically, institutionally, or otherwise marginalized are often highly vulnerable to climate change and climate change responses. So although climate change does not discriminate between different groups and regions the effects vary strongly among people and regions. Arid and semi arid regions in Africa are among the most vulnerable regions, already vulnerable groups such as women, children and old people are hit hardest by climate impacts. Climate-related hazards are an additional burden and act as an additional stressor on the development of peoples and regions.

A major trend in the 21st century is the further urbanization of societies, moving the hotspots of food insecurity towards cities and away from production areas. In urban and rural areas, wage-labor-dependent households in high food insecure regions are expected to be worst affected due to food price increases. In more rural areas the agricultural self-employed could benefit related to increased demand for food from cities.

Competition for land and water with non-agricultural sectors is expected to increase with increasing urbanization, and the competition for water will become more critical for agriculture due to changes in rainfall patterns.

Climate change increases the risk for unique and threatened systems (including cultures and ecosystems), and large-scale singular events resulting in abrupt and irreversible changes. Particularly increased is the risk of loss of marine and coastal ecosystems and terrestrial and inland water ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for livelihoods (especially for fishing communities in the tropics).
Risks associated with global temperature rise in excess of 4°C relative to preindustrial levels include potential adverse impacts on agricultural production worldwide, potentially extensive ecosystem impacts, and increasing species extinction risk, as well as possible crossing of thresholds that lead to disproportionately large earth system responses. Uncertainties related to the large magnitude of warming and the impacts remain large.

Current and future risk on food security, agriculture, ecosystems, and biodiversity

The current and future impacts of climate change on crop yields have been and are expected to be more negative than positive. This unfortunately is truer for Africa than for any other continent, particularly for the semi-arid areas. Increasing temperatures and changes in precipitation will reduce cereal crop productivity and have an adverse effect on food security. Also, high-value multi annual cash crops could be adversely affected by temperature rise undermining the livelihood of those depending on the revenues of these crops.

Box 1: Climate change and its impacts in Africa

Most of Africa has warmed by 0.5 degrees or more over the last 50-100 years and temperatures are projected to rise faster than the global average increase during the 21st Century. Heat waves and warm spell durations will increase toward the end of the century and droughts might intensify in some regions. Only for East Africa it seems clear that heavy precipitation is going to increase.

<table>
<thead>
<tr>
<th>Africa</th>
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<tbody>
<tr>
<td>Snow &amp; Ice, Rivers &amp; Lakes, Floods &amp; Drought</td>
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<tr>
<td>- Retreat of tropical highland glaciers in East Africa (High confidence, Major contribution from climate change)</td>
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<tr>
<td>- Reduced discharge in West African rivers (Low confidence, Major contribution from climate change)</td>
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<td>- Lake surface warming &amp; water column stratification increases in the Great Lakes &amp; Lake Kariba (High confidence, Major contribution from climate change)</td>
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<tr>
<td>- Increased soil moisture drought in the Sahel since 1970, partially wetter conditions since 1990 (Medium confidence, Major contribution from climate change)</td>
<td>[22.2-3, Tables 18-5, 18-6, &amp; 22-3]</td>
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<tr>
<td>Terrestrial Ecosystems</td>
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<td>- Tree density decreases in western Sahel &amp; semi-arid Morocco, beyond changes due to land use (Medium confidence, Major contribution from climate change)</td>
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<td>- Range shifts of several southern plants &amp; animals, beyond changes due to land use (Medium confidence, Major contribution from climate change)</td>
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<tr>
<td>- Increases in wildfires on Mt. Kilimanjaro (Low confidence, Major contribution from climate change)</td>
<td>[22.3, Tables 18-7 &amp; 22-3]</td>
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<tr>
<td>Coastal Erosion &amp; Marine Ecosystems</td>
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<tr>
<td>- Decline in coral reefs in tropical African waters beyond decline due to human impacts (high confidence, major contribution from climate change)</td>
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<td>Food Production &amp; Livelihoods</td>
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<tr>
<td>- Adaptive responses to changing rainfall by South African farmers, beyond changes due to economic conditions (Very low confidence, Major contribution from climate change)</td>
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<td>- Decline in fruit-bearing trees in Sahel (Low confidence, Major contribution from climate change)</td>
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<tr>
<td>- Malaria increases in Kenyan highlands, beyond changes due to vaccination, drug resistance, demography, &amp; livelihoods (Low confidence, Minor contribution from climate change)</td>
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<tr>
<td>- Reduced fisheries productivity of Great Lakes &amp; Lake Kariba, beyond changes due to fisheries management &amp; land use (Low confidence, Minor contribution from climate change)</td>
<td>[7.2, 11.5, 13.2, 22.3, Table 18-9]</td>
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Table 1 (IPCC WGII Table SPM.A1): Observed impacts attributed to climate change. These impacts have been attributed to climate change with very low, low, medium, or high confidence, with the relative contribution of climate change to the observed change indicated (major or minor), for natural and human systems across Africa over the past several decades. Absence from the table of additional impacts attributed to climate change does not imply that such impacts have not occurred.

