OECD/SWAC

CLIMATE, CLIMATE CHANGE AND AGROPASTORAL PRACTICES IN THE SAHEL REGION

May 2008

Regional brief

Sahel and West Africa Club, OECD

Climate change in Africa

Africa is considered the world's most vulnerable region with regard to the effects of climate change due to the fragility of its economies. However, it is still very difficult to assess the extent and nature of such changes in the future. Climate models are relatively useful when it comes to forecasting temperature changes in Africa. In its latest report, the Intergovernmental Panel on Climate Change (IPCC) confirmed that in the 21st century, global warming would be more intense in Africa than in the rest of the world. The average rise in temperature between 1980/99 and 2080/99 would be between 3 and 4°C for the continent as a whole, 1.5 times greater than at the global level. The increase would be less marked in coastal and equatorial areas (+3°C) and the highest increase would take place in the Western Sahara region (+4°C).

However, the results of rainfall projections remain uncertain. North Africa, Southern Africa and East Africa are some of the regions where there is less uncertainty. Africa's

Box 1: The Earth's climate – the warning by the IPCC

The Earth has cyclically gone through several warming and cooling phases. On a paleoclimatic scale, the planet has been going through an interglacial period, i.e. a warm period that has now lasted over 10,000 years. Within these long cycles, more intense and less frequent variations can be measured. The 10th and 11th centuries were marked by a warm and less humid period. This phase is called the medieval optimum. At the end of the Middle Ages, the Northern Hemisphere cooled down considerably, a process that continued until the beginning of the 19th century. This small glaciation or Little Ice Age seemed to correspond to low solar activity. It was marked by a succession of particularly harsh winters, accompanied by food shortages and famines.

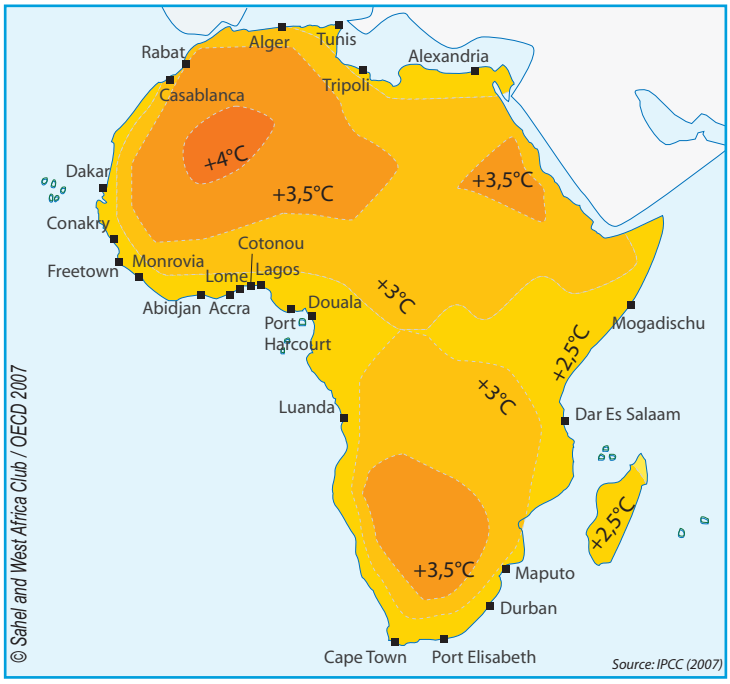
More recently, scientists have indicated a global warming trend. Ground temperature measurements taken between 1906 and 2005 show a general rise of 0.74°C. The IPCC has been issuing warnings regarding the extent and effects of global warming for several years. Worse, the latest IPCC report (AR4) confirmed with a "very high degree of confidence" the primacy of human responsibility over natural factors in global warming. The future rise in greenhouse gases will probably intensify global warming and impact the world's climate system in several ways. According to the scenarios developed, the Earth's average temperature will rise by 1.8°C to 4°C and sea levels will rise by 20 cm to 60 cm by the end of the century, with widespread heat waves and heavy periods of rainfall.

