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Climate Change Adaptation in SENEGAL

Climate change poses a threat to Senegal's socio-economic development. In general, climate models suggest that West African countries will likely experience increased temperatures, decreased annual rainfall, increases in the intensity and frequency of heavy rainfall events, and a rise in sea level. These changes will significantly affect the socio-economic and environmental resources of Senegal. Recognizing this, the Senegalese government, and international and national institutions and organizations, have begun to identify climate change impacts, vulnerabilities, and threats as well as to determine adaptation priorities, develop adaptation strategies, and mainstream adaptation into development planning. However, an implementation gap remains between existing adaptation plans and project realization. Reasons for this gap include financial constraints and limits in available, accessible, and locally derived data on climate change and its impacts on various sectors and communities.

Map of Senegal. Source: Encyclopedia Britannica

CLIMATE IMPACTS AND VULNERABILITY

Historic Weather and Climate

Observations indicate the following:

- Rises in average temperatures of about 0.9°C since 1960, an average of 0.2° per decade.
- Decreases in rainfall by 10-15 mm per decade and a shortening of the rainy season.
- Increases in daily rainfall and in the frequency of short dry spells.
- Loss of shoreline from erosion of 1-2 m per year along shorelines of sand beaches, and 0.1-0.7 m per year along rocky coastline areas, aggravated by sea level rise.

Predicted Future Climate Changes

In general, climate models predict for Senegal:

- An increase by the 2060s of 1.1-3.1°C in mean annual temperatures from the observed 1970-99 mean of 27.8°C.
- Greater climate variability, including in the frequency and proportion of rainfall coming in intense and extreme rainfall events.
- Sea level rise of up to 1 m by 2100.
- Changes in annual precipitation ranging from a 38% decrease to a 21% increase from the 1970-99 average, with the majority of models predicting a decrease.

KEY SECTOR VULNERABILITIES

Agriculture and Food Security

Senegal's agricultural sector employs more than 70% of the workforce and represents about 17% of the country's gross domestic product. Currently, over 65% of Senegal's arable land is cultivated, and it is expected that by 2050, almost all arable land will be cultivated. The sector consists primarily of rainfed agriculture, which is especially vulnerable to increases in temperature, changes in timing and amount of rainfall, and increases in the frequency of dry spells and droughts. These consequences are likely to have negative impacts on agricultural production as well as health, economic development, and the environment.

Climate Change Impacts on Agriculture and Food Security

Change in Climate	Potential impacts on agriculture and food security
Heavy rainfall and sea level rise	• Inundation, degradation, and salinization of agricultural lands, which can lead to crop loss and failure.

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* Chart continues on following page

Change in Climate	Potential impacts on agriculture and food security
Increase in droughts and floods	• Declines in crop yields and biomass production. • Food shortages and price increases. • Rural-urban migration, destabilization of peasant livelihoods. • Increases in bush fires and pest infestations.

In the Senegal River Valley, Niyes, and Lower and Upper Casamance regions, agriculture and fisheries are vulnerable to declines in rainfall, coastal erosion, salt water intrusion, and floods – all of which pose challenges to food security. Climate change-related impacts are likely to increase the negative effects of the non-climate stressors, such as overexploitation of natural resources and prolonged use of chemical pesticides, that currently threaten agricultural practices, livelihoods, and financial returns.

Water Resources

Current and projected climate variability are the climate stressors of greatest concern for water resources. Together with higher temperatures and decreases in annual rainfall, they are likely to contribute to potential declines in available and accessible surface and groundwater resources, affecting the sustainability of livelihoods, food security, and health, as well as local, domestic, and foreign economic activity in Senegal. By 2015, annual water availability is expected to decline due to a combination of climate and non-climate stressors; this decline places water resources in a vulnerable state.

