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UNIVERSITY of KHARTOUM  
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ETMA PROGRAM SUDAN

Environmental Monitoring  
Baseline and trend analysis reports

( 8 )

LOWER RIVER ATBARA AREA  
( NILE PROVINCE )

By

HASSAN A. ABDEL - ATI ( Ph. D. )  
Geography Department  
University of Khartoum

Prepared for :  
the united states agency  
for international  
development  
Project No, 698 - 0427  
December 1984

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1

ENVIRONMENTAL DEGRADATION IN  
THE LOWER RIVER ATBARA AREA  
(NILE PROVINCE)

Abstract:

The Lower Atbara refers to the area between Goz Ragab, on longitude  $35^{\circ} 30'$  East and latitude  $16^{\circ} 5'$  North, and the village of Al Magran at the junction of the the river Atbara and the Main Nile, just south of Atbara town. However for the purpose of the study, the name Lower Atbara is used to cover the triangle of Al Magran in the North-west, Ba'alak in the South east and Khor el Makabrab representing the southern limit of the area. (Fig.I).

The reasons for this delimitation include:-

- 1) The similar physical characteristics of the area in terms of climate, soil characteristics and natural vegetation.
2. Similar economic activities and land use system along the river banks (east and west), and the complementary nature of the economic activities away from the river with those on the river banks that was mainly in the past maintained in the form of a "mixed" primary economy combining animal herding and rainfed cultivation in the northern Butana with irrigated agriculture on the river banks.

3. These similarities represent a strong unifying force between the riverine areas (east and west) and the northern Butana, although this delimitation falls into three administrative areas, namely, Ed Damer Rural Council, Barber Rural Council and Seidon Rural Council. This of course could have made it substantially difficult to collect the necessary statistical data if there was an organized system of data collection, but the lack of it made little difference, if any, result from ignoring these administrative boundaries. Furthermore the recent changes (during the 1970's) of these administrative boundaries also contributed to that lack of statistical data.
4. Perhaps the most important factor behind that delimitation was the similar signs and impact of environmental degradation that has been taking place in the area over the last two decades. The area has been subject to the dual effect of Khashm el Girba Dam on the riverine areas and that of rainfall deficiencies in the area away from the river since the early 1960's, which is taken as the base line.
5. Finally one major factor behind the selection of this area in particular, is the fact that economic growth and development in Sudan has for the last 50 years or so been, and it seems that it will continue to be, heavily dependent on the expansion of irrigation systems and irrigated agriculture. Different studies conducted, suggest that the expansion of irrigation networks and construction of dams in most of the arid countries

has resulted in many ~~adverse~~ social, economic and ecological consequences, that were not originally anticipated by planners.<sup>1/</sup> This means that by studying this area it is not only possible to anticipate the negative environmental and economic consequences of dam-based irrigation, but also to throw some light on what could have been taking place, and may be unnoticed, in the different irrigated areas in Sudan.

#### The Physical Geography of the Area:

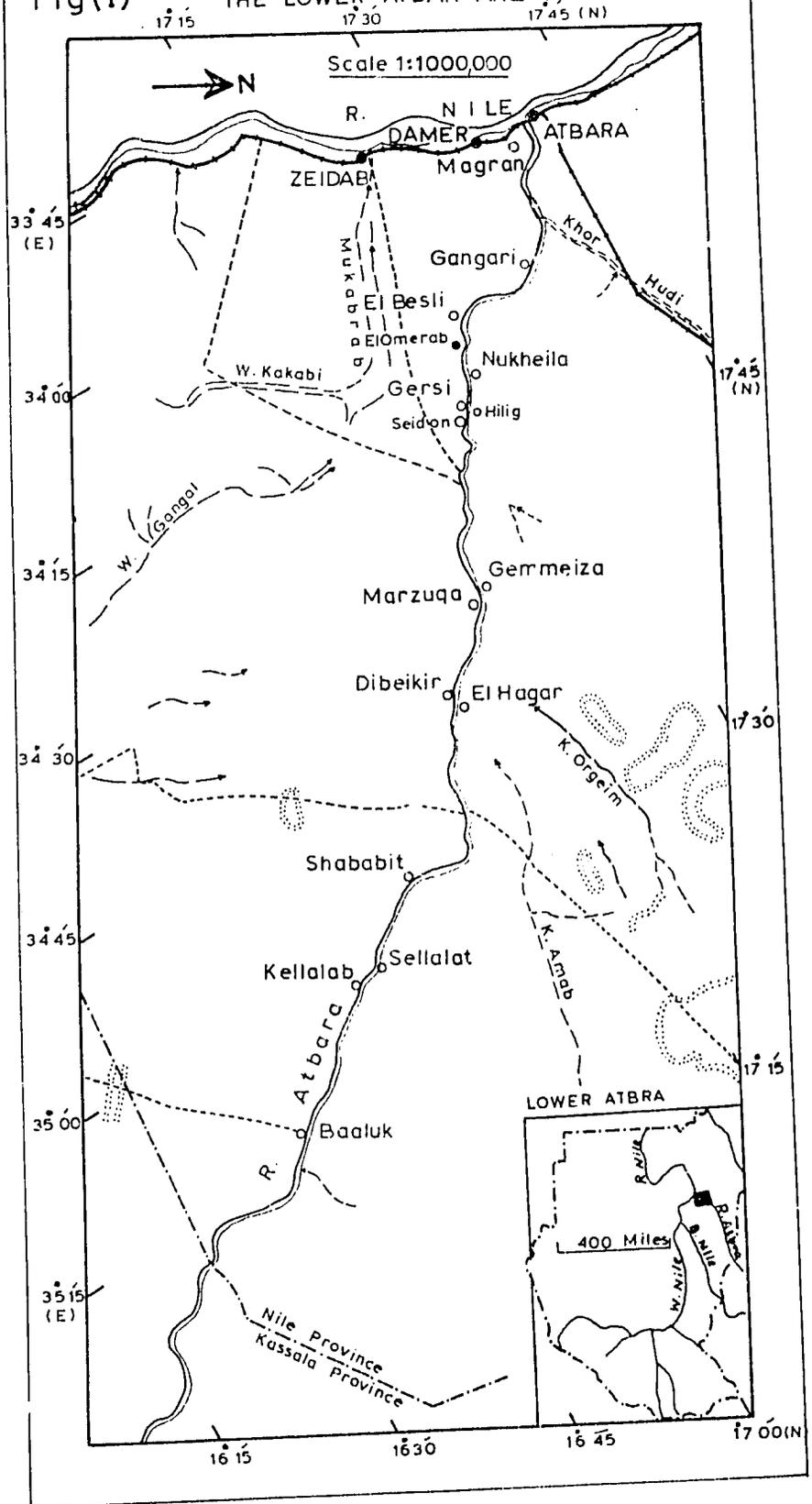
The area is characterized by an average total annual rain-fall of under 75 m.m., most of which is experienced in August and September. The climate is therefore of a desert type in which rainfall is negligible and its amount and duration depend on the direction and speed of the prevailing winds as well as on the temperature levels. The area is also well known of being one of the highest in all Sudan, in the intensity of haboob (dust storms), which reflect the dryness of the area, its lack of a vegetation cover and the disintegrated nature of its soil.

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<sup>1/</sup> See for example Farvar, M.T. and Milton, J.P.(eds) The Careless Technology: Ecology and International Development, Doubleday & Co., New York, 1972.

Fig(I)

THE LOWER ATBAR AREA



Alluvial and lacustrine soils cover most of the area, underlain mainly by the Basement Complex rocks except in the extreme north-west, near the junction of the Atbara river with the main Nile. This north-west corner of the Butana plain forms a part of the nubian-sandstone series that dominate the whole of north-western part of Sudan. As for the northern Butana plain itself, it is generally flat with light clay soils of first class fertility,<sup>1/</sup> deteriorating gradually to the north-west although along the river Atbara, at its worst the soil fertility grade never falls below second class.<sup>2/</sup> In his description of the riverine soils in the Lower Atbara, Ayob considered it as a mixed product of the river silt accumulation, aeolian deposits and a high terrace wash down.<sup>3/</sup> The vegetation cover is a semi-desert, consisting of desert scrub, thorny acacia and seyal, and semi-desert and desert grasses and herbs. The density of these grasses varies according to the level of rainfall

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<sup>1/</sup> This was one of the major factors behind the location of Khashm el Birba Scheme in its present place.

