

Info Note

Impact of climate change on African agriculture: focus on pests and diseases

Findings from CCAFS submissions to the UNFCCC SBSTA

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Key messages

- Climate change will bring greater risk of pests and diseases to African agricultural systems, affecting crop, livestock, and fisheries productivity.
- Severe and widespread climate change impacts on agricultural productivity will require adaptation through complex systemic and transformational changes in food systems accompanied by a combination of improved trade policies and shifts in diets.
- Crop pests already account for ~1/6th of farm productivity losses. Climate change will accelerate the prevalence of pests and diseases and increase the occurrence of shock events.
- Among 65 animal diseases identified as most important to poor people, 58 % are climate sensitive and will exacerbate under climate change. Climate change may also have indirect effects on animal disease, and these may be greater than the direct effects.
- There is clear evidence that some emergent livestock diseases have already expanded in range because of climate change.
- Aquaculture operations in the tropics experience higher cumulative mortalities and faster progression of diseases and this could be exacerbated by climate change.
- Strategies to cope with increased incidence of pests and diseases should focus on capacity enhancement at the regional, national, and local levels, as well as building multi-country coordination for new and adapted pest and disease management systems that are based on sound science.

Introduction

According to the IPCC's Fifth Assessment Report, changes in the climate over the last 30 years have

already reduced global agricultural production by 1 – 5 % per decade relative to a baseline without climate change. In addition, recent studies indicate that even a 2 degrees increase in global temperature will affect agricultural productivity, particularly in the tropics, and this impact will rise with increases in temperature. In this context, this Info Note presents recent evidence on the implications for crops, livestock, and fisheries production, and their associated pests and diseases in Africa.

Projected impacts of climate change on African agriculture

In the absence of effective adaptation measures, African crop production will likely be reduced by climate change, mostly as a result of increased regional temperatures.

- For maize and beans, two key staple crops in Africa, areas of suitability could decline by 20-40 % relative to the period 1970-2000.
- Conversely, across most of Africa, sorghum, cassava, yam, and pearl millet show, on average, either little loss or even gains in the area suitable for production.
- Western Africa appears to be a highly vulnerable region, with significant (>10 %) reductions in suitable area for maize, sorghum, finger millet, groundnut and bananas.
- The reduced productivity and suitability of the maize-beans cropping systems in Eastern and Southern Africa means that adaptation will be key for improving food security.
- Opportunities may arise from expanding cropping areas in certain countries and regions: cassava, yams and bananas across Eastern Africa, and to some extent also in Southern Africa.

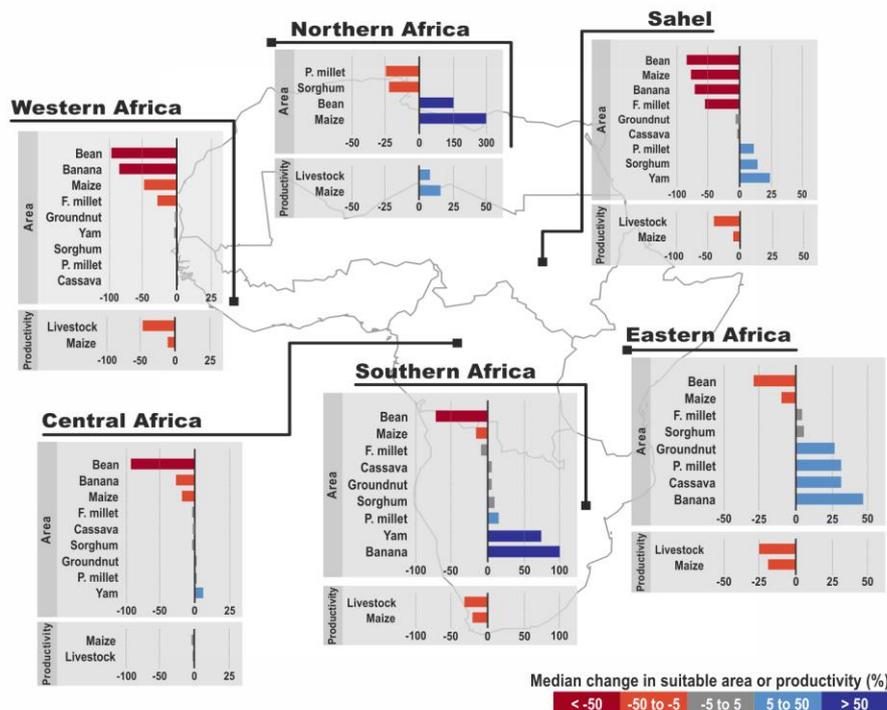


Figure 1. Projected median changes in climatically suitable area and productivity by 2050s and RCP8.5, relative to a historical period (1970-2000). Median values given are based on ensemble simulations of niche and productivity models, and therefore should be interpreted in light of associated uncertainties (see accompanying working papers on crop and livestock production). Livestock productivity refers to Annual Net Primary Productivity (ANPP) of rangelands (a proxy for livestock productivity), rather than to a direct measure of meat or milk productivity.