Climate change impacts are likely to aggravate existing non-climate stressors that contribute to the vulnerability of the water sector in Senegal. Non-climate stressors include rising water demand, poor management of irrigated areas, increased pressures on land for agriculture, greater exploitation of natural resources, and infrastructure development. The impact of both climate and non-climate stressors can affect the availability and quality of water for human consumption, sanitation, agricultural practices, livestock production, industries, and hydropower. Demands for domestic and non-domestic water (not including irrigation) are expected to increase by 32% between 2000 and 2020, further illustrating the need for long-term water management initiatives in Senegal.

Coastal Zones

Sea level rise threatens human settlements and economic activities in coastal areas of Senegal. It is estimated that about 74% of Senegal's coastal housing is vulnerable to sea level rise. Rising sea levels will likely increase coastal erosion, which in turn may result in greater destruction of infrastructure, businesses, natural resources, and ecosystems. In addition, economic activities along the coast, such as agricultural, industrial production, mining, and tourism, can be adversely affected by sea level rise. Another consequence of sea-level rise is the salinization of surface water, groundwater, and soil. This can contaminate available sources of fresh water and negatively affect cultivation, flora, and fauna in areas near the coast. Sea level rise, warmer land and water temperatures, and stronger winds may also intensify upwelling patterns and alter the composition of coastal ecosystems.

Physical Impacts of Climate Change and Consequences in Coastal Zones

Climate change related event	Impacts/Consequences
Increase in sea level	• Damage/erosion of human settlements, infrastructure, industry, natural features, and beaches. • Salinization of soil, coastal aquifers, and other ground and surface water sources. • Flooding of low-lying coastal areas. • Loss of coastal wetlands, lagoons, mangroves, and other coastal habitats. • Higher risk of pollution from coastal hazardous waste sites. • Higher cost of maintenance and expansion of coastal erosion controls. • Changes in the structure and composition of marine communities.
Changes in upwelling and higher sea surface temperature	• Declines in fish populations and reproduction. • Loss of marine biodiversity and changes in the structure and composition of marine plants and animal species. • Development of toxic agents in marine wildlife. • Loss of revenue for the portion of the population involved in fisheries sector.

Wetlands

Wetlands host many species of plants and animals; provide resources such as fisheries, shellfish, fuelwood, medicine, and agricultural products; and are relevant to the tourism industry. They also help to reduce the impacts of heavy rainfall, storms, and sea level rise, buffering impacts on communities and infrastructure. If wetlands are not in a healthy condition, they cannot absorb the impacts and damage of higher tides, storms, and flooding.

Intense rainfall events, decreases in rainfall, increases in air and ocean temperature, reoccurring droughts, and sea level rise contribute to the degradation and destruction of freshwater ecosystems and wetlands. Impacts include loss in biodiversity, the colonization of invasive

plant species, and the salinization of wetlands. Changes in wetlands also affect fish populations in mangroves, which has implications for the fishing industry.

Tropical and Woodland Forests

Climate change has already begun to affect tropical and woodland forests in Senegal, which are important economically, ecologically, and scientifically. As of 2005, forests accounted for about 45% of Senegal's land area, and served as a habitat for over 1,000 animal and 2,100 plant species. According to a study on Senegal's woodlands between 1982-84 and 1994-97, increases in temperature, droughts, bush fires, and long-term declines in rainfall significantly affected vegetation and soil quality in two-thirds of northern Senegal, leading to high mortality rates of woodland vegetation and reducing biodiversity by 30%.

Non-climate stressors, such as clearing of forest for land cultivation and grazing, mining activities, lack of forest resource management and policy enforcement, lack of alternative energy sources, and high demands for biomass and timber, also contribute to declines in forest land cover. From 1960-2009, Senegal's natural forest land diminished from 11 million ha to 4.7 million ha, causing a significant drop in biodiversity and forest produce; deforestation is currently occurring at a rate of 0.5% per year. Climate change is likely to aggravate these non-climate stressors affecting forests.