<sup>2/</sup> See Hassan Dafalla, "The Nubian Exodus", Hurst and Co. London, 1975, p. 107.

<sup>3/</sup> See Ali Ayob, "Soil Investigation in Um Agaga, Shaaliya and Idrisab villages," Unpublished report, Huddiba Agr. Research Station, Ed Damer, 1970

and the amount of water run off.<sup>1/</sup> However, it can safely be generalized that the density of vegetation decreases as we move south away from the river Atbara but it start to increase again towards the inner Butana, and it also decrease on the river banks itself as we move to the north-west, probably as a result of its close contact with the urban centres at Atbara and Ed Damer.

The River Atbara:

The Atbara river develops as a result of the rainfall in the Ethiopian Plateau north of Lake Tana, and as it enters Sudan, near Gallabat , it is joined by the Setit, the largest tributary that occupies about  $\frac{7}{10}$  th. of the river basin. The total length of the river is about 600 kms and an average width of one kilometre, although it varies considerably and some times and in some places its width is doubled, depending on the amount of rainfall and the nature of the channel rock surface.

For most of its course in Sudan, the River Atbara is well below the general level of the plain and about one half of its course especially in the upper

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<sup>1/</sup> See K.M. Barbour, The Republic of the Sudan, a regional geography, Universty of London Press, London, 1961, pp. 65-67.

regions is bordered by the Karab or badlands as it is referred to by Hurst.<sup>1/</sup>

The River Atbara used to contribute to the Nile waters some 12 milliard M<sup>3</sup> annually, 95% of which between July and December. This represents about 13.4%<sup>2/</sup> of the Nile waters. For the whole period of January-June the river used to be almost completely dry, except for the few swamps and water pools that develop, especially in the lower parts of the channel where the slope is relatively more gentle (See Fig. II).

The seasonal nature of the river, the very steep slope in its upper course, the forestation of these upper parts and the high silt content of its water, had all combined to form the basis for, and shape the settled life on the lower reaches of the Atbara river.

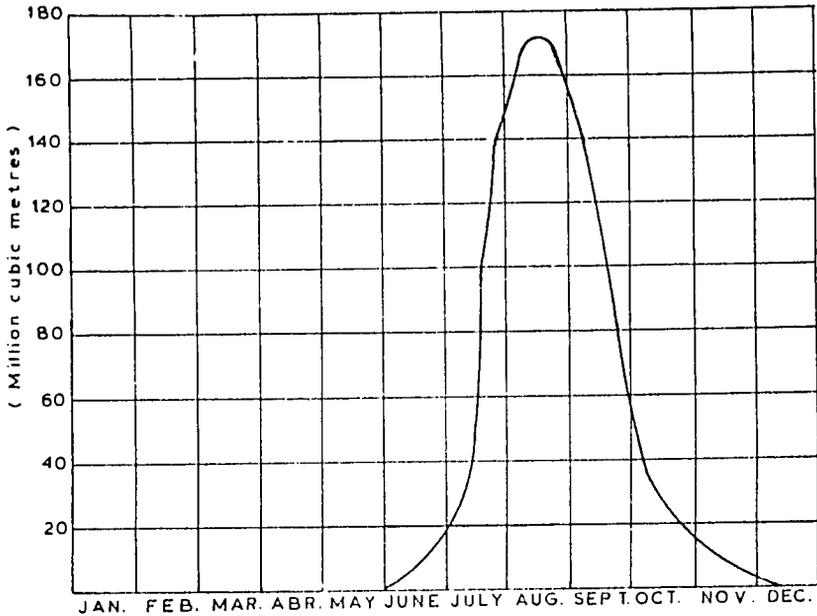
The huge elevation difference between the Ethiopian Plateau and the central plain of Northern Sudan made the speed and violence of the Atbara waters

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1/ See Hurst, H.E. The Nile: a general account of the river and the utilization of its waters, Constable & Co., London, 1951, p.90.

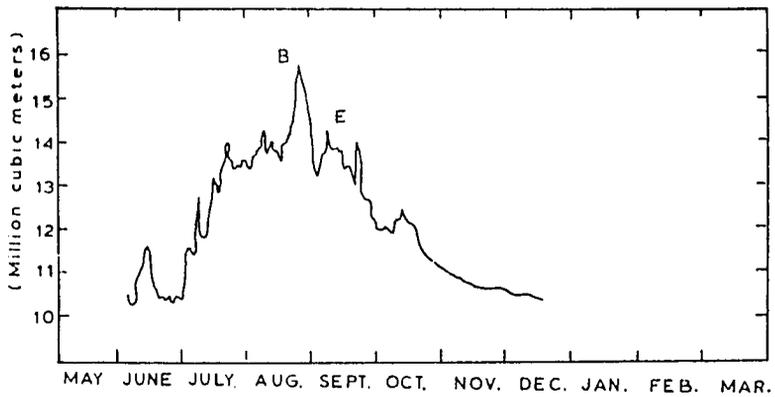
2/ See Yahia Abdel kaseed, Nile Control for Agricultural Development in Sudan, in Shaw, D.J.(ed.) Agricultural Development in the Sudan, Proceedings of the 13th Annual Conference of the Philosophical Society of Sudan, Vol.2, Khartoum, 1966, pp.318-9.

Fig(11,a) THE AVERAGE WATER DISCHARGE OF RIVER ATBARA (1912—1942 )  
 ( IN MILLION CUBIC METRES )



After S. el Shami ( 1967 )

( b ) MONTHLY DISCHARGE OF THE RIVER-ATBARA  
 ( AT K. EL GIRBA )



After Hurst(1952)

outstandingly high.<sup>1/</sup> This, in addition to the relatively short distance crossed by the river and the alluvial nature of the soil has contributed substantially to the strengthening of the erosive power of the river and its ability to uproot and drift falling trees from the Ethiopian Plateau. As a result the concentration of silt in the river waters prior to Khashm el Girba dam is estimated to be 200 parts permillion,<sup>2/</sup> or 3 or more kilogrammes of silt per cubic metre of water<sup>3/</sup> and it<sup>is</sup> thus certainly the highest among all the Nile tributaries<sup>in</sup> the silt content of its waters.<sup>4/</sup> The loss of the river waters was principally encountered through evaporation from the surface and percolation into its alluvial silt-bed.<sup>5/</sup>

The environmental conditions that existed in the lower Atbara prior to the construction of the

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- 1/ It is estimated that the speed of the Atbara river during the flood time and prior to the erection of Khashm el Girba dam was about 40 kms per hour.
- 2/ See, H.E. Hurst (1952) Op.cit., p.
- 3/ See Salah el Din El Shomi, Studies on the Nile, The Anglo-Egyptian Library, Cairo, 1967 (in Arabic) p.164.
- 4/ See Mohammed Awad Mohammed, The Nile, Cairo, 1956, (in Arabic), p.294.
- 5/ See K.M. Barbour (1961) Op.cit., p.119.

Khashm el Girba Dam, is largely responsible for the then prevalent economic activities and was hence reflected in the population structure and mobility. These conditions have allowed for, or may have imposed, an economic activity that, perhaps uniquely in Northern Sudan, continue throughout the year. This has taken the form of combining agriculture with animal husbandry herding, and both being supplemented by other minor activities, such as fishing, wood collection and handicrafts. This latter activity was largely dependent on the extensive presence of the dom trees or the branching palm (*Hyphaene thebaica*) in the area, which was the main source for saf (the dom leaves) from which hand-mattings such as broosh and baskets were made. Besides, an important source of cash was the collection of the huge amounts of wood that was annually brought by the river, which was sold as fire wood or as a building material in the neighbouring towns of Ed Damer and Atbara. Fishing was also practiced widely during the flood season, largely associated with wood collection.

However the erection of Khashm el Girba Dam in 1964, has considerably disrupted that pattern of life through the various ecological changes it caused

to occur in the area. These changes were clearly reflected in the forms of economic activities, land use patterns, and in the demographic structure of the population, all indicating the gradual loss of value of that environment.

