

LOGOS

INTERNATIONAL WORKSHOP ON ADAPTATION TO CLIMATE CHANGE IN WEST AFRICAN
AGRICULTURE

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DRAFT FORMULATION OF A REGIONAL FRAMEWORK FOR THE
ADAPTATION OF WEST AFRICAN AGRICULTURE TO CLIMATE CHANGE

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1. Background and Issues at Stake in West African Agriculture

1.1. Background

Agriculture remains the mainstay of West Africa's economy, because of its major contribution to feeding the populations, creating global wealth, providing jobs and incomes, etc. More than 60% of West Africa's workforce, the majority of which are women, lives in rural areas, works and derives the bulk of its means of livelihood¹ from the agricultural sector. Agriculture generally accounts for more than 60% of the Gross Domestic Product (GDP) of the various West African countries and 35 % at regional level. The exports of agricultural produce account for approximately 15.3 % of total exports of the region's goods and services and even up to 30% if Nigeria is excluded. For example, cocoa is the main export and economic resource of Côte d'Ivoire, which is the top world producer. This country's cocoa production accounts for 15% of the Gross Domestic Product (GDP) and is the source of income for approximately 6 million people. It accounts for 40% of the world market share with more than 1.2 million metric tons produced per annum and 60% of the African production. The following main farming systems occur in the various agro-climatic zones of West Africa:

- Pastoralism (extensive breeding of camels, cattle, goats and sheep) in Sahelian and pre-desert northern zones;
- rainfed agriculture characterised by millet and sorghum, combined with livestock breeding in Sahelian and northern Sudanian zones;
- rainfed agriculture characterised by sorghum, maize and rainfed rice, combined with semi-intensive livestock breeding and cash crops like cotton, groundnut and fruit trees in Sudanian and Guinean climatic zones;
- rainfed agriculture characterised by maize, plantain, tubers and roots combined with cash crops like cocoa and coffee in areas with bimodal rainfall conditions in the Gulf of Guinea's coastal zones;
- Irrigated agriculture in major irrigation schemes along large river beds intended for the cultivation of rice, sugar cane and vegetable crops.

In recent decades, all these West African farming systems experienced various changes, including:

- significant increase in production volumes recorded by almost all products (except for cattle) from 1980 to 2000;
- production intended for the local and regional markets significantly boosted by urban demand (vegetable crop productions and short-cycle livestock species);
- emergence of better structured and more enterprising new actors at regional level, genuine partners who cannot be circumvented when it comes to defining and implementing food security policies and strategies.

1.2. Assets of West African Agriculture

The West African agricultural sector has significant assets, which can be exploited to ensure its emergence as a genuine development pole. Three major assets can be mentioned:

¹ The 2006-2010 Regional action plan on the implementation of the ECOWAS agricultural policy (ECOWAP) and CAADP/NEPAD in West Africa.

- a great diversity of ecosystems in rural areas and huge potentialities for diversifying production. This "quasi-virgin" geographic area allows make the most of the region's comparative advantages;
- availability of hardly exploited cultivable agricultural lands. Indeed, out of a potential of approximately 284 million ha of cultivable lands, including long fallow periods, only 60 million hectares are developed. Out of more than 10 million hectares of irrigable lands, less than 10% are developed for rice and vegetable production. On top of this potential of cultivable lands, there is an additional more than 215 million hectares of pasture lands located in Sahelian and Sahelo Sudanian climatic zones;
- development of national and regional markets with several million consumers.

1.3. Major Constraints

Although it has significant assets to fully play a major economic role in the development of the West African sub-region, the agricultural sector experiences major constraints, which limit or slow down its emergence. The many limiting factors include, among others:

- poor performance and poor competitiveness of agriculture;
- unsuited agricultural development policies;
- multiplicity of systems for consultation and action at regional level.

