THE THREAT OF IRRIGATION SCHEMES TO WETLANDS IN NORTH EASTERN NIGERIA

BY

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Abstract

Wetlands have been recognised as very productive exosystems world-wide. In the northern part of Nigeria, the wetlands popularly known as 'fadamas' form the focus of the pastoral and agricultural life of the people. However, the semi-arid nature of the northern climate has caused emphasis to be placed more on irrigated agriculture than on 'fadama' or wetland farming. Consequently, there has been a proliferation of irrigation projects in the northern section of the country with its attendant environmental consequences. This paper reviews irrigation developments within the Hadejia-Jamaare basin and the predicament of the Hadejia-Nguru wetland, especially the on-going reduction in the size of the wetland due to the various dams which have been constructed in the upstream section of the basin. The paper concludes that the present emphasis on large-scale formal irrigation schemes is unnecessary considering their negative effects on the environment and recommends, among other strategies, the stepping-down of irrigation plans within the basin to avoid the total loss of the most important wetland in north-eastern Nigeria, the Hadejia-Nguru wetland. ***(International Journal of Social Science and Public Policy 1998:1(1) pp 162-172)***

Introduction

Wetlands are presently gaining recognition as one of the world's m productive ecosystems, providing goods and services for health, safety human welfare (Thompson and Hollis, 1995). The wetlands of the world usually located in lowlands or depressions where materials eroded a transported from the surrounding uplands by runoff and rivers accumula

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use of their origin therefore, wetlands are highly fertile and productive lands. orthern Nigeria, wetlands are referred to as "fadamas". The pastoral ultural life of the people is thus naturally centred on the "fadama" or wetland. word "fadama" simply means "seasonally flooded land" and this meaning ts to the significance of the fadama in agriculture in the north.

However, the semi-arid nature of most of northern Nigeria has caused nasis to shift from wetland farming to irrigated agriculture. At present, the est number of irrigation schemes are to be found in this environment. These ation projects have caused increase in the hectarage of cultivated land and also caused environmental degradation (**Olofin, 1992**).

The Hadejia-Nguru wetlands located in the Hadejia-Jamaare River Basin / far the most prominent wetland in north-eastern Nigeria. But its areal at has been drastically reduced from more than 2,000 km^2 in the 1960s to 0 km^2 in the 1970s and to less than 962 km^2 in 1991 (Morgan 1994; Thompson Hollis, 1995). The gradual reduction of the size of this wetland has been buted to irrigation activities upstream which has reduced water supply to the nstream section of the catchment.

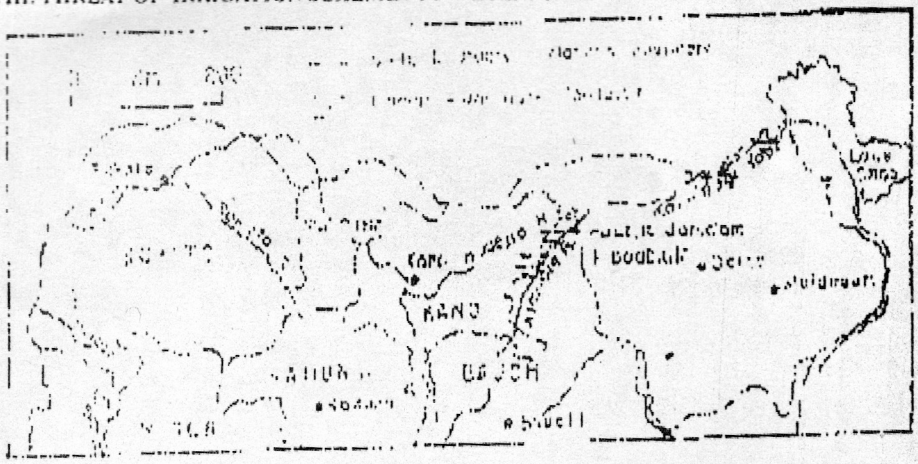
This paper reviews developments within the basin. It draws attention to mpact of irrigation projects in the basin on the wetland and recommends sures to conserve it.