Indicators of deterioration and the present trends in response to those changes are discussed below through a comparison between the conditions before and after the erection of the dam. First a general historical background about settlement in the area and the ethnic structure of the inhabitants is provided and it is followed by a brief description of the population characteristics. Secondly there is a description of the pre-dam economy of the area, heavily centred on the riverine land area. That is followed by a description and an analysis of the type and magnitude of environmental changes, a summary of their socio-economic consequences and their perception by the local population. Finally, on the basis of the comparison of the past with the present situation, a list of indicators of environmental degradation is, qualitatively, arrived at. The report is concluded by raising a number of research issues and questions to be investigated and through empirical research attempt to quantify those indicators and find out means of reversing or checking that trend of degradation.

## 2. The Population of the Lower Atbara Area:

No exact data can be given for the first settlements in the area, probably because of the numerous mobility associated with the indigenous nomadic population, but there is some evidence that suggests the existence of a complete settled life during the late 18th or early 19th century. In El Gubba village, there is the gubba (tomb of Faki Abu Negga'a, a religious man who is known to have migrated during the Funj Period (1650-1820). Another village, named Garf el Buja, might also suggest that the Baja nomads of eastern Sudan may have reached this area in their continuous search for water and pastures, and some of them might have settled in the area as cultivators.<sup>1/</sup>

### 2.1. The Ethnic Structure :

A numerous number of tribal groups depend totally or partially on the river Atbara and inhabit its banks. In the upper reaches of the river we find the Bisharin, Nifidab, Marhomab, Fadniya and Kamalab, while the Jaaliyin, especially Aliab, represent the majority

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- <sup>1/</sup> These views were formulated as a result of a series of conversations with inhabitants of the area over the last few years, especially Sayed Haj Ali Salih the ex-Omda of the area, who expressed the same views in an unpublished and undated paper titled: "A Note on the History of the Lower Atbara" (in Arabic).
- <sup>2/</sup> From a lecture by Haj Ali Salih on the Problem of the Lower Atbara, delivered on 21st December 1983 in Ed Demer.

of the population of the lower parts of the river Atbara. The Jaaliyin are believed to have moved to the area as established cultivators from the area east and west of the Nile near Ed Damer, most probably in the first half of the 19th century after El Difterdar revenge expeditions that followed the murder of Ismail Pasha in 1821.<sup>1/</sup>

## 2.2. The Demographic Characteristics:

The area under study is inhabited by about 80 thousands living in permanent villages on both sides of the river and some scattered camps on the western side of the river.

There is no detailed census or very reliable statistics for the population of the area and the only enumerated figures available are those of the 1955/56 census that was based on the Omodiya as the smallest unit.<sup>2/</sup> The 1973 census was based on the average number of household members and the number of houses in each village. Two other estimates for the population of the

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1/ See H.A. Abdel Ati, The Impact of Khashm el Girba Dam on the Lower Atbara Area-Sudan, Unpublished M.Sc. thesis, Centre for Development Studies, University of Wales (Swansea), 1979, p.13.

2/ This in fact suits most our purpose here as the area under study roughly coincides with the boundaries of the ex-Omodiya of Al Magran. Omodiya was an administrative unit consisting of two or more Sheikhships or villages under the authority of Omda.

area were also made by the Provincial authorities in 1969 and 1972 but no mention was made for the method or criteria on which these estimates were made. However these more recent sources suffer from the following:-

1. being based on estimates and the lack of any clear statistical method that were applied to arrive at those figures.
2. the considerable variations and inconsistencies when their figures are compared.
3. they seem to underestimate or ignore the significant variations between different villages, i.e. variations resulting from the combination of differences in the rates of in and out-migration and the influence of location relative to neighbouring town, if we assumed an equal rate of natural population increase.

Table (1) contains the figures given for six selected villages in the area namely Al Magran, Gangari, El Qubba, El Omerah, El Besli and Gersi ( all on the western side of the river), and indicates the huge differences between them.

Table 1

Total Population of six Selected Villages 1/  
in the Lower Atbara Area in selected years

Year	1955/56	1969	1972	1973	1978
Total Population	5,869	12,300	15,200	6,899	10,550
average household number	5.4	n.a.	n.a.	5.6	10.6
annual growth rate (approx)	2.9%	7.8%	6.0%	1.5%	2.8%

On the basis of the 1978 sample, being the most recent, the following observations can be made :-

- that about 52.3% of the population is either under 15 years or over 45 years old and hence the community can be described as a young one in terms of age.
- the average family size (i.e. all those living in the same household) is considerably high, exceeding 10.5 persons per household, although these ratios vary considerably between different villages, e.g. it is 7.2 persons in Al Magran while it is over 14 in El Qubba.
- the economic dependency ratio is fairly reasonable (3.5 persons), when compared to the average household size, although again it varies between different villages, from a minimum of 2.6

1/ Notes on the table :

- Sources, Respectively, the 1955/56 Population Census of Sudan; E.I. El Sabooni, A Report on the Problem of Lower Atbara, Nile Province Headquarters, Ed Damer, 1969; Nile Province, A memorandum on the Lower Atbara Area, Ed Damer, 1972; The 1973 Unpublished Census; and H. A. Abdel Ati (1979) Op.cit.
- Annual growth rate is calculated on the basis of the 1955/56 Census figures.

persons in El Omerab to a maximum of 5.5 in El Qubba. However this relatively low ratios of economic dependence, that suggest high participation rates in fact might have obscured the high levels of unemployment. The reason for such assertion lies in the unclear definition of "income earner" or "the economically active", as it included any income earner no matter how long or short the period of his employment is.

Comparing the 1978 sample figures, with those of the 1955/56 census we find that, although the annual growth rates are almost the same, the average household size has almost doubled. This indicates a high level of natural increase and it also suggests an intensive out-migration trend, involving mostly the young males and probably small families. However, on the one hand, the exceptionally high growth rates of the 1969 and 1972 estimates seem to suggest a significant trend of migration into the riverine area and that may be a reflection of the natural hazards' effect on the local population of the south-eastern parts of the area. The year 1968-69 witnessed the most extensive damage caused by the exceptionally high flooding of the river Atbara, and that damage caused some of the population to move further

north-west along the river banks to settle in the lower Atbara. That also coincided with the beginning of the drought in the northern Butana, when for the first time in a fairly long period, rainfall deficiencies were so great that it halted the rainfed cultivation and animal herding that was used to be practiced both by the nomads of the northern Butana and some of the riverine population. This has also caused some of the originally nomadic groups of the Butana to move and start a settled or semi-settled life near the river Atbara. However it must be noted that the occurrence of these hazards, the resultant influx of population towards the area, and probably the political row<sup>1/</sup> it caused may have influenced the estimates of population made in 1969 and 1972, and hence the calculated growth rates.

On the other hand, the 1973 figure of growth rate (1.54) which is far below the national average, also suggests an outward migration trend from the area but it is difficult to choose between it and the total population figure of the previous year, which is twice that of the 1973, and hence it is not easy to generalize.

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<sup>1/</sup> During the 1969-72 period the area was visited by the President of the Republic, various ministers and the Provincial Authorities conducted these surveys in response to those problems.

With regard to the sex balance, the overall male/female ratio, according to the 1978 sample results, is fairly even standing at 99.3%, but enormous variations are encountered for the different age groups (See Table 2). For those under 15 years of age, the male/female ratio is 104.5% and it is 115.3% for those over 44 years old but it is only 89.3% for the group of 15-44 years. The imbalance in this latter group, of course, indicates the migration of adult males, although the level of imbalance seems to have been kept down by the high ratio of population in the working age (47.7%) (See Fig. III).

The major destinations of these migrants are Ed Damer and Atbara towns, to which migration seems to be of a permanent nature, in addition to Khashm el Girba and the mechanized crop production schemes of the Gedarif area. But migration to these two latter areas seem to be a seasonal one, either during cultivation seasons or for a few number of years.

Table 2.

