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## CLIMATE CHANGE AND DEVELOPMENT

### CONSULTATION ON KEY RESEARCHABLE ISSUES

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**SECTION 6: WEST AFRICA REGION**  
**SECTION 6.2. SENEGAL SCOPING STUDY**  
**ENDA - NOGOYE THIAM AND OTHERS**

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## CLIMATE CHANGE AND DEVELOPMENT

### C. COUNTRY REPORT/SENEGAL

#### *C1. Introduction*

In accordance with the project's terms of reference, the methodology used combined an array of approaches that entailed:

- Compiling an inventory of, and making use of, documents relating to climate change with a view to establishing its impacts on the development process, identifying suitable adaptation strategies and assessing the effectiveness of actions undertaken to reduce the vulnerability of various sectors of the economy to climate;
- Carrying out interviews with key players in public institutions (ministries, technical departments, projects, etc.) in order to ascertain their views on adaptation strategies;
- Holding discussions in relatively small and homogenous groups on how climate change interacts with development. These focus groups looked at three topics: (i) water and agriculture, (ii) health and (iii) the management of coastal zones;
- Holding a regional workshop featuring representatives of all the various segments of society; the aim was to reach a shared understanding of the stakes and challenges that all have to overcome together.

It was decided that three main areas of focus would be pursued when it came to implementing activities:

- the impacts of climate change on different sectors;
- the benefits and limitations of adaptation strategies;
- activities to be carried out to meet the challenges of the impact of climate change and mitigate vulnerability to climate

#### *C2 Bio-physical and socio-economic context*

Located at the westernmost tip of mainland Africa, Senegal is a Sahelian country with a surface area of 196,722 km<sup>2</sup>. Geographically, it is a country of contrasts, with the northern part of the country on the verge of desert and the southern portion in the forest zone. It also has two other notable characteristics: weak relief, and unstable ecological balances.

Senegal has a relatively strong demographic push. The country's populations climbed from 3,500,000 in 1960 to 5,000,000 in 1975 and 10,112,000 in 2004 (Internet, Senegal's Population, Demographic Change). The demographic growth rate is 2.8% per year, meaning the population doubled in just 23 years. Forecasts reckon that by 2020, Senegal will be home to some 13 million people, most of whom will live in cities (Internet, UNFA Senegal). The country is currently subjected to the highest urbanisation rate in the whole Sahel (with 32% of the population living in cities).

Average density is 46 per km<sup>2</sup> but this conceals sizeable disparities between region: the rate is 6.8 per km<sup>2</sup> in the Tambacounda region as opposed to 4,000 per km<sup>2</sup> in Dakar. Some rural areas do have heavy population densities, notably those in the River Senegal valley and the groundnut basin in Lower Casamance (MEPN, 1995)

The most notable features of the country's socio-economic profile are:

- considerable migration;
- increasing poverty<sup>1</sup> ;
- low literacy (41%);
- high unemployment (15% of the active population) and under-employment;
- women have finding a way into the work place;
- no social protection for many social groups and categories;
- inadequate health coverage despite the fact that diseases thrive, especially malaria, bilharzias and others linked to atmospheric pollution in cities and wood burning in rural areas, etc.

Over the last few decades, the purchasing price of agricultural products has kept low, both for cash crops (groundnuts and cotton) and subsistence ones. Rural income has been in steady decline, falling from 22,100 F CFA in 1960 to 12.000 F CFA in 1972 and 10.900 F CFA in 1977 (CNCR, 2003). Accordingly, agriculture's share in GDP has also fallen, going from 24% in 1970 to 10% in 2000, 17.4% in 2001, 13,6% in 2002 and 15.4% in 2003 (Internet, APIX: reasons for investing in Senegal). Agricultural productivity seems locked in a downward spiral that is causing income to plummet, which also forces savings and investment down, which in turn hampers production.

The data in the Poverty Reduction Strategy paper (Senegal, 2001) reveals that 30% of households live below the poverty line, meaning they do not have enough to afford 2,400 calories per person per day. 75% of the poor households are in rural areas, and 58% of all rural households are poor. In rural areas, poverty means having little or no monetary income, not being able to produce enough for one's own needs and having difficulty accessing social services. In urban areas, the most relevant poverty indicators relate to social services, land rights and access to solidarity and support systems.

