Senegal River Basin (Guinea, Mali, Mauritania, Senegal)

[Based on information provided by the Organization for the Development of the Senegal River (Organisation pour la mise en valeur du fleuve Sénégal, OMVS)]

General context

Location and major physical characteristics

The Senegal River basin is located in West Africa. It is drained by the 1,800 km-long Senegal river, the second longest river of West Africa, and its main tributaries, the Bafing, Bakoye and Faleme Rivers, all three of which have their source in the Fouta Djallon mountains (Guinea). Most of the Senegal River basin has a sub-Saharan desert climate, which has been aggravated by more or less long periods of drought during the 1970s. As shown in the table, the Senegal River basin is shared by the following four countries: Guinea, Mali, Mauritania, and Senegal. The basin has three distinct parts: the upper basin, which is mountainous, the valley, and the delta, which is a source of biological diversity and wetlands. Topographical, hydrographic and climatic conditions are very different in these three regions and seasonal temperature variations are extensive.

Geographic distribution of the Senegal River basin:

<table>
<thead>
<tr>
<th>Country</th>
<th>Area (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guinea</td>
<td>31 000</td>
</tr>
<tr>
<td>Mali</td>
<td>155 000</td>
</tr>
<tr>
<td>Mauritania</td>
<td>75 500</td>
</tr>
<tr>
<td>Senegal</td>
<td>27 500</td>
</tr>
</tbody>
</table>

Socio-economic characteristics

Population

The Senegal River basin has a total population of around 3,500,000 inhabitants, 85 percent of whom live near the river. A large ethnic diversity characterizes the basin’s population, with, among others, Peuls, Toucouleurs, Soninkes, Malinkes, Bambaras, Wolofs and Moors. However, there is massive emigration of the youngest generations towards the major cities and to Europe.
Agriculture: the main activity of the basin

Irrigated agriculture rapidly expanded immediately after the new dams were filled (between 1986 and 1988). Today, irrigation is the motor of development in the basin, notably in the valley and in the delta, due not only to improved technology, but also to the wider variety of produce grown (rice, onions, tomatoes, potatoes, sweet potatoes). About 100,000 hectares of land are now cultivated in the basin: 60,000 hectares during the rainy season (June-September) and 20,000 during the dry season (March-June).

Livestock raising has also always been a major economic activity in the basin. Due to the existence of rather high-potential pasture land, combined with the carrying capacity of the grasslands and the flood plains, the riparian populations, and even those living elsewhere, practice transhumance and extensive cattle, sheep and goat raising.

Fishing, in terms of the income of the work force that it employs, is undoubtedly the largest economic activity in the basin after agriculture, notably for populations living near the river in the valley and the delta. Today, however, the future of this sector is in question because for several years now there has been a steady drop in the tonnage caught throughout the OMVS region (i.e. the basin area shared by Mali, Mauritania and Senegal). Some observers link this to the river development projects (dams, dikes) and to their impact on the environment (significant decrease in salinity, proliferation of floating water weeds, eutrophication, etc.).
Other economic activities

Operational since September 2001, the hydroelectric power plant in Manantali had the following initial objectives: producing 200 megawatts (Mw), to furnish an average of 800 giga watt per hour per year (Gwh/year) to electricity companies in the three OMVS member states. These figures were based on hydrological data from 1950 to 1994, but new simulations done with data from between 1974 and 1994 predict an energy production of only 547 Gwh. As a result of this decrease, the expected savings in OMVS member states expenditures for energy would unfortunately drop from 22 to 17 percent.

Navigation on the Senegal River is today very limited. The OMVS is aware of the strategic importance of its development over the short term, and a navigation project is under study. Like the exploitation of mineral resources, the ability to transport heavy goods at a lower cost and, especially, access to the Atlantic Ocean for Mali could give a new impetus to the region's economy. Industrial sector is slightly developed.

Water Resources

Hydrology

The river's flow regime depends, for the most part, on rain that falls in the upper basin in Guinea (about 2,000 mm/year). In the valley and the delta, rainfall is generally low and there is rarely more than 500 mm/year. During the drought years of the 1970s, there was significantly less. The climatic regime in the basin can be divided into three seasons: a rainy season, from June to September, a cold-dry off-season, from October to February, and a hot-dry off-season, from March to June. This creates a high-water period or flood stage between July and October and a low-water period between November and May/June. The Manantali dam, built on the Bafing River, is the largest in the basin. Its purpose is to attenuate extreme floods, generate electric power and store water in the wet season.

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The water level in the alluvial aquifer varies with the seasons along with the general hydrological regime in the valley. Since the dams were filled, groundwater recharge and the piezometric surface have been significantly modified. Reducing the volume of the floods and building dikes significantly reduces the area of natural recharge zones. On the other hand, flow regulation during low water periods and irrigation of large surfaces increases groundwater recharge during part of the dry season in some areas.
In some places, a degradation of surface water quality has been observed. This deterioration is caused primarily by **eutrophication** due to a reduction of the flow velocity and oxygenation of the water, due to the new dams and dikes, the proliferation of water weeds, and chemical and biological pollution related to the discharge of wastewater and pesticides.