graphical Setting

The Hadejia-Nguru wetlands are shared by three states, namely Jigawa, Bauchi Yobe States. The major towns situated around the wetlands include Nguru, Gashua Katagum. The wetlands are therefore located in the semi-arid zone of north- eastern ria and occupy the land area around the upstream of the confluence of river Hadejia River Jamaare, the two major rivers that drain the region. The location lies approximately 'een Latitude 9° 10' and 14° 45' E (figure 1)

The geology of the area is very unique with the upstream section being underlain npervious basement complex rocks and the downstream portion being composed ily of the sedimentary chad formation. The nature of the geology makes both the ejia and Jamaare rivers to lose flow to groundwater as they move from the impervious ment complex rocks to the sedimentary formation in the downstream section. With ect to soils, the floodplain is made up of mainly weakly developed halomorphic soils eltaic alluvium with some unleached dune soils.

The Hadejia-Nguru wetlands are located within the Sudano-Sahelian belt which is for fairly short period during the year (**Olofin, 1992**). The climate of the area is enced very seriously by the seasonal movement of the Inter-Tropical Convergence e which reaches its most northerly position (15° - 25°N) in August and whose influence luces the distinct wet and dry seasons characteristic of sub-saharan West Africa. The 's in the study area are thus seasonal and ephermeral recording periods of no flow at all ng the dry season (**Umar, 1985**).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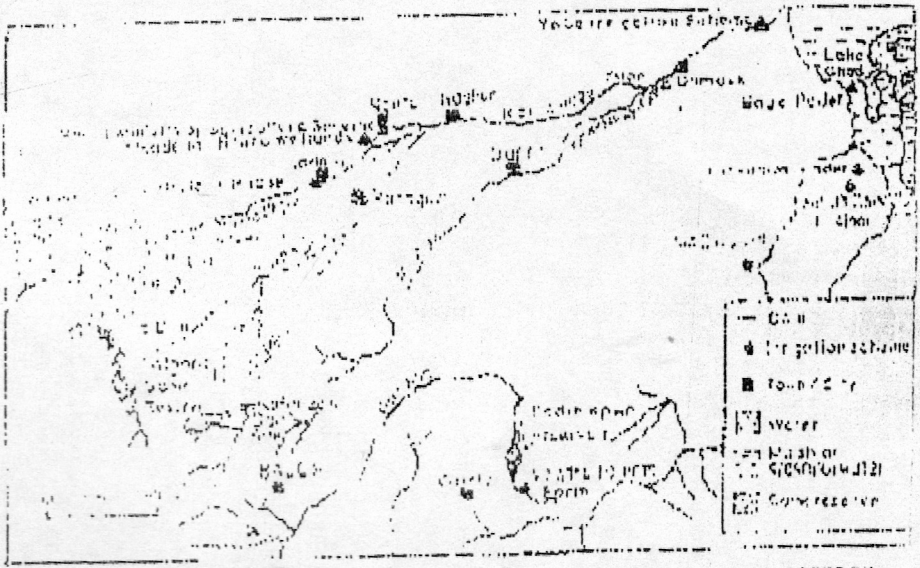
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The Sudano-Sahelian climate, the generaal climate of the area, is characterised by a long dry season (October to May) followed by a single wet season (June to September). The rains begin in June and rise gradually to a maximum in August, ending in September. October is usually very hot and dry, while November and February (Harmattan season) is usually cold and dry. Mean rainfall lies between 400 - 600mm (**UNSO,1990**). The mean annual rainfall for Nguru for 48 years as calculated by **Olofin (1992)**, is 487mm.

As is typical of most rivers in Northern Nigeria, streams in the area exhibit faster flows and high volumes of water in the rainy season especially in the months of August and Semptember. Within this period (August-September), the Hadejia-Nguru wetlands, corresponding to the downstream section of the Hadejia-Jamaare basin, are usually flooded and it is this annual inundation that has conferred many valuable features and attributes on the wetlands. Recently, the Hadejia-Nguru wetland was described as the most productive area of North Eastern Nigeria(**Thompson and Hollis, 1995**).