Lower Atbara Population: Age-sex structure, Education and Marital Status.(\*)

Age Group	Both Sexes (%)	Total		Married		Education % by age group		Male/Female Ratio	Broader Age Groups		
		Males	Females	M.	F.	M.	F.		Sub-total (%)	Education (%)	M/F. Ratio
0 - 4	6.2	6.7	5.6	-	-	-	-	117.8	<u>6.2</u>	-	-
5 - 9	11.7	11.4	12.0	-	-	60.0	68.8	93.8			
10-14	10.6	11.1	10.0	-	-	88.6	57.5	110.0	<u>22.2</u>	<u>68.9</u>	104.5
15-19	11.8	11.0	12.5	-	2.3	41.4	5.0	87.0			
20-24	10.1	9.7	10.5	2.1	5.4	9.1	2.4	91.7			
25-29	6.2	5.7	6.6	3.4	5.6	14.8	-	84.9			
30-34	6.8	6.4	7.1	4.5	6.8	3.9	-	89.5			
35-39	7.1	6.3	7.9	4.8	7.1	-	-	79.4			
40-44	5.8	6.1	5.5	5.8	4.8	2.1	-	109.1	<u>47.7</u>	<u>7.5</u>	<u>89.3</u>
45-49	5.5	5.2	5.8	5.0	4.0	4.9	-	89.1			
50-54	4.3	3.8	4.9	3.4	2.9	3.3	-	76.9			
55-59	3.1	3.9	2.4	3.3	1.8	-	-	163.2			
60-64	3.8	4.0	3.6	3.0	2.1	-	-	110.4			
65& over	7.2	8.8	5.5	7.3	2.1	-	-	159.1	<u>23.9</u>	<u>0.8</u>	<u>115.3</u>
Total	100.0	100.0	100.0	42.6	44.9	23.3	14.9	99.3	100.0	19.1	99.3

(\*) Notes on the Table :

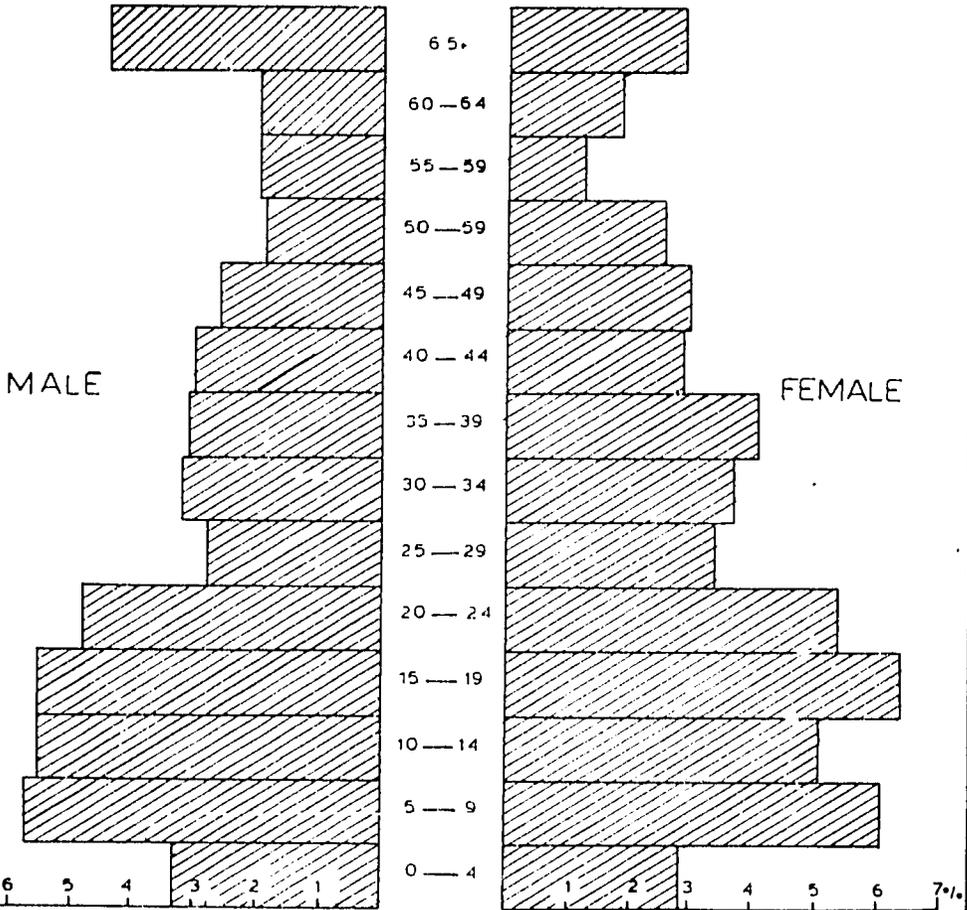
1) Source : H. A. Abdel Ati(1979) Op.cit., p.18.

2) All figures are based on a 150-household-based sample survey conducted in 1978 covering Six Sheikhships that form the ex-Omodiya of Al Magran.

Fig(III)

POPULATION PYRAMID OF LOWER ATBARA AREA

SCALE 1CM. = 1%



3. The Problem of Lower Atbara, A Historical Note:

As a result of the 1959 Nile Water Agreement between Egypt and Sudan that was followed by the construction of the Aswan High Dam, the inhabitants of Wadi-Halfa area (about 50,000) had to be evacuated. After a lengthy debate they were settled in the Khashm el Girba area in consideration of various factors, the most important of which were the low population density in the area and the high fertility of the soil.<sup>1/</sup> A dam was constructed on the river Atbara at Khashm el Girba village about 40 kms from the Ethiopian border and 350 kms from the Atbara-Nile junction, with a storage capacity of 1.3 milliard cubic metres, primarily to irrigate the 500,000 feddans-scheme that was established and to supply electricity (potentially 15 MW), to New Halfa, Kassala and Gedarif towns.<sup>2/</sup>

No serious attempt has ever been made to assess or measure the effects the dam can make on the areas outside its immediate vicinity. As for the Lower Atbara, as the most effected area along the Atbara river, it has never been a part of any evaluation of the

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1/ See for example, Hassan Dafalla (1975) Op.cit., pp. 134-5.

2/ See M.Sh.Osman and H.E.El Hag "Irrigation Practices and Development in the Sudan," Sudan Notes and Records, Vol.55, 1974, p.100.

Khashm el Girba Scheme neither by the dam authorities nor by the Central Government. With the completion of the Dam in 1964, the ecological balance started to be disturbed causing enormous economic and social changes, reaching the pressing state from 1969 onwards, the thing that motivated some action by the provincial authorities, one of which was those surveys of 1969 and 1972.

### 3.1. The Traditional Economy of Lower Atbara :

Prior to the erection of Khashm el Girba Dam the economy was predominantly agricultural. Over 90% of the population depended on irrigated agriculture to make a living, though most of them supplemented their incomes by fishing and trading in the wood drifted by the river. The river Atbara was therefore the corner-stone for the local economy. But nevertheless, rain cultivation in the inner Butana was practiced, when climatic conditions allowed, together with animal herding that sometimes involved a partial mobility of households.

#### 3.1.1. Agriculture :

Four types of cultivation were known in the area and these were :-

- a. gerf cultivation on the annually flooded banks of the river.
- b. karu land cultivation immediately above the gerf land, mostly irrigated by sagia.
- c. magat cultivation on the river bed when it dries up and develop into small water pools, and
- d. Atmur cultivation on the rainfed lands of the northern Butana.

Agriculture was typically subsistent and practiced on family basis. The subsistent nature of the society seem to have been imposed by the seasonal nature of the river Atbara and <sup>the</sup>irreliability of rainfall in the area. In fact it seems that, with the then available technology, this subsistence level was not easy to maintain without the full utilization of all agricultural potentials in the area, and this may also be the reason for the drastic changes caused by the Khashm el Girba dam.

The year was divided into three agricultural seasons, seifi, damira and shitwi. In the seifi season (April to August) cultivation was restricted to the karu land, depended on sagia irrigation and involved the production of dukhn (bulrush millet) and some vegetables. In damira season (August-November) crops cultivated were mainly vegetables, dura and lubia on the gerf lands,

the latter two to be <sup>cut</sup> green as animal fodder. During this season, the cultivation was the easiest and the demand for labour is generally low and for this reason, it represented the peak season for subsidiary activities such as fishing and floating wood collection. As for the shitwi season (November-March) it was considered to be the most important season in terms of working hours, labour force employed and the crops grown. It also represent the second rotation of farming on the karu lands. Lubia and bersim for animals, vegetables and horse beans for human food, and quite often for sale, were the major crops produced. In addition, wheat was also grown sometimes, when temperature levels were low and enough water was available for irrigation.