"Global warming sceptics"

However, not all scientists agree with the IPCC's conclusions. Global warming and the role ascribed to human beings through their greenhouse gas emissions are debated by believers and doubters. There is no consensus on this issue among global warming "sceptics". While many of them do not refute the reality of recent global warming, they sometimes dispute the anthropogenic origin as set out in the letter signed by 61 scientists sent to the Canadian Prime Minister in October 2006: *"The evidence drawn from observations does not support computer-generated current climate models (...). The expression "climate change is a reality" is meaningless and is used by militants to convince the general public that climatic catastrophe is imminent (…). This fear is unjustified. The planet's climate changes continually due to natural causes. Human impact is impossible to distinguish from natural occurrences."*

Mediterranean coast, like the Mediterranean coastline in general, is likely to experience a decrease in precipitation (-15 to -20%) between 1980/99 and 2080/99. At the other end of the continent, less rainfall is expected during the winter and especially in spring in Southern Africa. Along the tropical belt, the results achieved by the models show an increase in rainfall in East Africa, extending to the Horn of Africa. However, no conclusions can be drawn regarding rainfall in West Africa.

A Possible Overview of Climate Change in Africa



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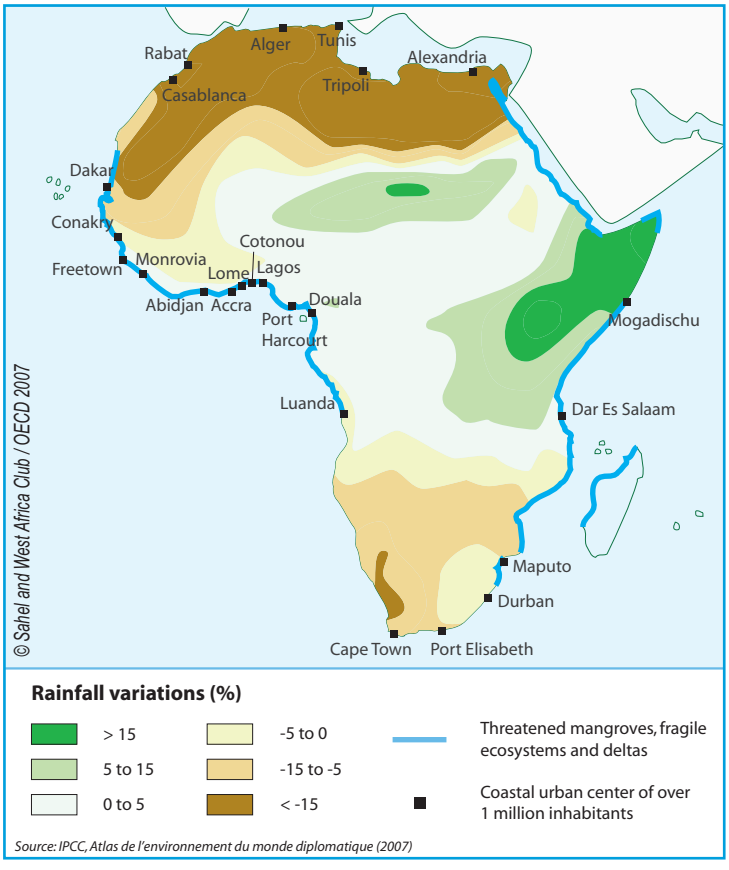
There is still a fair amount of uncertainty in rainfall-related climate projections for West Africa, especially in the Sahel



West Africa and climate change

There has been a substantial reduction in rainfall in West Africa over the second half of the 20th century, with a clear break between 1968 and 1972. The reduction is extremely clear in the Sahel. It has taken the shape of a historical climatic aridification process characterised by the great droughts of the 1970s and 1980s and the setting-up of the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS). The Sudan and Guinea were also effected by the drop in precipitation either during this period.