The first consequence of poverty, whether in cities or the countryside, is food insecurity: people do not have a regular food supply and therefore do not have a balanced diet. The country's annual food production per capita over the last decade is estimated to have been just 78% the 1987 level<sup>2</sup>. The Strategic Operational Document (MAE, 2001) shows that cereal importations, especially of rice, (around 800,000 tons per year over the last five years) are a

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<sup>1</sup> *Du point de vue du niveau de développement humain, le Sénégal se situe au 145<sup>ème</sup> rang sur 162 pays, avec un indice global de 0,423 (rapport sur le développement humain, 2001)*

<sup>2</sup> *Actuellement, la disponibilité brute moyenne de céréale par habitant est de 105 kg alors que la norme FAO est de 185 kg. Il faut ajouter à cela que le sous-secteur élevage n'assure qu'un niveau faible de consommation de viande (11 kg/an/habitant en 1997 contre 20 kg en 1960).*

growing burden for the national economy. None of the agricultural policies so far deployed have dispelled the country's dependency on these imports not slowed down the rate of impoverishment. These policies have, in fact, been of very little benefit to the poor since they perpetuate the very uneven distribution of incomes.

The chronic malnutrition in rural areas is a cumulative effect of several factors: the difficulty of instilling genuine diversification of income-generating activities, lack of access to the factors of production, precarious climatic conditions and low literacy and education levels. Urban areas have trouble absorbing new arrivals from the countryside. Poor urban households already spent 70% of their income on food before the devaluation of the CFA franc and the resultant price hike hit them hard. They adjusted by reducing the amount of food used in each meal, cut some foodstuffs out of their diet completely and also reduced the number of meals they have.

As rural population face ever-mounting hardship, they too have concocted survival strategies, but these put more and more pressure on natural resources. They have taken to cutting down trees where the land is not particularly fertile or suitable to agriculture unless large amounts of fertilisers are used. This exhausts the soil, accelerating the decline of agricultural yields. A vicious circle has thus developed between poverty and the degradation of natural resources, and the consequences are catastrophic for rural communities and the countryside in general, particularly at a time of high demographic growth

The public authorities are concerned by these problems, which is why they are eager to implement policies aimed at offsetting the eco-system's degradation process and, therefore, preserving much of the country's development potential. This is no easy task though, so the biggest challenge they face is to reconcile these two objectives while preserving the environment in the long term.

### **C3 Main sectors of activity affected by climate change**

Climate change affects many sectors that are vital for the country's development, such as agriculture, fishing, forestry, tourism, etc. The indirect effects of climate change can be tricky to ascertain, but the direct effects have been widely identified in research work on changes in water resource's vegetation, soil, etc.

One of the most obvious and detrimental effects is the change in rainfall. Senegal is located in a dry tropical zone marked by relatively high temperatures and an irregular pluviometry in both space and time terms. The climate is subjected to geographical influences (a seaboard stretching over 700 km) and atmospheric ones.

Climatic conditions are characterised by the alternation of two very different seasons: a dry season with maritime and continental trade winds, and a rainy season dominated by the flow of the monsoon from the Saint Helene anti-cyclone. Temperatures are high all year round. Average precipitation varies greatly from place to place: it is around 100 mm in northern regions and 1,500 mm in the south. In addition to year-on-year shifts, the number of rainy days and the quantity of precipitation is dropping. The country endured three major periods of drought in the past century (1910, 1940 and 1968). The most recent was the most severe, since recurring rain deficits pushed isohyets south across 120 km from 1971 to 1990. Another significant phenomenon is the advent of extreme climatic occurrences: in January 2002, the northern part of the country suffered exceptionally strong accompanied by a cold wave; while

this had positive effects such as the replenishment of groundwater tables, it had a devastating impact on many people and cattle. The UNDEP estimated (in 2002) that the weather conditions killed tens of people, 50,000 cows and 500,000 smaller ruminants; it also destroyed some 20,000 homes.

### ***C3.1 Impact of climate change on water resources***

The water potential in the country is estimated at 9 billion m<sup>3</sup> per year (Briquet, 1997). In 1995, the volume of water available per capita was 1,084 m<sup>3</sup>. If the current rate of demographic growth continues, this volume will by 2010 have fallen to 428 m<sup>3</sup> per year. This would lead to water shortages, which in turn would jeopardise food security and eco-systems. However, the Hydraulics Sector Development Policy Letter (Ministry of Hydraulics, 1999) highlights the sizeable water stocks that are available and insists that the country should have ample water for the next 15 to 20 years.

Regardless of which scenario we adopt, the fact remains that climate change will at least lead to a deterioration in water quality (proliferation of aquatic vegetation, salinification of groundwater tables and pollution of hydric resources). The simulations carried out as part of the vulnerability and adaptability studies of coastal zones and agriculture suggest that by 2050 pluviometry will decrease more in the south-west of the country than in the north-west.

