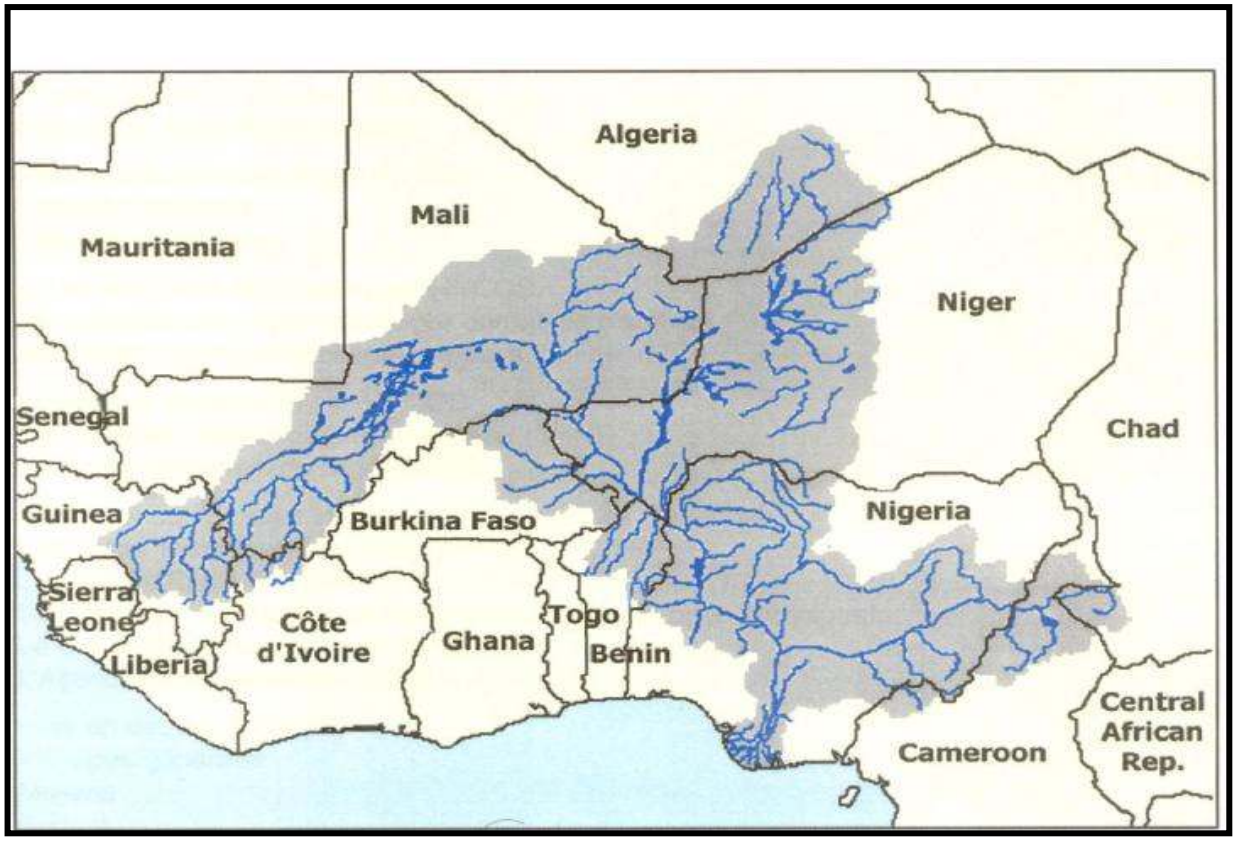
River Niger is the third longest river in Africa (after the Nile and the Congo) and the 9th largest river system in the world. It takes its source from the Fouta Djallon highland in Guinea at an approximate altitude of 800m before traversing over a distance of 4,200 km to empty into the Atlantic Ocean in Nigeria. The Niger basin has an active catchments area of about 1,500,000 sq km (7,5% of the African continent) covering the following 10 Countries in West and part of Central Africa; Algeria, Benin, Burkina, Cameroon, Chad, Cote D'Ivoire, Guinea, Mali, Niger and Nigeria as shown in Fig. 1.

Fig.1: Map showing the Niger Basin Catchment Areas



As the major source of potable water for over 100 million people, the river Niger has in the recent years, been adversely affected by the menace of drought. For example on 16th June 1985, the river was completely dry in Niamey, Niger Republic, for the first time in history. Similarly, the flow recorded during the 1984/85 and 2002/2003 hydrological years along the river Niger were the lowest in 50 years.