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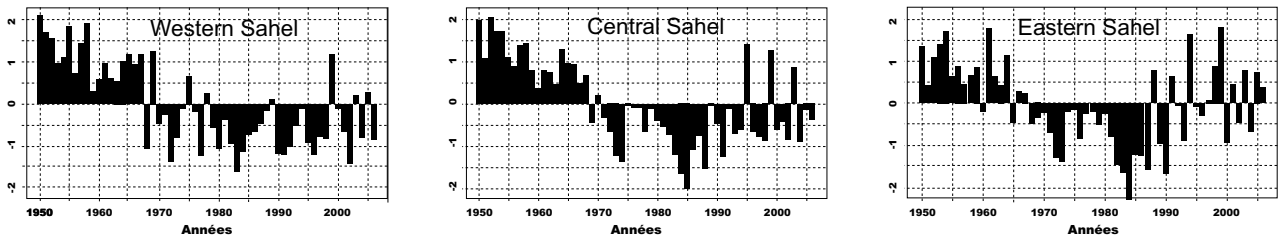
Changes in pluviometric indices in the Sahel(1950-2006)*



Source: Agrhymet Regional Centre, CILSS (2007)
* Standard pluviometric indices (SPI) for the 1950-2006

Since the mid-1990s, a return to better rainfall conditions has been noted in the Sahel. These conditions went hand in hand with greater interannual rainfall variability

Since the mid-1990s, a return to better rainfall conditions has been noted, in particular in continental Sahel (Niger, Northern Nigeria and Chad). These conditions went hand in hand with greater inter-annual rainfall variability.

There is still a fair amount of uncertainty in rainfall-related climate projections for West Africa. If a simple average of all the scenarios is taken, slight humidification in the Sahelian region (particularly in the East), with no real changes along the Guinean coast can be inferred. However, there is still too much uncertainty.

Recent tests have shown the limited capacity of General Circulation Model (GCM) to forecast West Africa's climate. The ACMAD's work on West Africa reveals that the rainy season appears 1-2 months prior to the dates actually observed. According to the CRA/CILSS, a comparison of the Sahelian climate observed (1961-1990) with climates simulated by six general circulation models recommended by the IPCC illustrates these shortcomings: early start of the rainy season and significant underestimation of aggregate annual rainfall as compared to observed data. The IPCC also acknowledges the limitations of research on extreme climate events. Climate changes are likely to enhance the frequency and seriousness of floods and droughts in regions with high rainfall variability. Were the widespread 1973 and 1984 droughts a manifestation of climate change?

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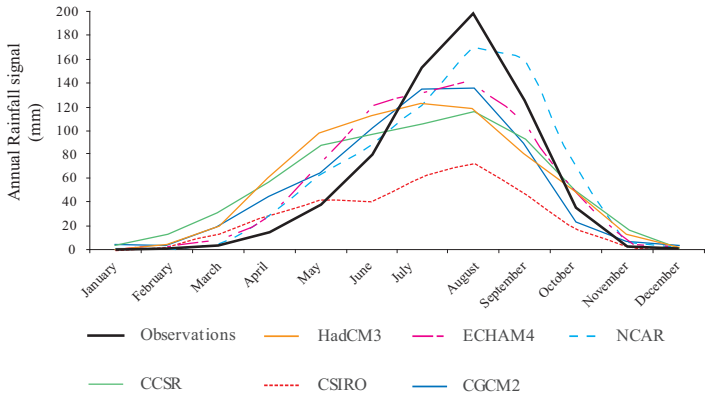
Performance of General Circulation Models applied to the Sahel



Source: Capacity building project for adaptation to climate change in the Sahel, CRA / CILSS (to be published)

What about the 2007 floods? Whatever the case, the Sahel has to face the climate challenge – primarily, vulnerability and uncertainty.

Sahelian producers' adaptation strategies

The stakes involved in the agropastoral sector and, therefore, food security, are considerable for Sahelian countries: the agricultural population accounts for 50-90% of the total population, depending on the country. These sectors account for 25-30% of their GDP. In the past, the Sahel's producers have shown that they were able to adapt to the climate's variability and uncertainty.