Pest, weed and disease pressure on crops and livestock could increase as a result of climate change combined with other factors. Moreover, new challenges to food security are emerging as a result of strong urbanization trends on the continent and increasingly globalized food chains, which require
better understanding of the multi-stressor context of food and livelihood security in both urban and rural Africa.

Africa's food production systems are among the most vulnerable because of extensive reliance on rain fed crop production, high intra- and inter-seasonal climate variability, recurrent droughts and floods that affect both crops and livestock, and persistent poverty that limits the capacity to adapt. Agriculture in Africa will face significant challenges in adapting to climate changes, as negative effects of high temperatures can become increasingly prominent.

The composition of farming systems from mixed crop-livestock to more livestock dominated food production may occur as a result of reduced growing season length for annual crops and increases in the frequency and prevalence of failed seasons. Transition zones, where livestock keeping is projected to replace crop cultivation by 2050, include the West African Sahel and coastal and mid-altitude areas in eastern and south eastern Africa, areas that currently support 35 million people and are chronically food insecure.

African ecosystems are already being affected by climate change, and future impacts are expected to be substantial.

Coastal and ocean systems are important for the economies and livelihoods of African countries, and climate change will increase challenges from existing stressors, such as overexploitation of resources, habitat degradation, loss of biodiversity, salinization, pollution, and coastal erosion. Coastal systems will experience impacts through sea level rise combined with storm swells. Fisheries mainly depend on either coral reefs (on the eastern coast) or coastal upwelling (on the western coast) which are the most biologically active systems in the oceans. Ocean ecosystems, particularly coral reefs and upwellings, will be affected by ocean acidification and warming. Coral reefs demonstrate both lower productivity and resilience, and changes in ocean upwellings negatively affect economic sectors such as fisheries.

Changes are occurring in the distribution and dynamics of all types of terrestrial ecosystems in Africa, including deserts, grasslands and scrublands, savannas and woodlands, and forests. The primary driver of these changes is anthropogenic land use change (such as the expansion of agriculture, livestock grazing, and fuel wood harvesting) in interaction with natural climate variability and anthropogenic climate change. Three primary trends have been observed at the continental scale: small expansion of desert and contraction of the total vegetated area; large increase of human influence within the vegetated area, accompanied by a decrease in natural vegetation; and a shift in the spatial distribution of the remaining natural vegetation types, with net decreases in woody vegetation in western Africa and net increases in woody vegetation in central, eastern, and southern Africa.

Freshwater ecosystems in Africa are at risk from anthropogenic land use change, over-extraction of water and diversions from rivers and lakes, and increased pollution and sedimentation. Climate change is also beginning to affect freshwater ecosystems, as evident by elevated water temperatures reported in surface waters of several large lakes. Moderate warming may be contributing to reduced lake water inflows and therefore nutrients, which might adversely affect food resources for higher trophic levels organisms of mainly plankton eating fish.

Managing the risks: ecosystem-based adaptation, climate smart agriculture and governance

Adaptation to climate change is a part of development planning. So far most development planning in Africa has focused on urgent and immediate needs and it is embedded in short term planning processes. However, climate change also requires a longer term planning horizon. Aligning the short term planning with long term planning processes is slowly starting.
A narrow focus on short term planning may lead to maladaptation and in fact increase the vulnerability or exposure of groups or sectors. Some short term responses to increasing risks related to climate change may also limit future choices. For example, enhanced protection of exposed assets can lock in dependence on further protection measures.

Identifying and acting on risks and opportunities and overcoming barriers includes availability and access knowledge, technologies appropriate institutions and institutional arrangements. Successful adaptation goes beyond the identification of adaptation options and assessing their costs and benefits.

Since 2007, Africa has gained experience in conceptualizing, planning and beginning to implement and support adaptation activities, from local to national levels and across a growing range of sectors. At the national level, African countries have initiated comprehensive planning processes for adaptation by developing National Adaptation Programmes of Action (NAPAs), in the case of the Least Developed Countries, or National Climate Change Response Strategies (NCCRS); implementation is, however, lagging and integration with economic and development planning is limited but growing. Prioritized adaptation measures in the NAPAs tend to focus on agriculture, food security, water resources, forestry, and disaster management; and on projects, technical solutions, education and capacity development, with little integration with economic planning and poverty reduction processes.

Figure 1 shows IPCC’s key risks for Africa from climate change and the potential for reducing risks through adaptation and mitigation (based on IPCC WG II Table TS.5 based on IPCC WG II Table TS.5). Each key risk is characterized for three timeframes: the present, near-term (here, assessed over 2030-2040), and longer-term (here, assessed over 2080-2100). In the near-term, projected levels of global mean temperature increase do not diverge substantially for different emission scenarios. For the longer-term, risk levels are presented for two scenarios of global mean temperature increase (2°C and 4°C above preindustrial levels). These scenarios illustrate the potential for mitigation and adaptation to reduce the risks related to climate change.
The National Adaptation Planning (NAP) process, launched in 2013, is a voluntary country driven process that aims to reduce the vulnerability to climate change and to integrate climate change into development planning. For Least Developed Countries it builds on the NAPAs. The NAP process has a stronger focus on medium and long term planning including the institutional arrangements and capacities needed to address the dual aims of the process.