Adaptation to these changes is possible, with strategies ranging from autonomous adaptation (e.g. shifts in planting dates, cultivar substitution) to deeper systemic and transformational changes (e.g. climate-smart breeding, livelihood diversification or change), and may also include improved trade policies and shifts in diets.

While the Fifth Assessment Report has limited information on livestock, substantial reductions in forage availability in some regions, and widespread negative impacts on forage quality and thus on livestock productivity are envisaged. Furthermore, most domesticated species perform best at temperatures between 10 and 30 °C. At temperatures above 30 °C, cattle, sheep, goats, pig and chickens all reduce their feed intake 3-5 % for each 1°C increase. These impacts will have cascading effects on incomes and food security of the many millions of African farmers who depend on livestock-based systems.

African countries are highly vulnerable to climate change impacts on fisheries due to the high dependence on fish as a source of protein and the physical impacts of climate change on the sector. Of the 33 countries identified as highly vulnerable to climate change impacts on fisheries, 23 are from Africa¹. Detailed projected impacts are unavailable, but where such analysis has been conducted, such as in the case of West Africa, a 21 % decline in the annual landed value of fish was projected by 2050², relative to the average of 2001-2010.

¹ Allison EH, Perry AL, Badjeck MN, Adger WN, Brown K, Conway D, Halls AS, Pilling GM, Reynolds JD, Andrew NL, Dulvy NK. 2009. Vulnerability of national economies to the impacts of climate change on fisheries. *Fish and Fisheries* 10(2):173-196.

² Lam VWY, Cheung WWL, Swartz W, Sumaila UR. 2012. Climate change impacts on fisheries in West Africa: implications for economic, food and nutritional security. *African Journal of Marine Science* 34(1):103-117.

Climate change impacts on pests and diseases in agricultural systems

Crops

Crop pests are already a major factor influencing farm productivity. Globally about one-sixth of field production is lost to pests, with further losses in storage. Under climate change it can be expected that:

- The prevalence of crop pests will change
- The frequency of new pest introductions will increase
- The occurrence of major pest outbreaks will increase
- The risk of pesticide residues in food will increase

These events will be driven by outcomes associated with climate change and extreme weather; namely

- Crops and area cultivated, along with fauna, will change, affecting pest prevalence
- Crop failures will increase, leading to new untested trade pathways, which will increase the risk of new pest entry
- Pesticides use and pesticide resistance will increase leading to reduced efficacy and food safety risks

Population growth, dietary change and increased globalisation of trade will further drive cropping system change and compound the risk of new pests and disease events. Understanding the granularity of these changes, in terms of choices made by farmers, cropping systems affected and markets disrupted, presents a critical challenge throughout Africa. Currently the capacity for managing pests is low, and this will need to be improved.

Livestock

Meta-analyses suggest that around 20 % of ruminants (25 % of young and 10 % of adult animals) in Africa and more than 50 % of poultry die prematurely each year, and case studies indicate at least half of deaths are due to infectious disease. Climate change can exacerbate disease in livestock, and some diseases are especially sensitive to climate change. Among 65 animal diseases identified as most important to poor people, 58 % are climate-sensitive. In addition to these direct impacts, climate change may also have indirect effects on animal disease, such as:

- Increased rate of development of parasites and pathogens as a result of higher temperatures and greater humidity.
- Changed distribution and abundance of disease vectors.
- Exposure to new pathogens and vectors as a result of increased pest range.
- Altered ecosystem structure and function.
- Changes in peoples' behaviour, which affect the exposure or vulnerability of animals.

There is clear evidence that some important livestock diseases, such as bluetongue, have already expanded because of climate change and models predict changes in priority diseases such as trypanosomiasis (costs farmers in east Africa \$2 billion a year), East Coast fever (kills one animal in Africa every 30 seconds) and Rift Valley fever (reduced exports from Africa by 75 %).