1.3.1 Less Effective and Competitive Agriculture

Since the 1980's, crops benefited from sustained incentives and recorded significant productivity gains. Thus, rice and maize yields almost doubled in all Sahelian countries. The voluntarist production policies resulted in increased volumes of exported products like cotton, coffee and cocoa.

Unfortunately, the improvement in the sub-region's production is due to considerable increase in surface areas. Thus, thousands of hectares of arable lands were cleared to expand surface areas under crop, notably the crops known as cash crops (coffee, palm tree, cocoa, cotton, groundnut, etc). Outputs and productivity per person in the agricultural labour force remained among the lowest worldwide. The added value of the agricultural sector is among the lowest with high production costs as a result of quasi-rudimentary factors of production. This ineffective and non-competitive agriculture is unable to feed the ever-increasing West African population. Today, approximately 20% of imports to West Africa consist of food supplies, particularly rice. On average, each West African country imports more than 50% of its food products. The recent global food crisis experienced in 2008 highlighted the fragility of this region's food situation, and the many demonstrations against the increase in the cost of living, which took place in the main towns, are a case in point.

1.3.2 Agricultural Policies undermined by Multilateral and Bilateral Policies

West African countries' agricultural policies were much undermined by international institutions' public policies. Indeed, over the last twenty years, partitioning of national agricultural policies and poor linkage between them and those initiated at regional level was observed. Thus, the visions of agricultural policies were mainly focused on the financial

profitability of production without the accompanying measures required to achieve the objectives pursued: food security, rural employment, integration into the regional market. Moreover, these agricultural policies were formulated without the adequate participation of actors at grassroots level. Lastly, they consist of action plans, programs and projects whose achievement largely depends on external financial contributions.

1.3.3 Multiplicity of Regional Systems for Consultation and Actions

Genuine indicators of the vitality and interest taken in agricultural issues at regional level, many frameworks for consultation and action came into being in the sub-region, including economic integration organisations such as ECOWAS and UEMOA. In addition, there are specialized co-operation institutions such as CILSS, NBA, OMVS, OMVG, ICRISAT, ICRAF, WARDA, IITA, CMA-AOC, and IFDC... Lastly, networks of socio-professional organisations such as ROPPA, RECAO, ROSEAO, INTERFACE, RESIMAO were structured at regional level. Unfortunately, this multiplicity of consultative frameworks, which are at the interface between agricultural issues at regional level, is not synonymous with effective actions. Finally, the many organisations working in the agricultural sector lack visibility and clarity to get this so promising agriculture out of its state of backwardness.

1.4. Issues at Stake in West African Agriculture

The major issues at stake in West African agriculture are the same as those of the entire African continent. It would be illusory to anticipate fast results or believe that there are miracle solutions as far as Africa's self-sufficiency in the fields of food and agriculture is concerned. Indeed, the shift from the primary agricultural sector to that of effective and profitable agribusiness requires that West Africa take up a complex set of challenges. The New Partnership for Africa's Development (NEPAD), through its Comprehensive Africa Agriculture Development Programme (CAADP), indicates the main bottlenecks (challenges) facing Africa's agriculture. These include:

- low real domestic demand, due to the poverty of the populations;
- poor relevance and profitability of external markets (instability and decline in world prices, keen competition from industrialized countries' subsidised agricultural produce);
- the vagaries of the weather and related risks are disincentives to investments;
- limited access to technologies and poor capacity to adopt new techniques;
- little investments made in the past in rural infrastructure (roads, markets, warehouses, rural electrification, etc), which are nevertheless essential for reducing transaction costs, increasing competitiveness, and necessary for stimulating production, processing and trade;
- significant institutional shortcomings in terms of services provided to the entire agricultural chain, from farms to markets;
- poor governance and inadequacy of agricultural policy and regulatory frameworks, which ignore the participation of rural communities and support for the operation of the commercial private sector.