Climate, cereal agriculture and adaptation of Sahelian producers

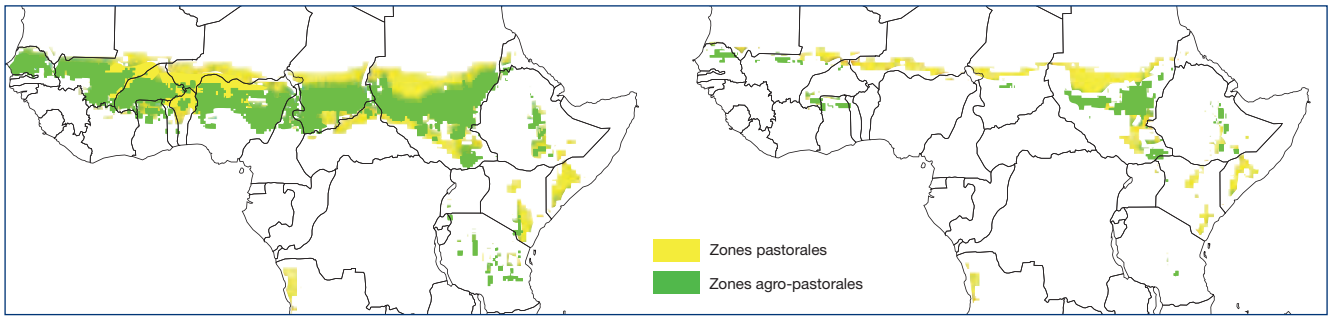
The stakes involved in the agropastoral sector and, therefore, food security, are considerable for Sahelian countries: This sector accounts for 25-30% of their GDP; the agricultural population represents 50-90% of the total population, depending on the country. Cereal consumption accounts for 80-85% of calorie equirement of the population. In the past, Sahelian producers have shown that they were able to adapt to the climate's variability and uncertainty.

Farmers have developed adaptation strategies in the face of the various risks of climate variability

Faced with the various risks of climate variability (drought, winds, crops insects and pests, etc.), farmers have developed adaptation strategies. Among them are strategies related to agricultural practices, such as combating agricultural soil degradation, soil fertility management, water management techniques, crop diversification, etc. (see Box 2). In addition, there are other forms of adaptation: production and sale of animals, mutual aid and cooperation, diversification of activities, seasonal migration, etc. Extensive farming is considered to be a strategy aimed at compensating for decreasing yields due to the lack of crop technique improvements. This kind of extension is unfortunately taking place to the detriment of pastoral areas.

1. Climate change could also have indirect effects, such as changes in the reproduction areas of destructive insects and pests and their displacement (Desert Locusts, Senegalese grasshoppers, etc.).

Areas where the length of the cropping season could decrease by over 20% by 2050 (Two emissions scenario)



Source: AR4, Africa (2007)

Box 2: A few agricultural adaptation practices in the Sahel

Anti-erosive small dykes
These are physical water and soil conservation techniques, such as stone retaining walls and small earthen dykes. The earthen dykes are waterproof structures that hold all the water and encourage maximum seepage. As they are least effective, earthen dykes are used only when conditions inhibit the construction of stone structures. Stone retaining walls, unlike earthen dykes that block the depth of runoff, are obstacles that allow water to filter through and slow down the runoff speed. They allow for sedimentation and particle deposits (sands, but also fine soil, organic material, etc.) upstream of the small dyke and an increase in runoff water percolation.