Consequently, in the last 4 decades the basin has been experiencing series of hydro-climatic changes that has resulted in the persistent drought causing the Sahara desert movement southward towards the Atlantic Ocean; erosion and river silting that is causing floods with its attendant loss of lives and properties; continued low flow that is reducing reservoir storage capacity with consequences on acute water shortages and increasing water demands; pollution, weed encroachment and increasing water borne diseases that

are now ravaging the river and the ecosystems as well as increasing mortality rate, famine, poverty and high rate of urban migration.

Countries within the Niger basin are facing serious shortages of surface and ground water for meeting rising demands from population growth.

The quantity of water entering Mali from Guinea (40 km^3/yr) is greater than the quantity of water entering Nigeria from Niger (36 km^3/yr), about 1800 hen further downstream. This is due among other reasons to the enormous reduction in runoff in the inner delta in Mali through seepage and evaporation combined with almost no runoff from the whole of the left bank in Mali and Niger.

The total area covered by the inner delta, which is a network of tributaries, channels, swamps and lakes, can reach about 30000 km^2 in flood season. The delta area is swampy and the soil sandy. Consequently, the river 'loses' nearly two-thirds of its potential flow between Ségou (at 900 km from its source) and Timbuktu (at 1500 km) due to seepage and evaporation, the latter being aggravated by the fact that the river here touches the southern flanks of the Sahara desert. All the water from the Bani tributary, which flows into the Niger River at Mopti (at 1150 km), does not compensate for the 'losses' in the inner delta, as the total flow further downstream still decreases rather than increases (Figure 13). The average 'loss' is estimated at 31 km^3/year, but varies considerably according to the years: it was 46 km^3 during the wet year of 1969 and about 17 km^3 during the dry year of 1973 [29].

The water in the Niger River is partially regulated through dams. The Sélingué dam on the Sankarani River is mainly used for hydropower, but also permits the irrigation of about 60000 ha under double cropping [14]. Two diversion dams, one at Sotuba just downstream of Bamako, and one at Markala, just downstream of Ségou, are used to irrigate the area of the Office du Niger (equipped area of about 54000 ha). However, double cropping in this area would only be possible if the Fomi Dam, planned on the Niandan river in Guinea, were constructed to provide a supplementary and regular amount of water. However, the negative effects on the environment that would be caused by the construction of this dam seem to be important.

The irrigation potential has been estimated at 556000 ha, of which about 200000 ha fully controlled and the rest for partially controlled schemes [138]. At present about 187000 ha are equipped in the Niger basin, but of this 57000 ha are already abandoned and of the remaining 130000 ha actually irrigated more than 60% need to be rehabilitated. Irrigation water requirements for double rice cropping in the Niger River valley range from over 30000 m^3/ha per year in the southwest to nearly 50000 m^3/ha per year in the northern part according to this study.

Irrigation of the 140000 ha in the Niger River valley and its tributaries on the right side would only be possible through the construction of the Kandadji Dam in the north, just downstream of the border with Mali. Without this dam it would be possible to irrigate only 15000 ha. However, construction of this multi-purpose dam has so far not been

possible due to financial and economic constraints. Reports also indicate that the dam would have a negative impact on the environment.

Water problems may arise in the Niger basin if the whole potential is developed.

Feddema (1998, 1999) has evaluated the impacts of soil degradation and global warming on water resources for Africa. All major watersheds are affected by global warming; although the trend is toward drying in most locations, there are significant differences in watershed-level responses, depending on timing and distribution of rainfall, as well as soil water-holding capacity. Soil water-holding capacity is modified by the degree of soil degradation.

A combination of human population growth, unsustainable resource use and development, and desertification

Habitat alterations are also threatening the rich tapestry of the Niger River ecosystem. These include dams, which drastically alter the flow and sediment regimes of the rivers in the basin in addition to directly fragmenting and destroying aquatic habitats

The combination of these changes in the Niger's aquatic environment are creating ideal conditions for the spread of the water hyacinth, an invasive species which chokes the river channels and increases evaporative losses from reservoirs by up to ten-fold. Future water development in the basin is likely to generate political tensions as the basin nations compete for control of an increasingly important resource.

- **Restoration of Habitat.** Restoration of the Niger River ecosystem should start in the river basin with management practices that increase vegetative cover and reduce soil erosion. The restoration of floodplain wetlands and bourgou pastures are invaluable elements in optimising the river's productivity.
- **Adaptation of Economic Activities to the Natural Rhythms of the River.** Intensified human use of the Niger River floodplain is vulnerable to regional cycles of flood and drought. Much can be learned from traditional resource use patterns that provided resilience through diversity.
- **Operation of Existing Dams to Replicate Natural Flood Pulses.** Water releases from existing dams can be timed to mimic natural flow patterns, resulting in benefits for food production and biodiversity conservation.
- **Awareness of the river's rich natural value.** Crucial to other practical measures will be building awareness among diverse communities-- including decision-makers-- of the range of natural functions and values of the Niger River.