Lifting these constraints, through a combination of actions, could contribute to reducing hunger and poverty, and increasing productivity and incomes. Unfortunately, it is worthy

of mention that very little attention is given by the governments and their partners (bilateral and multilateral) to the agricultural sector in particular, and to rural development in general. In this vein, for example hardly one percent (1%) of national budgets is allocated to this sector whilst the share of loans granted to agriculture by the World Bank keeps on decreasing (39%, 12 % and only 7% in 1978, 1996 and 2000, respectively).

In addition to these major stakes and challenges, West African agriculture should from now on cope with climate change. This document, which was prepared at the request of WMO and UNDP, aims at laying the foundations of a vast reflexion or consultation in order to set up a regional framework for the adaptation of West African agriculture to climate change.

2. Climate Change: A Global Challenge

Climate is characterised by the stability, over a long period, of meteorological characteristics specific to a given geographic environment. However, for about two decades now, there is growing concern about climatic warming and the possible impacts of industrial emissions of some gases (CFC, CH₄, CO₂, N₂O) on future climate. Carbon dioxide is the most significant anthropogenic greenhouse gas. Global atmospheric CO₂ concentration increased from a pre-industrial value of approximately 280 ppm to 379 ppm in 2005. This exceeded by far the natural normal value recorded over the last 650,000 years (180 to 300 ppm) based on ice cores. The annual rate of increase in carbon dioxide concentration over the last 10 years was the highest on record (average of 1.9 ppm per annum) since continuous atmospheric measurements began (1960 - 2005: 1.4 ppm per annum). However, there is a certain interannual variability (IPCC, 2007). Climatic warming is unequivocal, because based on observations it is now evident that global average air and sea temperatures increase. In the same way, the widespread melting of glaciers increases sea level (IPCC, 2007). These changes will have impacts on human health, terrestrial and aquatic ecosystems and socio-economic systems such agriculture, forestry, fisheries and water resources, which are essential elements in the development and wellbeing of humanity and sensitive to climate variations. Some of them are likely to be irreversible. Thus, human society should expect multiple disruptions to which it will have to adapt (IPCC, 1996).

2.1 West Africa vis-à-vis Climate Change

West Africa's rainfall depends on the monsoon system associated with the inter-tropical convergence zone. Changes in sea surface temperatures in the North and South Atlantic and Indian Oceans, as well as sea surface temperature anomalies in the Pacific Ocean associated with the El Niño phenomenon are significant drivers of the activity of the West African monsoon. On top of these global phenomena, there is the effect of continental surfaces processes (vegetation, soil moisture, water cycle, and albedo) on the monsoon dynamics. Thus, the West African climate, notably the rainfall parameter is subjected to significant variations due to global factors and regional and continental dynamics. This is particularly true of West Africa's Sahelian region.

As a result of the magnitude of these variations, West Africa has been experiencing significant decreases in precipitation with a dramatic change in the years 1968-69, particularly in the Sahel. Thus, episodes characterised by significant rainfall deficits in 1972-73, 1982-84 and 1997 resulted in a 100 to 200-km southward shift of isohyets (Diouf et al. 2000, CSAO, 2007). The decrease in rainfall also affected Sudanian, Guinean, even forest (Gulf of Guinea countries) zones. Since the 1990s, a slight return to normal rainfall

conditions was noticed in the eastern part of the Sahel, although it is the higher spatial and temporal variability, compared to the previous periods, that is noteworthy (Ali et al. 2008).

The process of knowledge acquisition on climate change in Africa is very recent. In its last report, IPCC confirmed that during the 21st century, climatic warming will be more significant in Africa than elsewhere in the world (IPCC, 2007). Thus, the rise in average temperature between 1980/1999 and 2080/2099 would be in the range of 3 - 4°C across the entire continent, that is, 1.5 times more than the global level. This rise will be less significant in coastal and equatorial areas (+3°C) and highest in Western Sahara (+4°C). Whereas the forecasts of change in temperature in Africa made by climate models are relatively satisfactory, there are on the other hand uncertainties about precipitation. Nonetheless, uncertainties are reported to be less significant for northern Africa, southern Africa or eastern Africa. Africa's Mediterranean region is expected to experience a decrease in precipitations (-15 to -20 %) during this century. These dry conditions would affect the northern boundary of the Sahara and the West African coast (Dakar). There are very significant uncertainties about forecasts over West Africa. No formal conclusion was drawn on this region's rainfall based on the results of these models. It is worthy of mention that rainfall is the determining element in West Africa's agricultural production.