Irrigation projects in the basin

Numerous dams and irrigation schemes exist in the study area, as shown on Fig.2. Two major bodies, the Hadejia-Jamaare River basin Development Authority (**HJRBDA**) in the upper part of the basin and the Chad Basin Rural Development Authority (**CBRDA**) in the lower part of the basin, are charged with the responsibility of developing the water resources of the basin. However, there are other bodies like the ADP's and a host of agricultural and rural development authorities which operate within the basin. The activities of these scarcely cordinated bodies have resulted in numerous dams, reservoirs and irrigation canals especially in the upper part of the basin.

Indeed, the history of dam construction in the area dates back to 1969 when a dam to supply domestic water was constructed in Birnin Kudu, Jigawa State. This was gradually followed by other dams which came into existence in the early 1970s. For example, the bagauda Dam on the Kano river was completed in 1971. The main purpose of the Bagauda Dam was to store water for the pilot irrigation at Kadawa. Following the success of the Bagauda scheme,the baga (Polder) and Gamboru irrigation projects were started in 1973 in the Southern parts of the Lake Chad. The Tiga Dam, the largest irrigation scheme in the area came next with its construction having been completed in 1974. Its reservoir was fully impounded in the wet season of 1975 and water from its reservoir served Kano River project (KRIP) phase I during 1974/75 dry season and was expanded in the 1975/76 irrigation season, though only one of its planned canals was completed (**Olofin, 1992**). The Tiga scheme was followed by the South Chad Irrigation Project (SCIP) based on the extraction of water from Lake Chad. As at Late 1980s, the major large scale irrigation schemes in

the Basin included the Tiga Dam, the Kano River irrigation Project (KRIP), the Challawa Gorge dam, the Hadejia Valley Project (HVP) and Kafin Zaki Dam. These schemes have also been supplemented by smaller irrigation schemes, such that by 1988 not less than 22 earth-filled Dams with varying sizes of reservoir were in operation in Kano and Jigawa States alone (**Olofin, 1988**). There are also numerous boreholes serving irrigation purposes in the basin. The popularity of boreholes in the area can be appreciated only when we compare the estimate of 476 boreholes for the entire country in 1976 (**Ayoade and Oyebande, 1983**) to 518 boreholes for Kano State alone in 1984 (**Umar at al, 1985**). Hence, since the 1980s, there has been an upsurge of tube wells (Shallow boreholes) and washbores in the basin especially in the downstream section of the Basin. The number of tubewells and washbores on the Southern parts of the Hadejia-Jamaare Basin runs into thousands.

The objectives of dam construction in the basin has been extended to cover fishing, flood control, recreation, and in a few cases, the generation of electricity, in addition to rural and urban water supply and irrigation (**Olofin, 1992**). The Tiga Dam, the largest in the area provides the best example. The reservoir has a storage capacity of about 1970 million cubic metres of water and a surface area of 178 Kilometres (**Olofin, 1992**). All the objectives indicated above were included as the purpose of the Dam though the aspect of hydroelectric generation has not been implemented. With regards to rural and urban water supply, the annual water consumption is estimated at 70.5 million cumecs while irrigation is expected to take 464.94 million cumecs for crop production and 49.06 million for storage in canals when the two phases are in operation to irrigate 62000 ha (**Olofin, 1992**).

Positive Impacts

Most irrigation schemes established within the Hadejia-Jamaare Basin have actually achieved some of the expected benefits. These benefits have been in the form of increased agricultural production, improvement in urban and rural water supply and the inhibition of drought and desertification.

With respect to increase in agricultural production, there has been improvements in the number of hectares brought under cultivation. For instance, within Kano and jigawa States, the KRIP in 1986, brought 12,000 ha of the 2?,000 ha projected for the first phase under cultivation. Recently, with Nigeria entering what Andrae and Beckman (1985) called the "wheat trap" and its accompanying incentives,more hectares of land were opened for irrigation, especially in the 1987/88 and 1988/98 seasons. An estimated 40,000 ha was rought under irrigation in the 1989/90 irrigation season as a result of the emphasis of government on wheat production (**Olofin, 1992**). It was also envisaged that about 100,000 ha would be put under irrigation in Kano State when the Challawa Gorge Dam becomes operational.