Magat cultivation of agur (cucumber cucumis) and water mellons, on the river bed, was usually carried out in March or April, when the river develops into pools, to be harvested in June or July before the flood time, thus making use of the moisture content of the river bed soil.

Atmur or rainfed cultivation in the Butana was practiced in June, July or August depending on the time of rainfall. It used to involve only a part

of the family (young males) who used to follow the herds during the dry season and they settle down with their herds after the start of the rainy season. Dhura was the only crop grown for food while the straw is dried to feed animals during the summer season.

3.1.2. Nomadism and Animal Herding:

According to the 1955/56 the nomads and semi-nomads in the lower Atbara area accounted for about 4% of the total population of the area. The major differences between these two groups were:-

- a. the nomads were largely concentrated in the south-eastern parts of the area around and south of Gersi Sheikhship, while the semi-nomads were scattered all over the area along the river channel;
- b. the nomads used to concentrate on raising camels and sheep while the semi-nomads concentrate on sheep, goats and some cattle;
- c. obviously the distance and duration of the nomads' mobility were both longer than those of the semi-nomads, as the nomads used to spend most of the year in the Butana pastures and wadis, the nearest of which was khor el Makabrab. Also sometimes nomads from the central Butana used to move for far longer distances towards the Atbara river during dry season and they might even cross the river to the

north.<sup>1/</sup> The semi nomads on the other hand, who were mostly farmers used to spend only two or three months away from the river Atbara and take shorter trips to Sih al Hagar, Wadi Umm Grain, Sararit and Wad Adar; and

- d. while all the family is involved in the nomadic mobility, only some of the males were involved in the case of the semi-nomadic family.

Although the ratio of nomads and semi-nomads to the total population is very small, these groups used to own a very high proportion of the livestock then present in the area.<sup>2/</sup> Sheep, cattle and camels, respectively in terms of their numbers, were the main types raised by these groups. Goats were heavily concentrated on the riverine areas and largely associated with the settled population or with the resident part of the semi-nomadic family. Animals in fact played a very important role in the economic life of the settled population. The sagia, the gussahiya and the wooden plough, the technology that was used at the time, were all completely dependent on animal power (oxen). Donkeys were also used for threshing wheat. These besides the provision of a source of diet, supply of manures and a means of transport.

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1/ See M.E.Abu Sin, A Survey and Analysis of Population Mobility within Northern and Central Sudan, Unpublished Ph.D thesis, University of London (Beford College), 1975, p.204.

2/ See H.A.Abdel Ati (1979) Op.cit., p.53.

### 3.1.3. Fishing and Floating Wood Collection :

Although a very small proportion of the population depended entirely on these two activities to make a living, yet they both formed an important source of pocket money for a considerable number of the population. Besides these activities suffered a number of problems such as :-

1. Being seasonal in their association with the river flood, the thing that made it difficult for the people to undertake them as basic activities,
2. the lack of transport and absence of local markets. These two factors used to depress prices for wood and lead to huge losses of fish catch; and
3. Furthermore the fishing activity in addition to the primitive means used in it, had also faced the problems of competition from the main Nile fisheries that was better in quality and higher in quantity as they were caught from a much longer and perennial river.

### 3.1.4. Handicrafts :

The dom trees that were predominant in the area provided the local population with a building material and a source for hand mattings. The stem of the dom tree was and is still extensively used for the roof support for houses in both urban and rural areas.

The leaves of the dem tree or saaf was the main source for handicrafts such as brush, baskets and ropes. These handicrafts were largely carried out by women and they represented one major contribution of females towards the household economy. In fact this activity to a large extent filled the slack season in the year as it was practiced during the late winter and early summer days. It must be noted that over 40% of the households were engaged in these activities.<sup>1/</sup>

In addition to this some of the male members of the community used to make use of the clay soil of the river and the availability of fire wood in the area, to make water pots (Zair) but again this was limited due to the difficulty of transport and the competition from the Nile areas.

In conclusion the main features of the traditional economy of the area can be summarized as follows:-

1. It was basically<sup>a</sup>/subsistent economy with a relatively high degree of self-sufficiency

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<sup>1/</sup> See H.A. Abdel Ati (1979) Op.cit., p.56.

2. There were various alternatives for the individual though largely dependant on natural conditions. Animal husbandry, fishing, wood collection and handicrafts all were supplementary activities to irrigated and rainfed cultivation.
3. The availability of these alternatives left no, or a very short, slack season for the household and hence very small or no surplus labour force that could have otherwise migrated.
4. The practice of these various economic activities beside agriculture and the raising of large numbers of livestock, even among the totally settled population, all seem to indicate some awareness on the part of the inhabitants about the marginality of their natural environment that they learned to cope with by straddling between these different activities.

4. Environmental Changes in the Area :

It was mentioned previously that the Lower Atbara area falls into the semi-desert climatic region, and the amount of rainfall decreases as one moves along the river from the south-east to the north-west. This gradual decline is indicated by the figures of rainfall averages in Atbara and Seidon, contained in Table 3 below:

Table 3.  
Average Monthly Rainfall in Atbara and Seidon.<sup>1/</sup>

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Atbara	0.0	0.0	0.0	0.0	3	3	27	31	5	1	0.0	0.0
Seidon	0.0	0.0	0.0	0.0	1	6	25	41	8	3	1	0.0

Over the last two decades the amount of rainfall started to decline. If the meteorological records of rainfall in the Central Butana is taken as an indicator for that decline, we find that the minimum recorded for sixty years was in 1970 (298 mm as opposed to the annual average of 429 mm.), although rain levels started to pick up again afterwards.<sup>2/</sup> It has also been reported that the area experienced the worst drought in its history between 1969 and 1973.<sup>3/</sup>

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- 1/ Source: Abbashar E. El Amin, The Basin of the River Atbara in Sudan: A Regional Study, Unpublished M.A. Thesis, Cairo University, 1976, p.99 (in Arabic).
- 2/ See Ahmed Mohd. El Hassan, The Environmental Consequences of Open Grazing in Central Butana - Sudan, I.E.S. Monograph Series, No.1, Khartoum, November, 1981, p.19.
- 3/ See Rapp, A., The Sudan, in A. Rapp and H. Hellden, Research on Environmental Monitoring Methods for Landuse Planning in African Drylands, London Univ., Geogr. Dept. Papers, No.42, 1979, p.47.

Two other changes, closely connected with the previous one, were also experienced in the area. These were :-

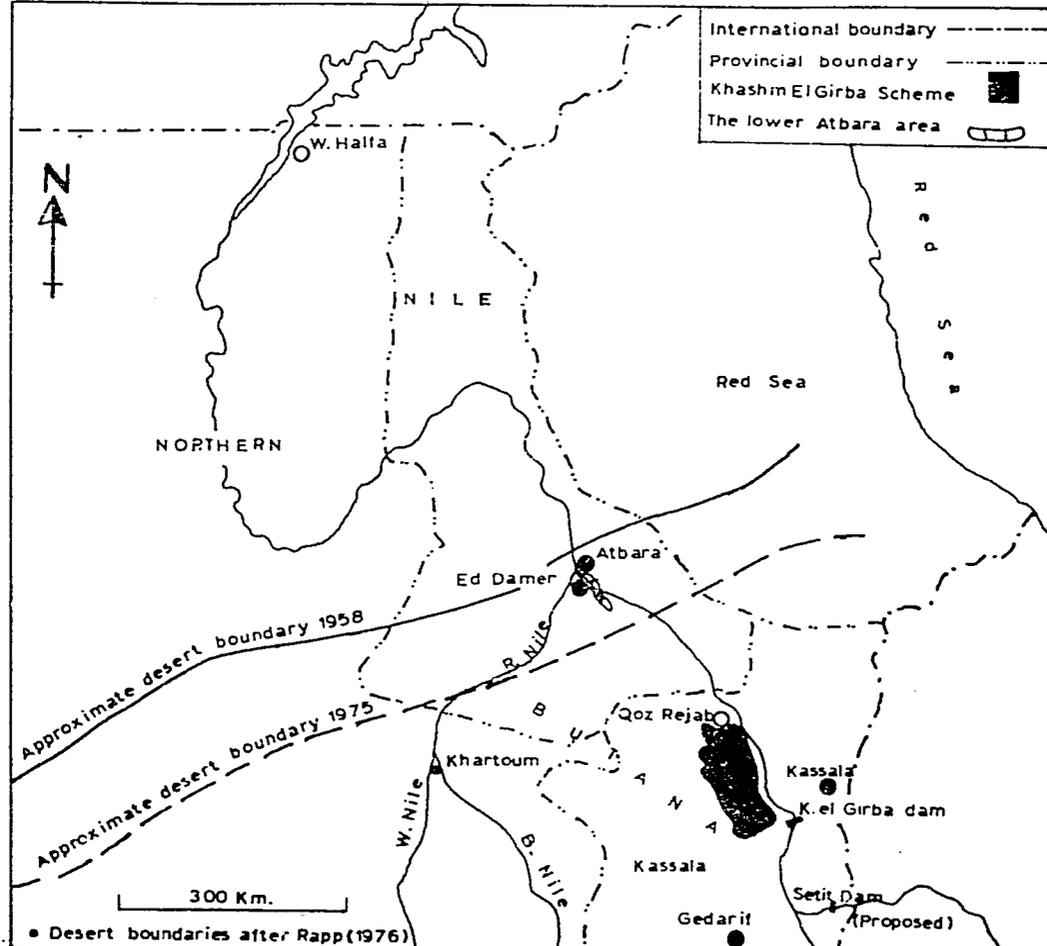
1. a considerable increase in the intensity of desert encroachment in the area. The desert line has advanced southwards by about 100 Kms. between 1958 and 1975,<sup>1/</sup> thus covering all the area under study including the riverine lands (Fig. IV), and
2. the construction of the Khasha el Girba dam in 1964 that had its most significant effects on the riverine lands and the riverine population.