The "zai" technique
The water pockets method, still called "zai" (or "zay"), is a traditional technique that was revived in the Yatenga (northern Burkina Faso) in 1982-1984, following years of drought. In the Moré language, "zaï" means "getting up early and hurrying out to prepare the soil" or even "breaking and fragmenting the soil crust before sowing". Micro-reservoirs of 10-20 cm or 20-40 cm in diameter, and 10-15 cm in depth, are dug out at a distance of 0.5-1 m from each other during the dry season, enriched with fertilizer, covered by a thin soil layer and then sowed at the beginning of the rainy season. Water collects and seeps in providing the seeds with a humid soil: plants germinate, grow quickly and form strong roots; at the seedling stage, they are protected from winds. This technique is also a way to avoid slaking crust (the formation of a slaking crust prevents any rainwater seepage and quickly leads to runoff). The optimal conditions for the zai technique can be found in the Sudano-Sahelian region (300-800 mm).

Half-moon technique
The half-moon technique is a variant of the zai method: on gentle slopes, a basin is dug; the excavated soil forms an arched dyke, following the contour lines. The half-moons are placed in staggered contour lines, collecting runoff waters that then seep into the soil. They are built on glacis or forward slopes covered by a hard crust of a few cm, which prevents the water from seepage.

The basins – 4 m in diameter and 15 to 25 cm deep – are placed at a gap from one contour line to the next, so that each half-moon has a necessary impluvium of 4 sq. m. The spacing is of 4 m between two half-moons on the same contour line and between two successive lines. The average density per hectare is assessed at 315 half-moons. This makes it possible to collect runoff waters and the half-moons are therefore well adapted to semi-arid and arid zones. Half-moons help improve the soil's water reserves as well as increase wetting depths by 20 to 40 cm. They enhance farm production – even more so if a mineral or organic supplement is added.

Improved land clearing
One of the techniques increasingly applied to maintain farm land productivity is that of improved land clearing. It is a technique that while land is cultivated, soil resources are not completely depleted. "Improved land clearing" consists of: not de-rooting or cutting shrubs and small trees down to ground level while weeding; but in managing rationally shrubs and small tree waste (multi-purpose uses: fodder, fuel wood, raw material for wickerwork, etc.). In particular, it is important to leave at least 2 to 3 shoots (sap drawer) per shrub or small tree while doing the clearing, in order to facilitate the regrowth of vegetation.

These techniques have had a significant impact on natural resources. Since the beginning of the 1980s, in Niger, 250 000 hectares of severely degradated land were recuperated by using simple techniques such as zai, half-moon and retaining walls.

Sources : *Projet d'appui aux capacités d'adaptation aux changements climatiques au Sahel* (Climate change adaptation capacity support project), Centre Régional Agrhymet (2007) (Agrhymet Regional Centre).
Quand le Sahel reverdit. Évaluation scientifique de 20 ans de lutte contre la désertification au Niger, [When the Sahel becomes green again. Scientific evaluation of 20 years combating desertification in Niger] CILSS (2007)

Uncertain future of migrant livestock farming

Along with cereal production, livestock farming plays an important role in all Sahelian countries. It contributes up to 10-15% of the GDP in Burkina Faso, Mali, Niger, Senegal and Chad (even more in Mauritania). Migratory pastoralism[2] (70-90% of cattle breeding is migratory) remains a production mode adapted to some Sahelo-Saharan ecosystems. It has undergone significant transformations due to population growth, the political options selected or environmental changes such as climatic variations.

Agropastoralism stems from a strategy adopted by farmers and shepherds to limit the risks associated with the uncertain climate

One of the significant innovations occurring in the Sahel over the last decades has been the birth and development of agropastoralism, i.e. the combination of farming and livestock breeding within the same farm. This system stems from a strategy adopted by farmers and shepherds to limit the risks associated with the uncertain climate. Farming helps shepherds limit the purchase of cereals during the lean period; farmers, on their part, seek to diversify their activities and capitalise on their income sources by investing in cattle.