Transboundary regional adaptation strategies are still in their infancy. Early examples include the Climate Change Strategies and Action Plans being developed by the Southern African Development Community and the Lake Victoria Basin Committee, as well as efforts being made by six highly forested Congo basin countries to co-ordinate conservation and sustainable forest management of the Central African forest ecosystem, and obtain payments for ecosystem services.

How to move ahead, looking for co-benefits

Significant co-benefits, synergies, and trade-offs exist between mitigation and adaptation and among different adaptation responses. Increasing efforts to mitigate and adapt to climate change imply an increasing complexity of interactions, particularly at the intersections among water, energy, land use, and biodiversity, but tools to understand and manage these interactions remain limited.

Examples of actions with co-benefits include:

i. improved energy efficiency and cleaner energy sources, leading to reduced emissions of health-damaging climate-altering air pollutants;

ii. reduced energy and water consumption in urban areas through greening cities and recycling water;

iii. sustainable agriculture and forestry;

iv. protection of ecosystems for carbon storage and other ecosystem services.

Adaptation strategies

Some illustrative examples of ecosystem-based adaptation experiences which at the same time reduce vulnerability and enhancing resilience include: maintaining wetlands; urban green spaces and green infrastructure (such as shade trees and green roofs); hill side terracing; (coastal) afforestation and reforestation.

Management actions can reduce, but not eliminate risks of impacts to terrestrial and freshwater ecosystems due to climate change. The capacity for natural adaptation by ecosystems and their organisms is substantial, but for many ecosystems and species it will be insufficient to cope with projected rates and magnitudes of climate change in the 21st century without substantial loss of species and ecosystem services. The capacity for ecosystems to adapt to climate change can be increased by reducing the other stresses operating on them; reducing the rate and magnitude of climate change; reducing habitat fragmentation and increasing connectivity; maintaining a large pool of genetic diversity and functional evolutionary processes; assisted translocation of slow moving organisms or those whose migration is impeded, along with the species on which they depend; and manipulation of disturbance regimes to keep them within the ranges necessary for species persistence and sustained ecosystem functioning.

In order to address the rising risks, our preparedness should be enhanced for disaster response by preparing for climate variability and extreme events. However uncertainty of these events occurring is high, we should particularly focus more on our efforts to build resilience and reduce the risk of disasters.

Adaptation responses to climate change in the urban and agricultural sectors can have unintended negative outcomes for terrestrial and freshwater ecosystems. For example, adaptation responses to counter increased variability of water supply, such as building more and larger impoundments and
increased water extraction, will in many cases worsen the direct effects of climate change in freshwater ecosystems.

Strategies that integrate land and water management, and disaster risk reduction, within a framework of emerging climate change risks would bolster resilient development in the face of projected impacts of climate change.

A wide array of conservation agriculture practices, including agroforestry and farmer-managed natural tree regeneration, conservation tillage, contouring and terracing, and mulching are being increasingly adopted in Africa. These practices may strengthen the resilience of the land base to extreme events and broaden sources of livelihoods, both of which have strongly positive implications for climate risk management and adaptation.

**Climate smart agriculture**

While vulnerable sectors such as agriculture give us particular reasons for concern they may offer opportunities in some instances to reduce climate related risks and threats by integrating both adaptation and mitigation strategies as a lever for reducing poverty and promoting climate resilient pathways. The integration of climate change adaptation and mitigation into agricultural policies and planning focusing on food security and development of the sector seems a promising way to move forward.

Climate smart agriculture is a way to address short and long term agricultural development priorities in the face of climate change. In addition it may and serve as an integrator to other development priorities. It seeks to support countries and other actors in securing the necessary policy, technical and financial conditions to enable them to:

1. sustainably increase agricultural productivity and incomes;
2. build resilience and the capacity of agricultural and food systems to adapt to climate change;
3. seek opportunities to reduce and remove greenhouse gases while meeting their national food security and development goals.

The 2014 IPCC- WGII report clearly positioned climate change as a development issue and serves as a strong reminder of the urgency to react to the available information. Clearly farmers, local communities, and civil society are already taking action, it seems however that the political leadership to move forward is not always clear.

Political leadership in national development is needed, this leadership would include connecting to private sector partners, knowledge institutes and civil society to jointly create an action agenda in which responsibilities are shared and leadership for tasks can be divided.

For agriculture the combination of public and private sector initiatives are possible via value chain management, investments in agricultural services, knowledge and training of farmers.

**Sources**

National Adaptation Plan process: http://goo.gl/THxKjV
Brochure Climate-Smart Agriculture: http://goo.gl/sdXzzk

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