Countering the gradual dwindling of groundwater tables entails implementing more coherent urbanisation and land planning policies. The rapid rate of urbanisation and paving of towns limits the infiltration of rainwater and, therefore, table replenishment

### ***C3.2 Impact of climate change on agriculture***

The study on the impact of climate change on agricultural production showed that following trends:

- the degradation of farming conditions and the reduction of production potential;
- agro-climatic zones are shifting south;
- the country is becoming increasingly dependent on imported foodstuffs;
- food security is deteriorating, especially for the most vulnerable;
- natural resources are being over-exploited, especially arable land;
- competition for resources is intensifying, with conflicts spouting up and more groups being marginalised.

In order to reinvigorate farming systems, irrigation must be deployed more so that farms are less sensitive to climate changes. Irrigation can only be promoted if water resources are used better. Farming systems should be based on technical performance criteria (windbreakers, water-efficient irrigation) as well as socio-economic (fighting poverty) and environmental (sustainable management of natural resources) factors.

### ***C3.3 Impact of climate change on forestry resources***

A handful of basic indicators are enough to appreciate the extent of the degradation of forestry resources (MEPN, 1995). In 1980, natural forests covered 8.1 million ha (out of a total of 11 million ha of forestry resources) but in 1990 they covered just 7.5 million ha, i.e. a fall of 7.4% in ten years. Between 1980 and 1990, ligneous resources decreased annually by about 2 million m<sup>3</sup>. At the same time, natural productivity of forest areas being degraded fell sharply (0.1 to 0.4m<sup>3</sup>/inhab/year in the northern half and 1.5 to 3 m<sup>3</sup>/inhab/year in the south).

Biomass is the main fuel used by populations in both urban and rural areas (DEFCCS, 1994). Wood represents 67% of energy consumed, while charcoal accounts for another 28% and butane gas is just 5%. It takes about 5.5 kg of wood to produce 1 kg of charcoal, and national wood consumption per year is 2,500,000 m<sup>3</sup>. One of the main factors in the degradation of forest areas is wood-gathering for fuel purposes. The current supply/demand A ratio is severely unbalanced: the deficit represents 25% of consumption.

Reduced rainfall and increased potential evapo-transpiration combine to make forests even more fragile. Combined with human pressure, these could lead to (i) further degradation of ligneous resources, (ii) a decline in forest productivity, (iii) loss of income for surrounding populations, iv) slashes in bio-diversity and (v) a loss of carbon reserves.

### ***C3.4 Impact of climate change on the coastal zone***

Senegal's coastline stretches over 700 km and its hinterland represents some 18,000 km<sup>2</sup>. This area has vast potential, especially during upwellings. What is more, the Senegalese coasts receive four water currents whose terrigenous deposits play a major role in enriching the area. The confluence of an array of favourable factors (temperature, sunshine, mineral salts) makes this a highly productive region. Accordingly, a lot of people have settled here and there is much infrastructure and productive business along the coast

In 2004, seafood resources met 75% of the population's animal protein needs and the fishing sector contributed 12% of the primary's sector GDP (Internet, APIX: reasons for investing in Senegal).

The degree of exploitation of biological varies greatly. Some species are very under-exploited while others are fished to the maximum or, indeed, over-exploitation. Climate change has already started to alter some eco-systems (causing salinification of some estuaries, shortening upwelling time, etc.); this reduces the sea's productivity.

Also, the destruction of plant cover, in particular the disappearance of mangrove forests – which are breeding grounds for many fish and shell fish – has hamstrung many fishing activities. Climate change also disturbs tourist activity in coastal regions.

The study on the risks of the destruction of coastal infrastructure and settlements (2002) suggested that by 2050/2100 – depending on flooding levels - 174,900 to 730.300 people will be placed in jeopardy in the Cape Verde region, leading to economic losses worth 52 to 129 million CFA francs.

## **C4 Methods for taking account of climate change in development policies**

As things stand, most of Senegal's economic growth is due to the tertiary sector, as the others are relatively weak. Agricultural production is very erratic, rural farmers' income is falling and large segments of the population are slipping into poverty. Faced with these woes, the public authorities opted to assign a high level of priority to improving economic competitiveness in a bid to boost sustainable development. Economic revival policies focus on issues such as food security, water resources control, land use management and resource optimisation.

Environmental change has in recent times become more apparent in the macro-economic sphere, however it is still worth wondering if enough attention is being paid to climate change in planning. As yet, there is no policy dedicated specifically to climate change. Instead, climate change concerns are addressed through projects and programmes aimed at mitigating its impacts on socio-economic activities. The main initiatives underway deal with the following areas:

- energy efficiency in buildings (savings of 20 to 60%);
- promoting substitution fuels and managing energy demand (distributing improved stoves and developing solar energy in rural areas);
- improving industrial production processes (replacing obsolete, polluting technologies, and acquiring equipment for enhancing energy yields, etc.);
- rationalising the transport sector (improving mobility, preserving air quality, etc.) ;
- promoting new and renewable energies.