The changes in these practices are coupled with the spatial transformation of activities, following the changes in the Sahel's climate conditions. In search of better pastures, nomadic shepherds go farther and farther away during the wet season, generally towards the North. Once the season ends, they gradually return to their villages where pastures and water supplies remain to be found. The 1973/74 and 1984/85 droughts especially changed the spatial dynamics of migratory herding and pasture lands in the Sahel. The case of Fula breeders in the Dallol Bosso area (Niger) is particularly striking in this regard. Many of these breeders found refuge farther south in Benin and Nigeria where they sometimes settled. These changes proved to be long-lasting and today, the 1973 and 1984 "pastoral runs" have turned into migratory pastures during the dry season (see Map)[3].

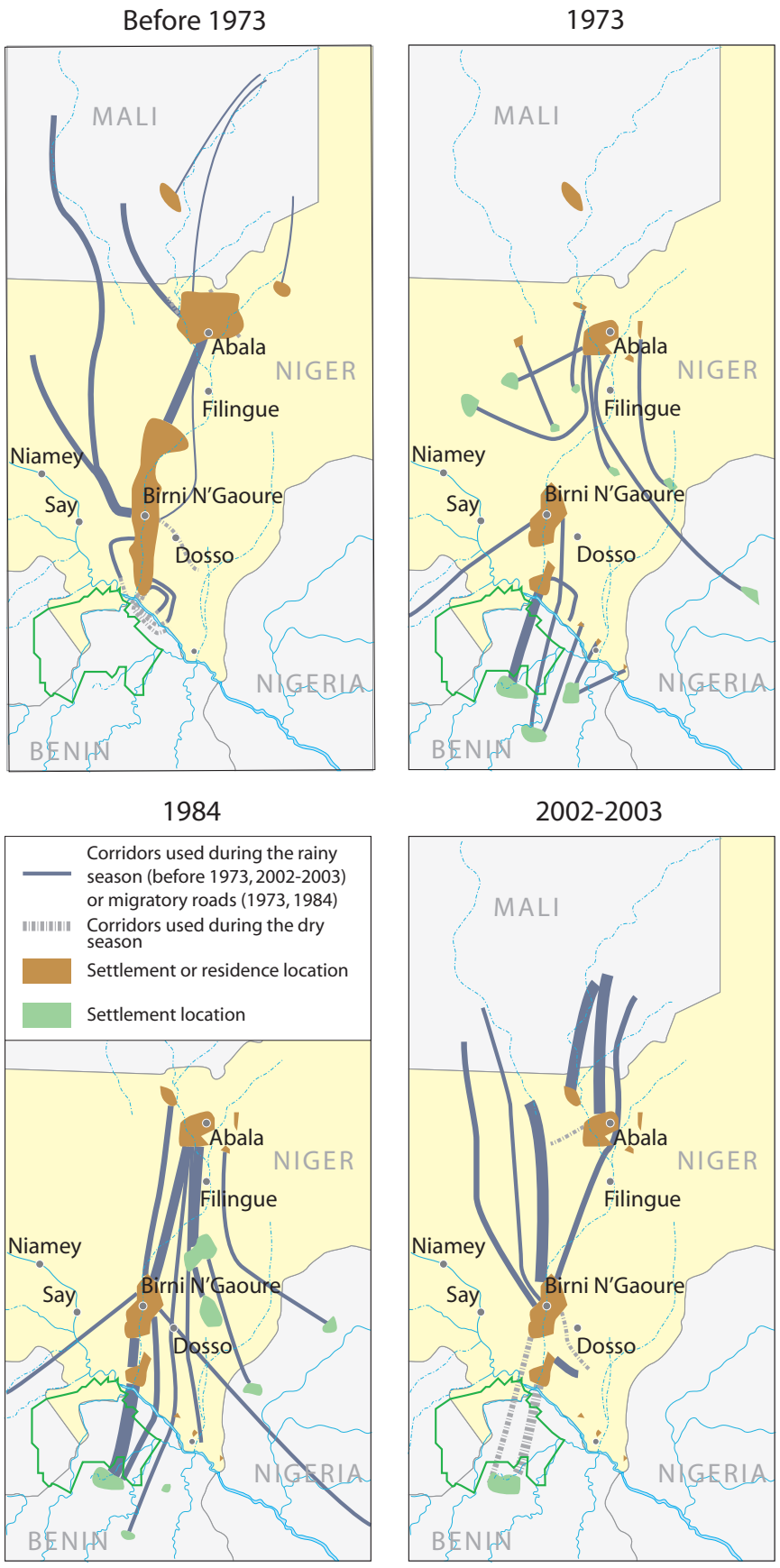
The environment is an integral part of the life of nomadic cattle breeders in the Sahel. Migratory herding characterises their need to adapt to the changes in the natural environment. Climate changes – favourable or not – will alter the quantity and quality of natural pastures and will undoubtedly lead to new forms of transhumance corridors in the region. But the breeders will have to deal with increasing agricultural pressures, greater environmental constraints in the years to come, occasional political risks[4], and the institutional change (decentralisation) and land tenure. Some of them may turn increasingly either towards agro-pastoralism or a sedentary or semi-migratory livestock breeding system. For others, mobility will remain at the heart of their strategy, provided that it finds support both at national and regional levels.