All these, of course, has combined to determine the quality of the environment and hence the type of economic activities practiced by the inhabitants of the area. In this section, emphasis are made on the riverine lands and how it was influenced by the dam and the change in the "natural" conditions.

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<sup>1/</sup> See H.F. Langray, A Report on the Desert Encroachment Reconnaissance in Northern Sudan, Nairobi, 1975, cited in Erick Eckholm and Lester Brown, *Spreading Deserts: The Hand of Man*, World Watch Papers, No.13, August 1977, pp.9-10.

Fig(IV) THE SOUTHERN ADVANCE OF THE DESERT LINE 1958-75



#### 4.1. The Erosion of the River Channel:

Before the construction of Khashm el Girba Dam, erosion on the river channel was mainly through the vertical cutting of the river bed itself, resulting in the clear low elevation of the river basin relative to its surrounding areas.<sup>1/</sup> The pre-dam picture of river in the lower parts seem to have resembled a simplified form of the present situation in its upper parts i.e. between Adarma and Gallabat where gullies have torn the kerrib land surface quite extensively. However, although the slope is generally steep (i.e. it is 1:400 between Khashm el Girba and the Atbara-Nile junction)<sup>2/</sup> and hence the river speed was relatively high, it seems that the long distance crossed by the river and the heavy load of both coarse and dissolved materials it used to transport, had helped to check its erosive power and restricted<sup>it</sup> to the river boundaries as the process was coupled with an equally high intensity of depositional activities in the lower parts of the channel. It is estimated that the<sup>River</sup> Atbara used to carry about 3 kilogrammes of dissolved and eroded materials per every cubic metre of water.<sup>3/</sup>

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1/ See S.El Shami (1967) Op.cit., p.161.

2/ See M.A.Mohammed (1956) Op.cit., p.112.

3/ See S.El Shami (1967) Op.cit., p.164.

At present the intensity of erosion below the Dam Site has increased considerably, as a result of:-

a. the river current regains its strength as it passes the dam gates, particularly a huge portion of the materials it carries from its upper coarse areas, that could have reduced its speed, are checked behind the dam (See section 4.4 below). This means that the lower parts of the river channel, instead of being subject to both erosion and deposition in a some-how balanced form, it became largely subject to erosion.

b. the relatively short distance between the Dam and the Atbara discharge area (about 400 kms), together with the relatively steep slope,<sup>1/</sup> and

c. the weak composition of the soil which consist of silt and clay, that were originally deposited by the river itself.

The intensity of haddam (land sliding) has now considerably increased on both sides of the river, leading almost to the complete disappearance of the gerf lands, especially on the left bank of the river channel where the effect is more profound.<sup>2/</sup> (See Fig.V).

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<sup>1/</sup> The elevation difference is 5 metres between the town of Atbara (345 m.) and Seidon (350 m.) while the distance between them is about 50 Kms.

<sup>2/</sup> See H.A. Abdel Ati (1979) Op.cit., pp.35-62 and 63.

#### 4.2. Siltation:

The annual accumulation of silt behind the Khashm el Girba dam has a twofold effect on the lower Atbara. On the one hand it reduces the fertility levels of the riverine soils and, on the other, reduces the connectivity of its particles making it yet more vulnerable to both water and wind erosion.<sup>1/</sup> The amount of sediments in the Khashm el Girba reservoir has risen from nil in 1964 to  $0.46 \times 10^9 \text{ M}^3$  in 1972/73, thus reducing the storage capacity from  $1.3 \times 10^9 \text{ M}^3$  to about  $0.84 \times 10^9 \text{ M}^3$  in the same season<sup>2/</sup> and Thimm estimate it to be  $0.80 \times 10^9 \text{ M}^3$  in 1978.<sup>3/</sup> The annual rate of sediment deposits' upstream advance was estimated in 1973 to be about  $40 \times 60^6 \text{ M}^3$ ,<sup>4/</sup> that is approximately a horizontal expansion of about 3 kilometres every year and 25 metres vertically above the

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1/ Ibid., p.36.

2/ Ministry of Irrigation (Sudan) A Report on the Sedimentation Problem of Khashm el Girba Reservoir, Khartoum, 1973, pp.4-7.

3/ See H.U. Thimm, Development Projects in Sudan: an analysis of their performance with implication for research and training in arid land management, U.N. University, 1979, p.16.

4/ See Sogreah, "A Preliminary Note on Experimental Flushing Operations of 1971 and Flushing Programmes of 1972" Ministry of Irrigation, Khartoum, 1972, p.4.

original river bed level. Furthermore Thimm estimates that about 50 million cubic metres of the River Atbara waters is annually lost as a result of this sedimentation problem in the reservoir.<sup>1/</sup>

#### 4.3. Fishing :

The adverse effects of irrigation dams on the downstream fish have been emphasized by various scholars and ecologists. The following are among the problems mentioned:-

1. the hindrance of up and down-stream movement of fish.
2. the obstruction of fish by turbines
3. the alteration of the water regimen downstream by the dam,<sup>that</sup> tend to deprive fish from making use of the seasonal shifts of water that are essential for feeding, spawning and breeding of fish as it lead to a drop in the nutrients level in the river waters
4. the alteration of the natural level of sedimentation and water velocity. This also influences the nutrients and the dissolved oxygen levels and hence the productivity of fish, and finally

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<sup>1/</sup> See H.U. Thimm (1979) Cp.cit., p.16.