Irrigation in the Basin has also brought changes in the variety of crops produced. For example, wheat, maize, soyabean and a few other irrigation crops have joined the traditional ones like tomatoes,onions, millet, rice, pepper, and sugar cane. Even the traditional crops have been improved in terms of gross

weight per ha through the process of cross breeding and the introduction of exotic species. A good example which was cited by Umar etal., (1985) is tomatoes which the gross production increased so much that the KRIP in 1984 had to use Air Force planes to evacuate them to other parts of the country to avoid wastage. Currently, however, wheat production is the 'in thing' in the basin and over 500,000 tonnes of wheat was harvested in 1988/89 irrigation season.

There has also been increase in the number of croppings per year with the result that at least two or three croppings per year is now possible. This is as against the pre-irrigation period in which only a single cropping per year was done. In addition to the increase in cropping period, the irrigation schemess in the basin have created additional cultivable lands which did not exist in the pre-dam period. For example,the Tiga dam has succeeded in flooding downstream to the extent that vast regulating tracts of wetlands which were waterlogged around Hadejia-Nguru area have been set free. Infact, Olofin (1980) reports that the 25,000 ha Hadejia valley project land is part of the gain from the upstream regulation of flooding.

Perhaps, one of the most laudable achievements of the irrigation schemes in the Hadejia - Jamaare basin is that it has led to a remarkable improvement in urban and rural water supply in the area.For instance, it is estimated that about 70.05 million cumecs of water is drawn every year from the Tiga reservoir for urban and rural water supply. There is therefore no gainsaying that the water supply situation in Kano metropolis, for example,is more reliable than what obtains in most Nigerian towns. The improved water supply status of Kano and other towns in the area have been linked directly to the coming of irrigation into the area **(Olofin, 1992).**

Furthermore, the irrigation of the Semi-arid lands of this zone has also helped to reduce the effect of drought and desertification. Infact, it can be said that these two environmental problems have been placed under check in these areas. As most irrigatonist will agree, the presence of water in reservoirs, lands and stream channels all the year round helps to increase soil moisture while the planting of both cultural and natural vegetation usually assist in mitigating the effect of drought and desertification. **Olofin (1987b)**, particularly emphasized the fact that more equable micro-weather conditions occurs near irrigation reservoirs. Indeed, it is generally believed that,the vegetation established along canals and fields in New Matre by SCIP provided significant checks against desertification in the very dry years of 1983/84 and 1987/88 **(Olofin, 1988).**

Finally, irrigation projects within the area have generated local employment for both skilled and unskilled manpower in the region. This is not to mention the effective utilization of the resources in the area which has been made possible only through the establishment of dams and tubewells. Indeed, there are other benefits of the system which have not been mentioned. However, it is important to note that in water-short areas such as the Hadejia-Jamaare basin, irrigation results in the optimal use of water resources, improvement in agricultural production, socio-economic status and other benefits. But, as Olofin (1992) has indicated, there are gains as well as pains in putting a water-look on the face of the drylands of Nigeria. The pains are more serious when there is no Environment Impact Assessment (EIA). Without environmental impact assessment, involving hydrological data and its analysis, it is very difficult to implement irrigation projects without running into trouble. And with the present emphasis on the use of resources sustainably so as to aviod environmental degradation, there is need to review the negative aspects of irrigation schemes within the river basin.

Negative impacts

The combined effecs of the preponderance of irrigation schemes downstream the Hadejia-Jamaare basin and uncordinated policies of the project authorities and government have brought in their wake certain negative impacts. These adverse consequences, variously referred to as doom, pains or losses of irrigation in the area (**Olofin, 1992**) are both social, economic and environmental in nature. Although the emphasis in this paper is on the environmental or physical consequences, a convenient starting point, perhaps, should be an analysis of the socio-economic pains which the irrigation culture has imposed on the unsuspecting people of the Hadejia-Jamaare basin. Firstly, irrigation within the basin has been associated with the displacement of the peasant population. Secondly, the ignoble poor resettlement management has left a lot of the inhabitants of the area dissatisfied. Thirdly, complains of inadequate, inappropriate and delayed compensations have been rampant. Fourthly, social disruptions of family ties and low-income groups have been observed. Fifthly, there is the incidence and fear of diseases. Sixthly, increases in the incidence of a variety of pests seem to have naturally followed the coming of irrigation into the basin. Seventhly, there is the crises of unacceptable crops or farming practices. Eighthly, there are reported cases of land speculation and outright sale of lands to absentee land owners by peasants who have rejected the new agricultural system and crops. Of all these negative socio-economic problems arising from irrigation in the basin, the most critical appears to be the one bordering on human health. As it were, the fear of Schistosomiasis and Orchocerciasis have been highlighted by the discovery of carrier snails of the former and blackfly, the vector of the later, within the basin (**Olofin, 1992**).