Thus, as a result of the general vulnerability profile of West Africa's natural, economic and social systems, climate change will affect all the means of livelihood of the populations. Ominde and Juma (1991) underlined Africa's high vulnerability to climate change because of its heavy dependence on agriculture and limited coping capacity. Even best-case scenarios (Reilly et al. 1994) forecast adverse effects of agricultural damage on the wellbeing of consumers in Africa. All forecasts indicate that climate change will result in the deterioration of living conditions on the continent (DFID, 2006). The Millennium Project (2005), in its report entitled "Halving Hunger: it can be done", concludes that the frequency of natural disasters increases when climate changes, and the resulting increased vulnerability causes the populations to take less risks; this attitude results in a decrease in agricultural investments and production. ENDA Tiers Monde (2005) indicates that the potential consequences of climate change in West Africa include, among other things, the increase in surface area under crop to the detriment of forests, protected areas, marginal lands and pastures; the increase in the number of conflicts between farmers and livestock breeders; the amplification of the phenomenon of migration; the loss of incomes by individuals, hence public authorities; the exacerbation of food insecurity.

2.2 Potential Impacts of Climate Change on Major West African Farming Systems

The various farming systems identified above are all very vulnerable to climate change. As is the case with rainfed systems, which are threatened by the increase in the frequency of extreme events such as drought and flooding, irrigated systems are also exposed, because frequent droughts will be synonymous with more significant uncertainties about the availability of water resources, more frequent flooding, losses of cultivable surface areas or harvests.

In addition, transition zones between areas characterised by monomodal and bimodal rainfall, as well as areas with bimodal rainfall already experience problems associated with cropping periods. The cultivation of cereals and tubers twice a year in these areas will involve more risks because of increased uncertainties about the duration of the various rainy seasons.

The increase in temperatures is also likely to reduce the duration of the hot off-season period for irrigated rice farming, because of increased risk of sterility due to high

temperatures at flowering stage. Vegetable crops will also witness a shortening of the period favourable for their cultivation and a reduction in their yields due to higher temperatures.

High temperatures will result in a fall in photosynthetic efficiency of most tropical crops, and will also be conducive to the development of diseases and crop pests everywhere in the sub-region, more particularly in wetter zones which are expected to experience an exacerbation of phytosanitary problems. Furthermore, according to the IPCC 2007 report, the continent's vulnerability to climate change is much higher than originally thought. This report points out that, for example:

- 30 % of African coastal infrastructure, including man-made developments along the Gulf of Guinea and Senegalese, Gambians and Egyptian coast, is likely to be submerged;
- 25 to 40 % of African species habitats could disappear by 2085;
- The yield of cereal crops will drop by 5 % as a result of climate change.

Africa, like the majority of developing regions, would be particularly vulnerable to the potential impacts of climate change. Many works, notably those of ENDA Tiers Monde (1997), indicate that climate change will have impacts in the various areas of West Africa. This report indicates that:

- in the Sahel, drought will exacerbate soil degradation, fall in agricultural and pastoral productions, chronic shortage of food supplies, continuous and large-scale movement of populations, political instability, an increase in diseases and a significant loss of biological diversity. One should expect more frequent droughts and longer dry spells;
- in West African humid zones, storms and flooding could intensify and result in gully erosion. Thus, coastal areas will be affected by the rise in water level, which will result in coastal erosion, submerged lands, flooding and an increase in groundwater salinity;
- the rise in average temperatures and the change in precipitation regimes will result in the change of ecology, particularly the natural vegetation.