5. the changes in the salinity and chemical structure of the river waters, as the concentration of salt in water is known to cause the contamination of fish reserves.<sup>1</sup>

Of course most of these apply to the fisheries of the River Athara, especially with regard to the high silt content of the water in the lower parts. However, as fishing was only practiced seasonally and a supplementary source of income, the economic impact of its disruption by the Dam, can only be seen significant in association with the other aspects of the economy, particularly with regard to two things. First the seasonality of the river and the blockage by the Dam led to the drop in the number of fish in the lower parts and when it is available it is in most cases useful only as sardines as a result of the disruption of the breeding cycle. Secondly, the loss of other income sources, both agricultural and non-agricultural, denied those who practice fishing the capital necessary to conduct it as the sardine industry, for example, requires an economic base far beyond the financial resources of the majority of

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<sup>1</sup>/ For an elaboration of these points see Dassmann, R.F., Milton, J.P., and Freemann, P.H. Ecological Principles for Economic Development, John Wiley & Sons Ltd, London, 1978, pp.191-197.

these people.<sup>1/</sup> This is probably why in 1978, it was found that only 0.7% of the Lower Atbara population rely on fishing entirely as the major source of income.<sup>2/</sup>

#### 4.4. Deforestation :

It was mentioned previously that the River Atbara before the construction of Khashm el Girba, used to drift a considerable amount of falling trees from its upper course areas in the Ethiopian high land forests. Sunt (*Acacia albida*), talh (*Ac. seyal*), tundub (*Capparis Decidua*), Salam (*Ac. flora*), haraz (*Ac. albida*), and Highleeg (*Balanites Aegyptiaca*) were the main types of wood drifted by the river downstream. The natural vegetation of the Lower Atbara area itself consisted of dom trees (*Hyphaene thebaica*), tundub, Sunt, talh, kittir (*Ac. Mellifera*) and laa'ut (*Ac. nubica*), in addition to the date palms that were concentrated along the river banks. Desert and semi-desert shrubs and grasses were also abundant in the area between Marzuqa and Atbara east and west of the river, decreasing in density towards the north and east and west away from the river. These included tarfa (*Tamarix ophylla*), haskaneet (*Cenchrus*), nal (*Cymbopogon nervatus*), halfa (*Demoslarpya Cyrosuroidas*) and tabas (Scrub).<sup>3/</sup>

All these had their economic value for the local population as firewood, building material and a source of cash. The construction of Khashm el Girba dam has

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<sup>1/</sup> Sardine industry at present, seem to be practiced largely by urban-based fishermen, mainly from Atbara town, fishing at the Atbara-Nile junction where they claim, fishing is easier and fish is more abundant.

<sup>2/</sup> See H. A. Abdel Ati, (1979), Op.cit., p.44.

<sup>3/</sup> For a more detailed description of vegetation, See A. E. El Amin (1976), Op.cit., pp.117-118.

not only halted the flow of wood downstream, but by so doing it caused extensive damage to the vegetation in the downstream area.

It is very difficult to estimate the volume of wood that was annually drifted by the river Atbara as it varied considerably from one year to another. At present it usually extends for 1-2 kilometres upstream from the Dam on the full width of the reservoir, with the maximum accumulation occurring at the early days of the flood season (July-August).<sup>1/</sup> This is important in two respects. First the accumulation of wood increases the rate of sedimentation in the reservoir. And secondly, the removal operations of that wood, require the complete closure of the Dam in order to raise the water level to the maximum height (468 metres).<sup>2/</sup> Thus in addition to the checking of floating wood, the lower Atbara also suffers the restraint of both silt and irrigation water and hence the disruption of the agricultural cycle.

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<sup>1/</sup> See, Ministry of Irrigation Report on the Sedimentation Problem of Khashm el Girba Reservoir, Khartoum, 1973, p.23.

<sup>2/</sup> Ibid., p.22.

Denied the access or opportunity to floating wood collection, the inhabitants of the lower Atbara turned to surrounding areas, cutting trees for domestic uses and sometimes for commercial purposes. This is particularly true for the extreme lower parts, close to the urban areas (El Damer and Atbara) where the demand for wood is high, and here the acacia trees and even dam<sup>1/</sup> trees were almost cleared completely. (See Fig. V). In addition to this a considerable number of the date palms on the river banks, was lost as a result of the high intensity of haddam. Furthermore, the drought of the late 1960's early 1970's put more pressure on the vegetation cover as various nomadic groups from the northern Butana started to move towards the river and spend longer periods in its vicinity for water, while supporting their animals from these natural vegetations. It is well known that the combination of vegetation clearance by man and prolonged droughts is a prime cause of desertification.<sup>2/</sup> Overgrazing is also accused for

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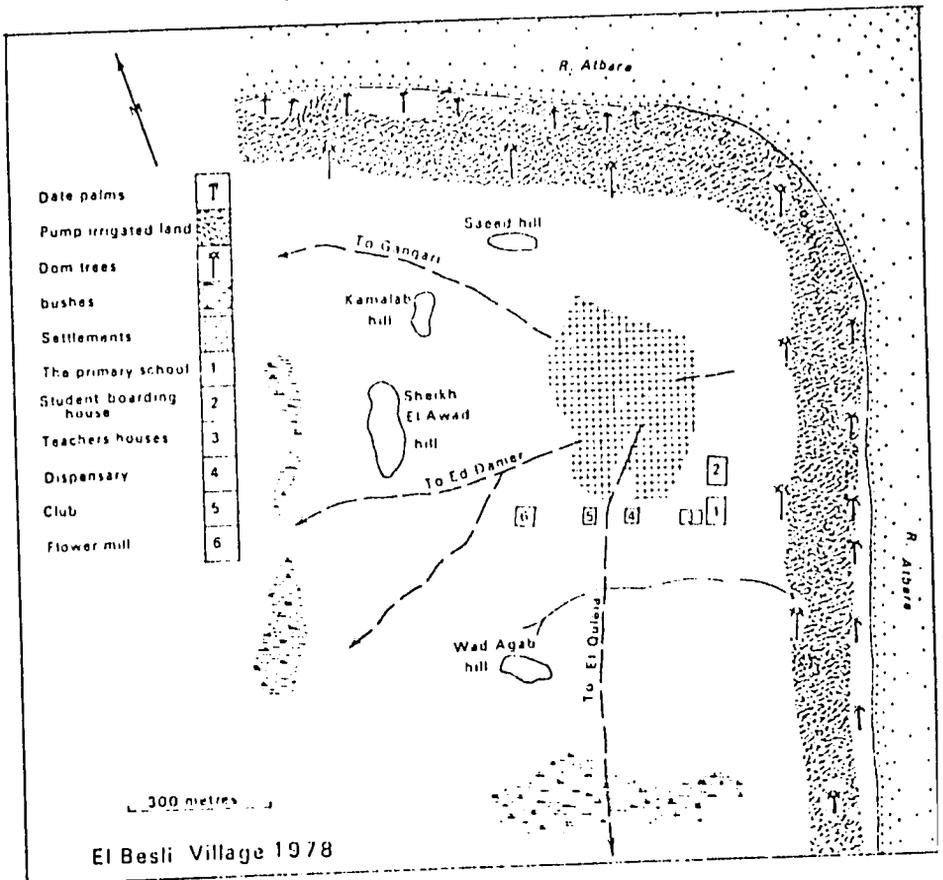
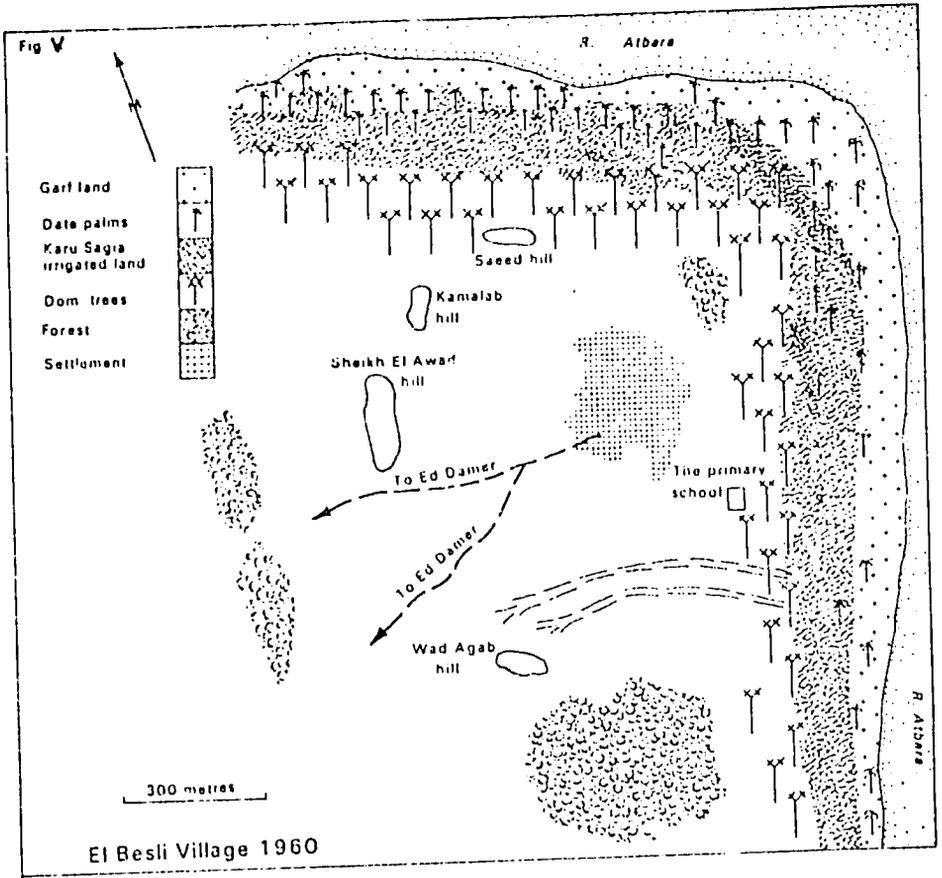
1/ The sketch map in fact indicates both the clearance of vegetation and the erosion of the gerf lands by the river.