NATIONAL STRATEGIES, PLANS AND INSTITUTIONS RELEVANT TO CLIMATE CHANGE

National Strategies and Plans

- National Plan of Action for the Environment (1997): Provides a framework for linking various sectoral policies with forest conservation and natural resource and coastal zone management.
- Initial National Communication (1997): Presents information on key sector vulnerabilities, possible adaptation strategies, and the policy and institutional context for responding to climate change.
- National Adaptation Programme of Action (NAPA) (2006): Incorporates participatory methods in the implementation and monitoring of projects, community ownership of solutions, capacity building, poverty alleviation, strategies for improving and diversifying livelihoods for vulnerable groups, and consideration of gender issues.

Institutional Framework

- The Directorate of Environment and Classified Establishments is responsible for strengthening the awareness and knowledge of various government agencies on climate change and adaptation issues.
- Implementation of the NAPA is led by four directorates: National Parks; Environment and Classified Establishments; Water, Forests, Hunting, and Soil Conservation; and Water Retention Basins and Artificial Lakes.
- The National Climate Change Committee aims to contribute all necessary expertise for the implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and its protocols in Senegal. This committee is comprised of the ministries of Agriculture, Tourism, Environment, and Education.

Priority Adaptation Projects from NAPA

- Restoration of mangrove swamps and reforestation
- Development of infrastructure such as dams, dikes, retention basins, and anti-salinization structures to reduce flooding (particularly in the Senegal River basin)
- Revitalization of river networks and ecosystems
- Maintenance of balance between surface and groundwater use
- Increase in accessibility and availability of irrigation infrastructure
- Improvement and diversity of agricultural practices, livelihoods
- Increase food security
- Creation of community woodlands and secure energy production
- Improvement of water conservation and capture methods
- Physical protection against beach erosion and saline intrusion
- Establishment of early warning systems for flooding
- Increase public awareness and education

Government Adaptation Priorities

Senegal's NAPA identifies priority sectors and projects of the Government of Senegal, focusing on areas most vulnerable to climate change (see box at right). The NAPA also highlights the importance of regional and international cooperation and the mainstreaming of climate change efforts into all relevant national ministries, institutions, and policies. In order to avoid duplication of efforts and maximize resources and results, improved national coordination among stakeholders addressing climate change issues is a priority.

In addition, based on climate scenarios, sector-based studies, and an analysis of various development challenges, other general priority areas for adaptation are research, systematic observation, and capacity building. The improvement, development, and enforcement of environmental, climate change, and disaster risk reduction policies and laws in Senegal are also vital for reducing climate vulnerability.

KEY PLAYERS AND INITIATIVES

Key ministries responsible for conducting assessments and developing plans and strategies are the Ministries of Environment and Natural Protection, Agriculture, and Water Resources. An increasing number of climate change adaptation initiatives in Senegal are being spearheaded by international, regional, and national institutions and non-governmental organizations (NGOs). The German Agency for International Cooperation (GIZ), United States Agency for International Development (USAID), Government of Japan, United Kingdom Department for International Development (DFID), and Food and Agriculture Organization of the United Nations (FAO) have been involved in a number of initiatives. These organizations have focused primarily on assessments, research, capacity building of local stakeholders, strategy development, and dissemination of information on climate change and adaptation issues in Senegal, in the

agriculture and rural livelihoods, health, water resource management, and urban and coastal management sectors. Current initiatives include:

- Integrating climate change risk implications in national planning and strategies programming; integration of climate risks in urbanization plans; and supporting integrated and comprehensive approaches to climate change adaptation in Africa (United Nations Development Programme (UNDP)/ United Nations Environment Programme/Climate Change Adaptation and Development Initiative/UNFCCC).
- Improving food production and water capture with ridge tillage technology in the Sahel of West Africa (University of Hawaii/Centre d'étude régional pour l'amélioration de l'adaptation a la sécheresse en Senegal/Farmers in the region) (funded by USAID).
- Reducing vulnerability to locust infestation (World Bank).
- Managing water and environment in the Senegal River Basin (Organization for the Development of the Senegal River (OMVS), World Bank, UNDP) (funded by Global Environment Fund).