2. Migratory pastoralism can be defined as a livestock production system marked by seasonal movements of cyclical nature and of variable scope. These movements take place between complementary ecological zones, under the supervision of a few individuals, with a large section of the group remaining sedentary. Sahel and West Africa Club (2007): Livestock in the Sahel and West Africa. Note to decision-makers, Issue 3.

3. Boutrais Jean (2007): Crises écologiques et mobilités pastorales au Sahel : les Peuls du Dallol Bosso. (Ecological crises and pastoral mobility in the Sahel: The Fula people from Dallol Bosso) Drought 2007; 18(1): 5-12.

4. Tensions between northern Niger and Mali limit the availability of pastures for livestock farmers in these regions.

Changes in the Fula Ethnic Goup's Migratory Corridors Between Niger, Mali, Benin and Nigeria



Source: IRD, Laboratoire de cartographie appliquée, Boutrais Jean (2005)

Conclusion

In the past, agricultural producers developed strategies to deal with climate change. Some of the traditional knowledge and practices helped them adapt to climate fluctuations and soil erosion, in particular, and more generally to the degradation of natural resources. Admittedly, these practices did not always prove effective. Also they may not always be able to deal with extreme climatic events or very different climatic conditions which could prevail over the longer term (for instance, a 3°C increase in temperature over a century).

Despite these limitations, to better define and implement adaptation policies at the national and regional level, an inventory and promotion of local knowledge is needed as well as the analysis of the uses of natural resources and of environmental risk management strategies in different West African agro-ecological zones. These strategies could be supported by research on technologies for developing climate change resistant crops, for instance.

To better define and implement adaptation policies at the national and regional level, an inventory and promotion of local knowledge on adaptation to climate variability is needed

Besides, farm producers and producers' organisations are not well informed or aware of the new challenges that they may face due to climate change. They are not very involved in debates and consultations on different ways of mitigating or adapting. Raising awareness and consulting with farm leaders is required in order for them to contribute to the debate and participate in the development and implementation of these strategies.

A few bibliographical references:

CILSS, SWAC, FAO (2008): Climate and Climate Change. Atlas on Regional Integration in West Africa, SWAC/OECD, ECOWAS.

FAO (2007): Climate Change and Food Security: a Framework for Action, Rome, 2007. (Document published for the Bali's Conference).

CRA / CILSS (2007) : Projet d'appui aux capacités d'adaptation aux changements climatiques au Sahel. Centre Régional Agrhymet, CRA/CILSS, Niamey.

IPCC (2007): Climate Change 2007. Fourth Assessment Report (AR4).

A few websites

Atlas on Regional Integration in West Africa : http://www.atlas-ouestafrique.org
Centre Régional Agrhymet (CRA) : http://www.agrhymet.ne/
FAO (Climate Change Website): www.fao.org/climatechange
FAO (High Level Conference on World Food Security) :
http://www.fao.org/foodclimate/hlc-home/en/

Contacts

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