Livestock diseases also have impacts on human health. Over 60 % of human pathogens are zoonotic, or transmissible from animals, with a smaller number of zoonosis are responsible for most illness. The most important are food-borne zoonosis, which cause billions of cases of illness. A World Bank study estimates that over the last couple of decades, zoonotic emerging diseases have had global costs of \$6.7 billion per year. In low-income countries, zoonosis and diseases which recently emerged from animals, make up 26 % of the infectious disease burden and 10 % of the total human disease burden.

Aquatic animal disease

Compared to Asia which accounts for more than 90 % of the global aquaculture production, aquaculture is in its infancy in the African continent, but has huge potential to expand and contribute to food and nutritional security of the region. Countries like Nigeria, Egypt and Namibia are making large investments in aquaculture. Aquaculture operations in the tropics experience higher cumulative mortalities and faster progression of diseases. This could be exacerbated by climate change.

Water-borne pathogens have the potential to spread at faster rates than in terrestrial systems. Extreme weather events and international trade (especially trade in live aquatic animals) have the potential to transmit disease across wide geographies. Reports of two major climate-sensitive diseases, namely epizootic ulcerative syndrome (EUS) in fishes since 2007 in Botswana, Namibia and Zambia and shrimp white spot disease (WSD) since 2011 in Mozambique, are clear examples of how pathogens can jump national and international boundaries and bring about devastating impacts on communities. EUS occurs in natural freshwater systems and extreme weather events like flooding can distribute EUS over thousands of kilometers. Spread of EUS up and downstream of the Zambezi River (4th longest river in Africa) is a strong possibility with consequences for fish catches in the delta.

Strategies for addressing climate change impacts on pests and diseases

While climate change impacts on pests and diseases on agricultural systems present challenges and have an element of uncertainty, there are possible strategies to address these impacts. The key components of an effective strategy to combat pests and diseases include:

- **Capacity enhancement:** The capacity of regional, national, as well as local organizations to detect and respond to pests and diseases will need to be increased. These organizations will need to be supported with accurate information on pests and disease presence, level, impacts and the costs for control.
- **Coordination:** Pests and disease impacts are not constrained within national boundaries, and thus response strategies should develop approaches to coordinate at the regional and continental scales.
- **Data quality and quantity:** There are gaps in our current knowledge on pests and diseases, these gaps arise from a lack of data in some cases and poor data quality or non-comparable data in other cases. Streamlining and increasing data collection efforts will allow response strategies to be science-based.
- **Pre-emptive breeding:** Breeding pest and disease resistant varieties is a key component of response strategies in the crop, livestock, and aquaculture sectors.
- **Resilience of production systems:** Overall increase in resilience of production systems will allow these to withstand shocks from increased incidence of pests and diseases.
- **Research and development:** Research and development to improve approaches for forecasting and predicting pests and disease outbreaks, as well as into mechanisms to manage these outbreaks are be crucial under climate change.

Conclusions and a way forward

In the face of adverse impacts of climate change on agricultural systems, including increased incidence of pests and diseases, Africa's food security situation will be under threat. Its agriculture needs to adapt rapidly by building capacity for observations at regional, national and local levels to better understand factors informing shifts in pest and disease regimes. The other approach is to increase knowledge exchange and shared best practices on monitoring and evaluating early warning systems for pest and diseases with potential for cross border application in the sub-regions of Africa. While adaptation may be incremental in responding to new and emerging pests and disease threats, farmers and fishers have an important role in making choices that limit exposure and recover from pest and disease shocks. There is a need to build the knowledge base for informed action, to ensure that new and adapted management systems are based on sound science. The risk of zoonotic diseases needs to be managed, to limit contact between animals and humans in order to address the emerging climate related disease burden for Africa.

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Further Reading

Grace D, Bett B, Lindahl J, Robinson T. 2015. [Climate and Livestock Disease: assessing the vulnerability of agricultural systems to livestock pests under climate change scenarios](#). CCAFS Working Paper No. 116. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Mohan CV. 2015. [Climate Change and Aquatic Animal Disease](#). CCAFS Working Paper No. 117. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Ramirez-Villegas J, Thornton PK. 2015. [Climate change impacts on African crop production](#). CCAFS Working Paper No. 119. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Smith J. 2015. [Crops, crop pests and climate change – why Africa needs to be better prepared](#). CCAFS Working Paper No. 114. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Thornton PK, Boone RB, Ramirez-Villegas J. 2015. [Climate change impacts on livestock](#). CCAFS Working Paper No. 120. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

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