**Impact of development on the population and on natural resources**

The dam's implementation has both positive and negative effects on the basin's population and natural resources. The Senegal basin's flood plain ecology has changed from a salty and brackish aquatic environment with marked seasonal changes to a low-flow perennial freshwater ecology. Some of the main negative effects are the displacement of populations, the degradation of the whole ecosystem, leading to the proliferation of water-borne diseases. However, the installation of the dams has enabled a year-round availability of freshwater in sufficient quantities, and thus the development of irrigated agriculture in the valley, and access to drinking water installations for populations living near the dams, among other things.

**Water Management**

**Presentation of the OMVS**

The OMVS river basin organization was established about three decades ago by three out of the four riparian states. Mali's principal interests are the maintenance of river levels so as to obtain navigable access to the sea and energy produced by the Manantali dam. Mauritanian and Senegalese interests converge in power production and irrigation, while Senegal seeks to improve livelihoods for local populations. These varied interests are typical of a transboundary water management situation. The Manantali dam, although located in Mali, belongs to all the members of the OMVS authority.

The first institutions to develop the Senegal River valley were created during the colonial period. In 1963, shortly after independence, Guinea, Mali, Mauritania and Senegal signed the Bamako Convention for the Development of the Senegal River Basin, that declared the Senegal River to be an 'International River' and created an 'Interstate Committee' to oversee its development. In 1968, the Labé Convention created the Organization of Boundary States of the Senegal River (OERS, Organisation des Etats Riverains du Sénégal) to replace the Interstate Committee, broadening the field of subregional cooperation.

**Current approach**

The OMVS's fundamental conventions of 1972 and the Senegal River Water Charter signed in May 2002, which establish its legal and regulatory framework, clearly state that river water must be allocated to the various use sectors. The resource is not allocated to riparian states in terms of volumes of water to be withdrawn, but rather to uses as a function of possibilities. The various uses can be for agriculture, inland fishing, livestock raising, fish farming, tree farming, fauna and flora, hydroelectric energy production, urban and rural drinking water supply, health, industry, navigation and the environment.
The start-up of environmental monitoring by the Observatory represents golden opportunities for increasing the involvement of representatives of the various stakeholders in the resource management decision-making process. This participatory approach will be reinforced by the launching of the Master Plan next year.

Main Problems

Degradation of ecosystems

The flood plain ecosystems have been most affected by construction of the dams. In less than ten years, the degradation of these environments and the consequences on the health of the local population have been dramatic.

Upstream of Diama, the functioning of regularly flooded wetlands, lakes and ponds, like the Djoudj, Guiers Lake and Lake Diawling, has been seriously disrupted. After 1986, Diama dam blocked seawater intrusion. The water above the dam is now fresh year-round, creating ecological conditions favouring the proliferation of freshwater plants. These are very invasive and eutrophication has begun in some places in the valley and the delta. Downstream of the Diama dam, perturbations in the functioning of ecosystems takes the form of an increase in salinity and/or a drying-up during part of the year (Ndiael wetlands) due to the reduction of flooding or the destruction of water inflow channels during construction of dikes, irrigated areas, etc. Anthropogenic pollution is caused by the discharge of industrial and agricultural chemicals into these environments.

Other problems arise from increased competition for agricultural land and firewood. As marginal land on slopes and river banks is cleared, there is increased erosion. In addition, large areas of the basin have been denuded due to overgrazing.

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Public health

The degradation of the basin's ecosystems has affected the riverine population to various degrees. For example, there has been a drop in productivity in some economic areas (agriculture, fishing, livestock raising) compared to productivity during the first years after the dams were filled. This has led to a decrease in income and, therefore, a decrease in the standard of living.

The most serious problem that the basin has had to face since 1993/94, however, is the impact of the dams on public health. There has been not only a rapid increase in the prevalence of water-borne diseases that were already known in the area (malaria, urinary schistosomiasis, diarrhoea, intestinal parasitic diseases), but also the appearance of intestinal schistosomiasis, a much more dangerous form of the disease.

Useful links

Read the complete case study, published in the first edition of the UN World Water Development Report (WWDR1)

To know more about the Senegal basin, here is a list of interesting projects and organizations:

- Senegal Government: Presentation of the OMVS and Contacts.
- Food and Agricultural Organization (FAO) website: Presentation of The Senegal River basin.

The UN World Water Development Report, coordinated by the UN World Water Assessment Programme, is a joint effort of the 26 UN agencies and entities which make up UN-Water, working in partnership with governments, international organizations, non-governmental organizations and other stakeholders. For more information, visit our website at www.unesco.org/water/wwap.