Although the evidence is not conclusive, changes or fluctuations were observed in surface areas under crops, land use and pace of desertification. Some ecological zones seem to be particularly vulnerable to climate change: wet and swampy lands, semi-arid dry and sub-humid lands, arid and semi-arid zones, and highlands in mountainous areas. In dryland, semi-arid and sub-humid areas like the Sahel, the impacts will be more pronounced on upland crops, notably cotton, groundnuts, maize, tree crops, and extensive livestock raising. Long-term trends associated with significant impacts of climate change are also expected on cash crop production areas. The expected impacts of the ENSO phenomena on cocoa production are a case in point. Indeed, DJE Kouakou Bernard, 2007² indicates that El Nino results in a fall in cocoa production and that La Nina brings about an increase in production in Côte d'Ivoire.

Case studies carried out in Burkina Faso and Niger under the CILSS/CIDA Project for Strengthening the Capacity of the CILSS Member States to Adapt to Climate Change (AGRHYMET, 2007)³ indicate that the average yield of millet and sorghum crops, which are the staple food of the Sahelian populations, would decrease by 15 to 25 % by 2080. On

² Presentation made at the International Conference on Climate Change, Ouagadougou, January 2007.

³ Provisional report of the CILSS/CIDA Project for Strengthening the Capacity of the CILSS Member States to Adapt to Climate Change, 2007

the other hand, these crops would be less vulnerable to variations in temperatures lower than 2°C and to low variations in precipitations ($\pm 10\%$). Conversely, the average yield of rice crop (rainfed or irrigated) would increase. Indeed, a rise in atmospheric CO₂ concentration (fertilizing effect), a moderate increase in temperature and sufficient water resources, would result in an increase in grain yields by 10 to 25 % in CILSS countries' irrigation schemes and by 2 to 10 % for rainfed rice. The assessment of impacts of climate change on these various crops does not take into account the evolution of the cropping season (change of sowing dates or extreme rainfall events) and crop pest behaviour.

Climate change could also result in a change in the location of optimum crop production areas because of the southward shift in isohyets. The change in West African cotton producing areas, with the disappearance of Niger's cotton producing area is a case in point. One can therefore come to the conclusion that the impacts of climate change will certainly be more pronounced in West Africa where, poverty, hunger and diseases already affect millions of people.

3. Regional Framework for the Adaptation of West African Agriculture to Climate Change

3.1 Theoretical Framework

The choices and trajectories of development in Africa in general and West Africa in particular are closely related to climate. Indeed, climate is the main regulator of the region's socio-economic activities. Its disruption will have impacts on various natural and human systems, hence on the development potential. Sensitivity to climatic stress is more pronounced when the main activity of the populations rests on the exploitation of natural resources (which also depend on climate). Agriculture, livestock raising and inshore fishing in which the great majority of the West African populations are engaged are a case in point.

According to the Climate Change Convention, adaptation is all responses (solutions) to the adverse or positive effects of climate change. According to Burton, Huq et al., (2002) and IPCC (2001), adaptation consists of an adjustment within a human system in response to a climatic stimulus or its current or forecasted effects, including climate variability and extremes. Adaptation is therefore a process which takes root through socialization, social and political learning, and is expressed through mechanisms and decisions to cope with climatic stresses (Ader and Kelly, 1999). It can take place naturally, or through a spontaneous (for example in the event of a climatic disaster) or planned reaction as part of planning. Adaptation is therefore a social process and not an end in itself.

Many studies carried out recently on the means of livelihood in risk zones show wide ranging reactive or anticipatory coping strategies. The populations do their best to diversify their means of livelihood and to strengthen mechanisms regulating capacity and insurance, but give little attention to production cost effectiveness. A number of these strategies and mechanisms consist of farming and livestock raising, particularly the combination of agro-ecological situations, the importance of technologies for harvesting rainwater and for drainage, drip irrigation, livestock mobility, access to pasture reserves and water resource reserves during droughts.