However, the most devastating effect of irrigation activities in the area is on the physical environment downstream. This offsite section of the different dams have suffered a lot of degradation ranging from erosion to loss of biodiversity following a general reduction of the wetlands downstream.

Erosion, for instance, most especially channel and valleyside slope erosion has been reported in the downstream areas of the various dams on the Kano, Challawa and Jamaare basins. The details can be obtained in Olofin (1980 and 1992) and Adams (1985). For instance, along the Kano River, Channel incision attained a depth of 1.44m and gullymouths incision reached 60cm. In the chalawa section, channel incision had attained a depth of 1.70m and gullymouths were incised by over one metre.

The various dams in the area over the years have led to the prevention of flood water with its attendant rich silt load from reaching places downstream. The effect of this problem has been very much felt in the Hadejia-Nguru wetlands where a gradual reduction in the size fo the natural wetland or fadama has been observed since the coming of the Tiga Dam. The records of the flood extent in the lowland catchment above Gashua gives the picture of the reduction of the area usually flooded in the wet season within the wetlands. According to Schultz (1970), in the wet season of 1969 and 1974, 2350 km^2 and 2004 km^2, respectively of the wetland was flooded. The 1985 aerial mapping by the Hadejia-Nguru wetlands conservation project shows that only 962 km^2 of the wetland was inundated while in October 1993, the wet season flood covered only an area of 413 km^2. Clearly there has been a drastic reduction of the size of flood plain wetland within Hadejia-Nguru area from 2350 km^2 to 413 km^2 (see table 1 below).

Table 1: Records of Flood Extent in the Lowland Catchment above Gashua

Date	Flood Extent(km^2)	Source
October 1969	2350	Schultz 1976
September 1974	2004	Schultz (1976)
November 1978	1825	Thompson & Hollis, (1995)
September 1987	700	Thompson & Hollis, (1995)
October 1992	525	Morgan (1994)
October 1993	413	Morgan (1994)

Added to the issue of gradual reduction in the size of wetlands in the area is the fear of the possible failure of the dams and this is taking cognisance of the location of these dams all upstream of the wetlands. Research workers have cited the havoc wrecked by the failure of Bagauda dam in 1988 and the Bakolori

dam in 1985 to reason that the failure of the gigantic Tiga Dam will result in worst consequences on the wetland than those associated with the Bagauda and Bakolori dams. For instance, the Bagauda Reservoir is less than 5% of the Tiga Reservoir and yet during the failure in 1988, the resulting flood wipped off the nutrient laden soils in its downstream section, breached a road and deposited rubbles and infertile sand derived from the dam some where at the confluence between the Kano and Bagauda River.

Furthermore, the problems of alkalinity, salinity, sodicity, siltations and water logging have been associated with irrigated fields in the area (**Olofin, 1992**). These problems, the by-product of faulty design, appear to have been compounded by the harsh environmental conditions such as periodic drought, high temperatures, rainstorms and intense winds. For instance, drought occasioned by high evaporation accounted for the decrease in the volume of the Tiga dam from 1720 cumecs in September 1981 to 1220 cumecs in September 1983 (**Olofin, 1985**).

Another physical problem arising from Dam construction in the area has to do with the disturbance of the water table around the Hadejia-Nguru wetlands as a result of irrigation schemes upstream. Umar et al. (1985) has reported the lowering of the water table around Hadejia by as much as 27m. This loss although associated with seepage due to the unconsolidated nature of the geological materials of the basement complex - chad formation, is in the main, the result of the disturbance of the hydrological system of the area artificially. In the absence of optimum flow to the Hadejia area and seepage, then the wetlands downstream are surely consigned for extinction.