## **C5. Research policies and priority research topics**

At the national workshop in Dakar, discussion examined (i) achievements to-date of research, both at institutional level and in terms of operational results in the field<sup>3</sup>; (ii) the scope and limitations of the initiatives undertaken, (iii) challenges for the future and actions needed to remedy weaknesses in the initiatives underway.

It quickly became clear that approaches taken so far to adapt to climate change are too sector-centric. The main challenge then, is to transcend this compartmentalisation and forge a multi-sectoral approach that harnesses synergies. In other words, the issue of climate change has to be tackled in a way that meshes it with development.

The national workshop set out some guiding principles along the following three planks:

- the need to identify the most salient topics on the basis of development priorities set by countries;
- the need to set multi-sectoral indicators to lead research work and ensure it is genuinely useful in terms of providing policy-makers with knowledge need to make decisions;

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<sup>3</sup> *Un cadre institutionnel a été mis en place avec la création de la Commission nationale sur le changement climatique. Cette commission comporte deux sous-commissions (carbone et énergie).*

- the need to concentrate on a limited number of topics, ones that, if taken into account, could act as levers and engendering significant changes in other spheres.

### ***C5.1 Research topic on water and agriculture***

The workshop participants recommended centring research on the following:

- water control (possible options for swelling stocks, conservation techniques, usage, resource quality, etc.);
- the development of agro-forestry as a strategy both for adapting to climate change and eradicating poverty;
- la promotion of crop species suited to drought and salinification;
- approaches and strategies for bolstering the integration of agriculture and pastoral farming;
- the incidence of the promotion of GM foods on farming systems.

### ***C5.2 Research topic on coastal zones***

The main themes to be targeted by research are:

- the models<sup>4</sup> on the impact of rising sea levels on infrastructure, human settlements, coastal erosion, etc.;
- adaptation strategies for coping with rising sea levels;
- materials for protecting coastal zones.

### ***C5.3 Research topic on energy***

Research should concentrate on:

- appropriate new and renewable energy technologies, especially in rural areas;
- spreading awareness of energy-efficient policies (energy-efficient appliances);
- sustainable management strategies for biomass resources with a view to harnessing further valorising them;
- technology-transfer methods that promote energy-efficient power stations.

### ***C5.4 Research topic on health***

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<sup>4</sup> *L'établissement de modèles fiables passe nécessairement par l'amélioration des bases de données existantes.*

The main theme to be focused on is diseases that are determined by their environment (infectious diseases, allergies, water-related diseases, etc.).

### ***C5.5 Research policies***

In terms of research policy, the national workshop emphasised the need to distinguish between requirements for the national research system as a whole and those specific to research on climate change. Climate change initiatives look at a variety of sectors (agriculture, energy, water, coastal zones management, etc.). However, these initiatives are dispersed and do not form a coherent framework. Another debilitating factor is the lack of any instrument for guiding and coordinating research activities on climate change. The ministry with responsibility for research does not have the political authority to steer research centres, who, in many cases, are under the aegis of other departments.

In terms of public policies on knowledge generated by research, the national workshop made the following three observations:

- there is a firmer political willingness to take account of research findings as part of overall planning. This is true, of example, in the agricultural sector, where research on enhanced seeds, mobile techniques, etc. Influenced the shape of agricultural programmes;
- prevailing legislation demands that preliminary impact studies are carried out before any project likely to affect the environment begins. Legislation also recommends using clean technologies for managing the greenhouse effect;
- Research findings are not adequately valorised because the criteria for promoting researchers do not take account of the importance of this. This is compounded by the fact that policy-makers frequently do not have enough room for manoeuvre to implement the results;

The lessons learned from experiences of valorising research results related to:

- The need to make more concerted efforts to steer research in keeping with social demand;
- The need to improve presentation formats so that they can be more easily appropriated by users and decision-makers;
- The need to enhance the working of dialogue arenas for researchers, decision-makers and beneficiaries.

Financial constraints greatly impede the promotion of research programmes, which usually rely on outside funding. It is essential that the declared willingness of the public authorities to do something is translated into budgetary allocations that ensure research will be sustainable.

The workshop identified some paving stones that could plot the way towards ensuring climate change research dovetails more with social requirements and researchers can better pre-empt developments and carry out effective technological and scientific monitoring. These focus on (i) the overall coordination of research initiatives and (ii) establishing greater cohesion between research topics and populations' concerns.