It is therefore important that the adaptation of the agricultural sector to climate change be part of the main orientations or visions of agricultural policies developed by ECOWAS Member States. This vision is clearly expressed in the ECOWAS agricultural policy (ECOWAP) which builds on the Comprehensive Africa Agriculture Development Program (CAADP) of NEPAD. The West African component of CAADP is based on the twofold ambition of:

ensuring that the main orientations of NEPAD, laid down at Pan-African level, are taken into account in West African priorities within the broader approach of agricultural development continent-wide;

to consider this programme in addressing agricultural problems specific to the West African region and especially in the choices of regional policy thrusts which were the subject of trade-off by the Heads of State and Government of the ECOWAS Member States, after broad-based consultation in each country and at regional level. Thus, ECOWAP⁴ remains the framework of reference for the emergence of prosperous and competitive agriculture in West Africa.

3.2 What is ECOWAP about?

ECOWAP or the ECOWAS agricultural policy defines West Africa's vision and objectives in the field of agricultural development for all ECOWAS member States. It is the framework of reference which should govern the orientations and actions of regional institutions and member States. Therefore, implementation of ECOWAP is incumbent upon all regional actors, be they IGOs, producer organizations structured on a regional scale or economic operators. However, many of the actions defined rest on the mobilization of member States and actors of the agricultural and agro-food sector at national level.

As the assessment of the situation highlighted that Africa's agriculture was in crisis, the initiatives proposed by ECOWAP are based on four (4) fundamental sectors likely to resolve as fast as possible West Africa's agricultural crisis:

- 1) Land and water management;
- 2) Rural infrastructure and commercial capacity to facilitate access to markets;
- 3) Support to activities strengthening the productivity of small holdings under food security programmes;
- 4) Research and development combined with the dissemination of technologies and their adoption on a large scale.

Thus, the regional framework for the adaptation of West African agriculture cannot be dissociated from the political, economic and social dynamics in progress in the sub-region. These relevant strategic orientations must be supported while including the climate change dimension, which aspect was not taken into account at the time when this vision of West Africa's agriculture was developed.

3.2.1 Fundamental Sector 1: Land and Water Management

Around the world, rational use of water is essential to increase agricultural productivity and guarantee production predictability. Water is crucial in developing land potential and in allowing improved plant varieties and animal breeds to make the most of factors of production, which help increase yields. That is the reason why, CILSS has developed and is currently implementing a regional programme entitled managing water to reduce hunger.

The current surface area under water management and land development in the whole of Africa is estimated at 12.6 million hectares⁵, that is, only 7% of total available arable land, of which only 3.7% in sub-Saharan Africa. 40 percent of total irrigated surface area is located in northern Africa. Irrigation, which has the potential to quickly increase production, can

⁴ The 2006-2010 Regional action plan on the implementation of the ECOWAS agricultural policy (ECOWAP)

⁵ FAO. 2000. Global Agriculture : 2015/30 time horizon (estimations)

ensure increased production of food products more rapidly. However, it is worthy of note that the reduction of hunger also depends on modalities that govern access to irrigated lands by poor populations.

Though it is not a panacea for all agricultural evils, irrigation provides possibilities conducive to agricultural growth, such as better use of lands and resources in general, optimised use of fertilisers, use of improved plant varieties and infrastructure upgrading. Irrigation and soil management will give best results if investments are made to develop infrastructure and expand the market.

Climate change will affect the "lands – water" productive couple. Coping actions in this field focus on the mastery of these two essential factors of production. Efforts to disseminate water and soils conservation/restoration techniques, which have already been successfully tested in the sub-region to cope with climate variability, should continue and be intensified in order to better adapt the production potential to the possible deterioration of climatic conditions.