The need to save the wetland

Wetlands are highly productive natural ecosystems which must be savedfrom irreversible extinction. The concept of sustainable water development in particular means that we must ensure that development of water resources does not in any way contribute to their destruction. For instance, even though dams are built to irrigate the land and make agriculture bloom in otherwise arid areas,it is paradoxical if the same dam induces salinity, sodicity, water-borne diseases, flooding and the destruction of the natural ecosystem. Sustainable development addresses the issue of balancing environment with development. Hence the task of irrigation authorities within the Hadejia-Jamaare Basin is how to maximize the positive impacts and reduce the negative ones. Specifically, the protection of the wetlands should top the agenda of the major irrigation authorities in the catchment.

There are many international and local organizations which have recently shown interest in the protection of wetlands in semi-arid environments. Such organizations include the United Nations Environment Programme (**UNEP**), the International Union for the Conservation of Nature and National Resources (**IUCN**), the European Economic Community (**EEC**) and the Hadejia-Nguru Wetland Conservation Project. These agencies have expressed concern over the continuing reduction of the size of this all important wetland in North-Eastern Nigeria.

The major reasons for the clarion call to protect the wetlands are economic and yet beyond economic. Economically, it has been proved by Barbier et al (1991) in their analysis of the wetland economy that agricultural benefits from the Hadejia- Nguru wetlands are substantially high per hectare than the benefits derived from formal irrigation schemes in the area. The other values possessed by the wetland cannot be simly quantified in economic terms. For instance,the wetlands provide dry season grazing for livestock from the surrounding sahel pastures,non-timber forest products, groundwater recharge, refuge for human population during times of drought and habitat for both afro-tropical and palaeartic birds. However, it has been argued that the most important function of the wetland is the recharge of the swallow and deeper acquifers of the chad formation which is made possible by the annual wet season flooding of the Hadejia-Nguru wetland *(Schultz 1976, Thompson & Hollis, 1995).* These reasons and others not mentioned here explain why the wetlands must be saved.

Conclusion

Nigeria has placed great emphasis on the development of large-scale formal irrigation schemes especially to boost agriculture in the semi-arid section of the country. Although these schemes have no doubt made some positive impacts, their negative effects are not wholly healthy to the off-site environment and this has led to the creation of more problems than the so-called irrigation gains. This obviously may be attributed to the lack of an environmental impact assessment of the various irrigation schemes either individually or collectively. As Olofin (1992) has rightly pointed out, if the people of hadejia-Nguru wetlands had been warned about changes that would be regained with the introduction of irrigation, the hardship they experienced especially between 1975 and 1984 would have been avoided. Now 1979 was when their fadama holdings were left high and dry, and 1984 was the time when a new system of cultivation was sold to them.

The question is what must we do to save the wetlands in view of their multiple uses ? To answer this question we do not suggest that the dams already constructed in various sections of the basin should be pulled down or abandoned. Rather our suggestion is that the existing structures (dams) should be operated in a manner that will ensure water supply to all the places presently under irrigation and also maintain adquate flows downstream to flood

the wetlands. This can be achieved through the setting up of a body that can co-ordinate all activities in the basin in an integrated manner. Such a Unitary body should have a clearly stated policy for water allocation in the basin. We advocate for an equitable use of the water resources in the basin by both the upstream irrigation farmers and the downstream wetland users. This can only happen after a thorough understanding of the hydrology of the area and effective cordination of all irrigation activities presently taking place in the basin. There is therefore the need to undertake a comprehensive and proper Environmental Impact Assesment (**EIA**) of all the reservoirs in the area. Meanwhile, irrigation plans should be stepped down to avoid the total loss of the wetland habitat and other ecological disasters. Finally, Considering the poor performance of irrigation schemes in the country, the issue of foreign debt crises, and the high level of corruption in government parastatals such as irrigation schemes, there is need to rather encourage and sustain small scale traditional agricultural practices in the basin instead of investing on formal irrigation projects which would wipe off the wetlands of the region.

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