Senegal also hosts a large array of NGOs and research institutions that focus primarily on improving adaptation capacities and building adaptation networks. Among these are:

- Environment and Development in the Third World (ENDA-TM), which is working on agricultural, water resource, environmental protection, and sustainable development issues as they relate to climate change.
- Senegalese Institute of Agricultural Research, which is charged with conducting research and shaping sustainable agriculture agendas.
- Council of NGOs for Development, a network of 116 NGOs aimed at developing co-actions and exchange between development NGOs.
- OMVS, which is responsible for providing secure, steadily improving livelihoods for inhabitants of the Senegal River valley, and safeguarding ecological balance in the region.

PRIORITY CHALLENGES AND CONSTRAINTS FOR ADDRESSING VULNERABILITY AND INCREASING RESILIENCE

Climate change adaptation strategies and initiatives need to be mainstreamed into Senegal's development process. This requires detailed, location-specific risk and vulnerability assessments and studies on the social and economic effects of climate change within the country. Additional data, research, and capacity needs include, by sector:

- Water: Reducing vulnerability to flooding through data collection, food vulnerability assessments, development of risk zone maps, and improving water management in the Senegal River basin.
- Coastal zone management: Mapping vulnerable coastal resources, as well as monitoring and modeling changes in sea level and storm surges in the vulnerable regions of Thiés, Dakar, and the Senegal River delta.
- Agriculture: Identifying risks and opportunities for food security especially in the rural south, improving water use in agriculture, and encouraging the use of new cultivars and improved seeds – important for regions facing water deficits during the dry season.
- Infrastructure: Developing adequate climate monitoring and modeling technology to forecast the occurrence of extreme weather events and assess possible changes in weather patterns throughout the country.

In addition, existing information on climate change and adaptation needs to become more accessible to local and national institutions, government agencies, NGOs, urban and rural communities, and other stakeholders. Dissemination is vital in supporting and strengthening stakeholder efforts. Furthermore, policymakers need additional institutional support and training on local and global climate change science, impacts, and vulnerabilities to support decision and policy-making.

KEY SOURCES

McSweeney C, New M, and Lizanco G. UNDP Climate Change Country profi les – Senegal [Internet]. School of Geography and Environment - University of Oxford and Tyndall Centre for Climate Change Research; 2008 [cited 2011 Jun 2]. Available from: http://country-profi les.geog.ox.ac.uk

Ministère de l'Environnement et de la Protection de la Nature (MEPN). Plan d'Action National Pour l'Adaptation Aux Changements Climatiques [Internet]. UNFCCC; 2006 [cited 2011 Jun 10]. Available from: http://unfccc.int/resource/docs/napa/sen01f.pdf

Senegal Country Report [Internet]. [updated 2011 Jun 20]. Food and Agriculture Organization (FAO); [cited 2011 June 5]. Available from: http://www.fao.org/countries/55528/en/sen/GFDRR. Climate Risk and Adaption Country Profi le - Vulnerability, Risk Reduction, and Adaptation to Climate Change: Senegal [Internet]. World Bank; 2011 [cited 2011 Jun 10]. Available from: http://sdwebx.worldbank.org/climateportal/doc/GFDRRCountryProfi les/wb_gfdrr_climate_change_country_profi le_for_SEN.pdf

Global Environmental Facility (GEF), United Nations Development Programme (UNDP), United Nations Education, Scientifi c and Cultural Organization (UNESCO), Intergovernmental Oceanographic Commission (IOC). Adaptation to Climate Change - Responding to Shoreline Change and its human dimensions in West Africa through integrated coastal area management – ACCC National Reports: Cape Verde, Gambia, Guinea Bissau, Mauritania, Senegal [Internet]. UNESCO; 2006 [cited 6 Jun 2011]. Available from: http://ioc3.unesco.org/accc/images/stories/File/Documents/ACCC%20National%20Reports2106-EN.pdf