3.2.2 Fundamental Sector 2: Rural Infrastructures and Commercial Capacities

Infrastructure in African rural areas, are far from being satisfactory and the poorly developed road network is a case in point. To reach the closest large markets, the populations cover longer distances than those covered in the other continents. The poor state of infrastructure reflects the little importance given to investments and also the fact that the production level seldom justifies the required investments and maintenance costs. Growth in agricultural production and the improvement of production competitiveness, processing or trade in crop, animal, forest or fishery products, require additional investments in rural infrastructure, particularly roads, storage, processing and markets. The already insufficient infrastructure will be further affected by extreme climatic events. It is important that their design takes into account new climatic data, notably the projections of global models to ensure their sustainability.

3.2.3 Fundamental Sector 3: Increased Food Supplies and Hunger Reduction

Hunger, which has been prevailing for a long time in Africa, is a widespread phenomenon. In spite of the progress made by some countries, hunger is a major risk for a high number of people and poses many adverse consequences for health and the productivity of the population. This situation exacerbates poverty. In Africa like elsewhere, the poorest are also those, who suffer more from hunger, experience a situation close to survival, and are highly vulnerable to all shocks. In the short term however, it is necessary to take action directly on the living conditions and food security of underprivileged groups through the increase in their own agricultural production.

The fall in production due to climate change will result in problems of supplying markets with food products, which can amplify food shortage, hence hunger in the sub-region. CILSS' experience in seasonal crop monitoring toward the assessment of regional agricultural production is a relevant strategy to expand to the whole of West Africa. Strategies for managing and storing food products and analysing cross-border trade should be further fine-tuned for better flow of agricultural surpluses to deficit areas. Supplies and markets are closely linked and depend both on infrastructure and transport.

3.2.4 Fundamental Sector 4: Agricultural Research, Technology Dissemination and Adoption

In Africa, like elsewhere in the world, agriculture needs scientific and technological support to increase productivity so as to remain competitive. The critical situation of agriculture characterised by the fall in productivity, poor investments in research and development, the absence of contacts between researchers and farmers, require reforms for sustainable research and its funding at national, sub-regional and regional levels. Although analyses related to the West African sub-region are inadequate and the results of climatic projections and their consequences are uncertain to better anticipate the risks and opportunities associated with climate change, National Action Programmes for Adaptation (NAPAs) were prepared. At regional level, a regional action programme for reducing vulnerability to climate change in West Africa and Chad is in the process of preparation under the aegis of ECOWAS in collaboration with CILSS, ACMAD and ECA. Moreover, an initiative aimed at preparing a document on the common sub-region policy and strategy to cope with climate change is in progress. The implementation of these various action plans and other initiatives, as well as the development of more reliable information system adapted to local and regional contexts should be at the core of research activities to undertake.

Thus, national and sub-regional research institutions should be supported to:

- Develop new crop varieties tolerant of extreme climatic conditions (droughts, flooding, high temperatures);
- develop integrated farming systems, including agroforestry, supplemental irrigation and water and soil conservation techniques;
- adapt meteorological and climatic information to producers' needs, by improving the spatio-temporal scales of forecasts and by providing advice on tactical and strategic decisions.

4. Conclusion

The expected impacts of climate change on West African farming systems are likely to exacerbate the precarious situation already experienced by the populations of the sub-region. The States, thanks to support from sub-regional or international institutions, have already undertaken actions aimed at curbing the adverse effects of climate variability and at anticipating those linked to climate change in the long term. National Action Programmes for Adaptation and national communications on climate change are a case in point. Moreover, intergovernmental integration organisations are reflecting with a view to considering climate change in development policies. In this vein, ECOWAS in collaboration with CILSS, ACMAD and ECA undertook since 2007 to develop the sub-regional adaptation programme to reduce vulnerability to climate change in West Africa and Chad on the one hand, and the common policy and strategy to cope with climate change on the other.

This regional framework to adapt to climate change in West Africa is expected to be anchored in the ECOWAS agricultural policy (ECOWAP), but especially in the initiatives on climate change in progress. Lastly, it is expected to place emphasis on capacity building of institutions existing in the sub-region, which are better placed to produce scientific information and decision support information.

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