

Climate Changes and Food Security

Impacts and Vulnerability of Rural and Urban Populations

Sahelian landscape (Source: SOS Sahel, 2013)

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Synthesis

The picture is bleak for food security in West Africa, due to the expected impacts of climate changes.

Indeed, increased intensity of extreme weather events, droughts and water stress, warming of water and decreasing fish production, land degradation, changes in the distribution of animal and human vector-borne diseases, etc. are anticipated (IPCC, 2013).

These effects are aggravated by a significant degradation of land and natural resources by human activities.

Despite a possible increase in precipitation in some areas, West Africa is in a delicate situation because of its environmental, economic, and political vulnerabilities.

Among others, key vulnerabilities are dependence on agriculture, low incomes, and the already significant variability in climate.

Crops in West Africa are already affected by drought and depletion of water resources. Pests and diseases are common, and livestock is affected by regular outbreaks.

Pastures rarely produce enough forage.

People are dependent on markets and thus undergo changes in local and global food prices.

The diet of the population is generally poor in animal proteins, sometimes in vegetables.

According farming systems, specificities emerge in terms of vulnerability, such as:

- Risks of significant flooding in irrigated farming system;
- Low adaptation investments in farming systems based on tubers and cereals;
- Isolation, high land degradation, and silting up of ponds in agro-pastoral farming systems based on millet and sorghum;
- Drying up of water sources, bush fires, conflicts, and adverse terms of trade for cattle ranchers in pastoral farming system;
- Shortages of drinking water in urban and peri-urban areas.

Successful adaptation practices do exist. Some of them are presented in another note.



Introduction

The first section of this note compiles key facts from the two most recognised sources on the assessment of climate change impacts on agriculture and food security: Stern Report (2006) on the economics of climate change and the last two assessment reports (2007 and 2013) of the Intergovernmental Panel of

Experts on Climate Change (IPCC).

More specific data for West Africa are then compiled. Finally, the note presents the cases of four farming systems, as well as the peri-urban populations of Nouakchott, and the specificities of each of these systems in terms of vulnerability to climate changes.

1. Food Security

1.1. Impacts of Climate Changes

In the sub-Saharan region, extreme weather events will increase in intensity: violent storms, forest fires, droughts, severe floods, heat waves or cold spells (Stern, 2006).

These events are already observed in West Africa. For example, the number of floods has increased from +6 to +12/year in recent decades. It is very likely that these floods are linked to climate change and become more frequent and intense (IPCC, 2013).

Beyond extreme weather events, climate-related slow-onset events also hit Africa, especially in the West.

75 to 250 million people will be affected by high water stress by 2020, more than double in 2050. The arid and semi-arid areas will range from 5% to 8% by 2080, reducing agricultural productivity: shorter cropping season, stronger water stress, etc. (Ibid).

There is already a shift of isohyets in West Africa. Thus, in Burkina-Faso, the 1000-1300 isohyets have virtually disappeared from the South of Burkina-Faso during the period 1971-2000:

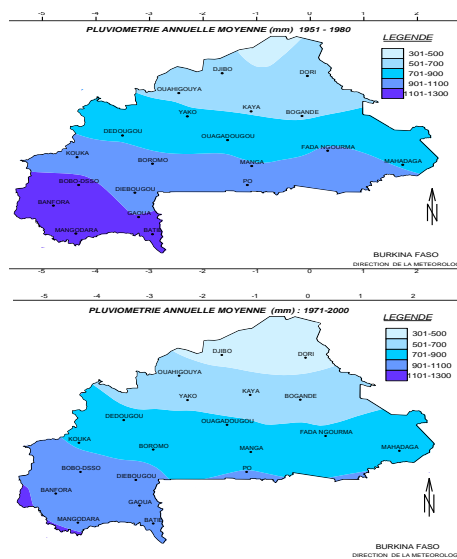


Figure 1 – Isohyets 1951-1980 (up) and 1971-2000 (bottom) in Burkina-Faso (Source: Météo nat., 2013)

A change in the distribution of animal and human vector-borne diseases is also expected (Stern, 2006).

Finally, the interactions of climate changes with human activities (deforestation, fires, etc.) lead to ecosystem disturbances that are expected to worsen in the future (Ibid).

1.2. Forecasts of Crop Yields

Overall, yields from rain-fed agriculture are expected to drop up to 50% by 2050 in some countries. Small farmers should be the most affected, their net income may fall by 90% by 2100 (Stern, 2006).

Droughts will lead to a fall of harvest and population migration, starting with the marginal region of the Sahel, which will lead in turn to an increase of the risks of conflict (Ibid).

These global estimates are partly confirmed by a recent study on the forecasts of crop yields in West Africa (maize, millet, rice, sorghum, peanuts, etc.), using MIROC and CSIRO Models: yields should fall by 5 to 25% and the cropping area (millet and sorghum in particular) in Northern Sahel is expected to decline (IFPRI, 2013).

However, in some areas (Northern Côte d'Ivoire, Ghana, Burkina Faso, and Nigeria), yields (maize in particular) are expected to increase from 5 to 25% (Ibid).

The figure below illustrates these forecasts, in the case of millet:

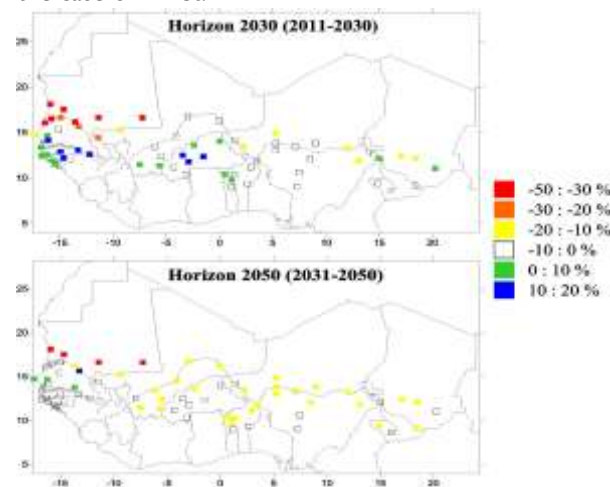


Figure 2 – Yield forecast for millet by 2050, using the DSSAT model (Source: CILSS, 2013)

75 to 250 million people will be affected by higher water stress in 2020

Falling of rainfed agriculture yields by 50% by 2050

IFPRI: International Food Policy Research Institute

MIROC: Model for Interdisciplinary Research on Climate (Japan)

CSIRO: Commonwealth Scientific and Industrial Research Organisation (Australia)

2. Vulnerability of West Africa

2.1. Regional Context

Developing regions are disadvantaged. They are generally already warmer than the developed regions and subject to high rainfall variability (Stern, 2006).

Dry subtropical regions are expected to warm more than the humid tropics. The dependence of the economies of these countries to agriculture makes them very vulnerable to the effects of climate changes (Ibid).

Low incomes limit the means of action in terms of adaptation. This weakness is likely to worsen due to lower revenues and investment capacities, for households as well as States (Ibid).

Multiple risks from climate changes will be exacerbated by development challenges: endemic poverty, political instability, limited access to capital and markets, infrastructure and technology, degraded ecosystems, and armed conflicts (IPCC, 2013).

In order to refine the vulnerability assessment, focus can be put on the populations of the four major farming systems in West Africa (see figure below. FAO, 2001), as well as urban populations. This is presented below, by synthesising 13 local studies of the HEA Sahel initiative, which aims at analysing the livelihoods and vulnerability of populations (see list of local studies on the right).



Figure 3 – Farming systems in West Africa (Source: FAO, 2001)

2.2. “Irrigated” Farming Systems

Cases (i), (ii) and (iii) are concerned.

Crops are vulnerable to flooding (i and iii), in particular rice, in case of strong winds and destruction of dams (iii). Strong winds carrying sands indeed cause significant damage.

Droughts are also common and can enhance crop vulnerability if early stages (iii), especially as the seed quality may be low (i).



Figure 4 – Dry-season gardening perimeter on the Niger bank, Haute-Guinée (Source: SalvaTerra, 2006)

Pests and diseases, including birds, locusts, and root-feeding fish, are constant threats (i and iii).

Livestock farming also faces many constraints (i and iii): epizootic diseases (liver fluke, pleuropneumonia, anthrax, etc.), parasites, lack of feed due to poor distribution of rainfall, silting of wells, thefts of animals, price variability of food supplements, etc.

The household diet lacks of milk and meat (ii). The high dependence of the population to food markets makes them particularly vulnerable to price fluctuations, in particular for cereals (i, ii and iii), or dependent on remittances from the diaspora (ii).

Finally, malaria aggravates food insecurity, as it reduces the work capacity (iii).

2.3. “Tubers and Cereals” Farming Systems

Cases (iv), (v), and (vi) are concerned.

Floods, droughts and poor rainfall distribution (iv and v) can also be a constraint for agriculture and livestock, the latter being penalised by a lack of pastures (v and vi).

The lack of investment capacity and consequently the low use of inputs and limited farming area per household (v and vi) limit auto-consumption (v) and expose households to price fluctuations (vi).

Pests and diseases (including locusts, grasshoppers, birds, and caterpillars) are present and wandering livestock is an additional pressure (v and vi). To these constraints are added bushfires (v).



Figure 5 – Yam mounds in Haute-Guinée (Source: SalvaTerra, 2005)

Livestock farming is vulnerable to animal diseases (dermatitis, pneumonia, foot and mouth disease, rinderpest, poultry diseases), cattle theft, pastures overloading during transhumance (v), to the dwindling grazing areas, poor sales of livestock, and shortages of cereals on local markets (vi).

Finally, the lack of solidarity mechanism (v) and isolation (vi) accentuate these vulnerabilities.

Some local studies

HEA* Sahel:

*Household Economy Approach

- (i) [Gardening perimeters in Aïr - Niger](#)
- (ii) [Senegal River Valley - Wilala of Gorgol and Brakna in Mauritania](#)
- (iii) [Municipality of Téméra, in riverside area of Northern Mali](#)
- (iv) [Southwest Region and Provinces of Sissili and Ziro in Burkina Faso](#)
- (v) [Southeast of Zamfara State in Nigeria](#)
- (vi) [Department of Kimiti in Chad](#)
- (vii) [“Cercle” of Diema in Mali](#)
- (viii) [Department of Madarounfa in Niger](#)
- (ix) [Monguel agro-pastoral zone in Mauritania](#)
- (x) [Department of Dakoro in Niger](#)
- (xi) [Tilemsi Valley, Municipality of Tarkhint in Mali](#)
- (xii) [Department of Biltine in Chad](#)
- (xiii) [Suburban area of Nouakchott in Mauritania](#)

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2.4. “Agro-Pastoralism Based on Millet and Sorghum” Farming Systems

Cases (vii), (viii), and (ix) are concerned.

Droughts, floods and other extreme weather events are still presented as major risks to food security.

Underground water reserves are low (vii and ix) and water shortages are observed for crops (market gardening in particular), pastures, and human consumption. The silting of ponds aggravates the situation (vii, viii, and ix).

Soils are poor (the poorest ones being used by the poorest households) and overexploited, inputs are rarely used, seeds have a low quality: yields are low (vii, viii, and ix) and crops are attacked by birds, insects, and wandering cattle (vii, viii, and ix).



Figure 6 - Flowering of millet (Source: RECA Niger, 2013)

The vulnerabilities of livestock farming are also important: poor pastures (lack of water, overexploitation), many epizootic diseases (dermatitis, pleuropneumonia, avian influenza), no grass-fed and ill-health of livestock, leading to poor sales, cattle theft, low income for the maintenance of the animals or for recapitalisation.

The isolation and lack of markets for products, extreme poverty due to lack of income-generating activities (resulting in low investment capacity), high vulnerability to food prices fluctuations in the markets, lack of valuable plant species due to significant environmental degradation, and very high population densities are specific to these agropastoral areas.

This results in an unbalanced diet, with very low levels of proteins and vegetables.

2.5. “Pastoralism” Farming Systems

Cases (x), (xi), and (xii) are concerned.

The lack of pasture due to insufficient rainfall seems to be the main constraint (x, xi, and xii), aggravated by bushfires (x and xi).

Early drying up of water sources, silting up and drying of ponds lead to difficulties of access to water for livestock and households (xi and xii).



Figure 7 - Sheep farming in Sénégal (Source: SalvaTerra, 2013)

Subject to many diseases (anthrax, lever fluke, pasteurellosis, etc.), not benefiting from grass-feeding, cattle is poorly valued against the cereals. Furthermore, population migrations, inherent to mobile pastoral systems, cause conflict and cattle theft.

Cereals can reach very high prices, especially during the hunger gap or in case of supply difficulties, as it happens in the Niger-Algeria border (xi).

Indeed, soils are poor (low organic matter and phosphorus deficiencies), subject to erosion and desertification (xi and xii), and crops are further threatened by wandering livestock and locusts.

The populations of these areas are isolated (xii), very poor and their food security depends primarily on the markets.

The result is a strong dependence on food aid and a low protein diet.

2.6. (Peri-) Urban Populations

Case (xiii) is concerned.

Near Nouakchott (unique suburban area considered by the HEA Sahel study), populations depend on food markets and are therefore sensitive to local or global changes in commodity prices, especially since Mauritania is strongly affected by climate hazards.

The state of the economy in Nouakchott plays an important role with regard the food security of these populations, because their ability to feed relies heavily on wages.

The poorest populations have a diet low in vegetables and animal proteins. Finally, people already suffers from low availability and high cost of water.

This tension on the use of water (human consumption vs agricultural consumption for gardening or small livestock farming) is exacerbated by climate changes.