2/ See A. Rapp, Sudan, in Rapp, Houreau and Lundholm (eds), Can Desert Enchroachment Be Stopped? Ecological Bulletin, No. 24, Stockholm, 1976, p.

soil erosion and causing desertification in various parts of the semi-arid zone in Sudan.<sup>1/</sup> All these factors seem to have contributed to the southern advance of the desert line, to cover all the lower Atbara area. (See Fig. IV).

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<sup>1/</sup> See E. Eckholm and L.R. Brown, Spreading Deserts: The Hands of Man, World Watch Papers, No.13, August, 1977, pp.9-10.



SOURCE: H.A. ABDEL ATI (1979)

5. The Implications of Changes on the Economy of the Area :

The marked drop in the amount of the river waters passing down stream and the disruption of floating wood collection and fishing activities caused by the erection of Khashm el Girba dam on the one hand and the drought of the late 1960's on the other, has combined to agitate and reshape the economy of the lower Atbara. Here an attempt is made to assess the implications of those changes on the two pre-existing major economic activities, namely, agriculture and livestock raising.

5.1. Agriculture :

Being the major economic activity, agriculture was the activity most affected by the erection of the dam and the environmental changes that occurred. The reduction of the river water, the loss of cultivable lands as a result of erosion of the river banks and the drop in rainfall levels in the atmur lands were the prime factors of change. The implications of this were enormous on all aspects of agriculture including land ownership, the crops and cropping systems employed, cultivation methods, and consequently, production relations.

As a result of the control measures over the River Atbara waters applied by the Khashm el Girba dam authorities, the "normal" flow of the river is restricted to three month (August-October), and by January or at most February, the river is completely dry when most of the water pools disappear. As a result of this and the variations in the time of opening the dam gates from one year to another, on the one hand, and the high intensity of haddam on the other, both magat and gerf cultivation have ceased to exist.

The traditional irrigation system by swari also had to be changed and replaced by diesel pumps' irrigation. This change was necessitated by :-

- a. the limited capacity of sagia<sup>1/</sup>. This made it idle for over three quarters of the year particularly with the high elevation, of the land to be irrigated, caused by haddam;
- b. the continuous changes in the river course that was difficult to cope with by changing the location or site of the wooden wheel because of its bulky size and the special skills it require in addition to the high costs involved;

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<sup>1/</sup> On the main Nile the maximum capacity of the sagia was 5 feddans when the river is at its highest level but on average it rarely exceeds 2.5 feddans.

- c. the loss of the gerf and atur lands that necessitated the use of a more efficient irrigation machinery to allow the maximum use of the available land. Equally important it seems, was the intention to use the area that had been occupied by fodder crops for the sagia bulls; and
- d. probably, the reduction in the amount of wood and livestock in the area after the construction of the dam.

As a result of all these the number of swari in the area started to decline and gradually replaced by diesel pumps (See table 4). But inspite of the obvious economic advantages of this change, it had a more serious consequence stemming from the inability of the vast majority of producers to buy pumps. This led to the emergence of a landlord class, providing irrigation water to small farmers on a 50/50 share-cropping basis, for the first time in the area, thus altering the pre-existing sets of production relations.

Table 4

<u>Methods of Irrigation in Lower Atbara</u>				
<u>Before and after the K. el Girba Dam</u>				
<u>% of farming population</u>	<u>Methods of Irrigation</u>			
	<u>Flood</u>	<u>Sagia</u>	<u>Pump</u>	<u>Rain</u>
Before the Dam (1964)	42	53	10	15
After the Dam (1978)	25	10	64	1
Difference (%)	-40.5	-69.7	+54.0	-93.3

1/ Source: H.A. Abdel Ati (1979) Op.cit., p.61.

The second major change in agriculture was that related to the crops cultivated. The change have took the following forms:-

a. Most of the fodder crops like lubia (Dolocis lablab) and dura (sorghum vulgare)<sup>1/</sup> on the gerf lands, as well as dukhn and dura of the atmur lands disappeared. The former as a result of erosion, the latter as a result of rainfall defeciencies.

b. The drop in the moisture content of the river bed soils and the annual variations in the time and course on which the river flows, led to a sharp drop in the intensity of magat cultivation.

c. The cultivation of fodder crops on the karu land that was practiced by some farmers to feed domestic animals, also gave way to dura and other food crops gradually with the decline in the numbers of animals raised and this in fact reflect the competition between man and animals for food

d. The thirst-resistant and low-water demanding crops started to occupy proportionally large areas of the karu lands. These include, for example lubia, the only fodder crop that is still grown on a relatively large scale, and groundnuts in some areas. Although the area under these crops is very small, its

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<sup>1/</sup> Dura was cultivated on the gerf lands to be cut green several times as animal fodder locally known as buttig

significance arise from the exustion of soil and the dissentegration of its particles caused when harvesting groundnuts for example. Both of these tend to reduce soil fertility and hence its productivity.

e. The agricultural cycle also experienced the change as cultivation became restricted to the damira season and the early days of the winter. That means the dissentigrated soil becomes subject to the strong north-easterly winds for most of the winter months. The evidence of this effect is the deposits of the riverine fine clay soil now found in the northern fringes of the Butana, east of Ed Damor.

In a survey conducted in 1978, food crops (dura, dukhn and vegetables) were grown as the major crops by about 91% of the farmers, and occupied the largest proportion of the cultivated land. This implies that the decision regarding what to cultivate is largely influenced by the family food requirements and emphasizes the assertion made earlier about the competition between man and animal, that was obviously concluded in favour of the former. The

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<sup>1/</sup> For an elaboration see H.A. Abdel Ati (1979) Op.cit., pp.64-66.

problem of land shortage is further stressed by the decline of the karu land fertility as a result of the continuous use of it, and the loss of all other means of fertilization (natural, traditional or artificial) that was caused by the blockage of the river silt, the sharp drop in the numbers of livestock in the area, and the poor financial conditions of the farmers.

Another important change experienced was that related to agricultural land ownership as it is shown in table (5) below. It is clear from the table that the ratio of those who cultivate hired lands has increased substantially, although in terms of numbers land hirers are still far less than private holders. The reason for this contradiction is a statistical one that emerged from the negligible number of land hirers prior to the construction of the dam.

Table 5.

Land Ownership and Size of Plots Before  
and After the Dam. 1/

: % of farmers	: Type of ownership				: Plot Size (in feddans)			
	: Private : land	: Hired	: Govern- : ment	: Comm- : un- : al	: Under : 3	: 3-4.99	: 5-9.99	: 10 and : over.
Before the dam (1964)	69	24	4	3	64.7	15.3	12.7	7.3
After the Dam (1978)	59.5	31.7	5.8	3	70.2	13.5	4.8	11.5
Degree of Change	-13.8	+32.0	+45.0	0.0	+8.5	-11.8	-62.2	+57.5

1/ Source: Compiled from H.A. Abdel Ati (1978), Op.cit., Table VII and VIII, pp.62 and 63.

(≠) Government lands, refer to all unregistered lands that were used by local farmers, mostly situated away from the river around the various Khors and Mayaait (water encatchment areas) that develop in the northern Butana during rainy seasons.

However, although private owners constitute the highest ratio among farmers, almost 70% of them have lost their private lands over the first 15 years that followed the dam construction. Closely linked to this was the decrease in the sizes of cultivated plots from an average of 3.5 feddans in 1964 to 3.0 feddans in 1978. The reduction in farm size and intensity of private ownership can be explained, other than the loss of gerf and atmur lands, by natural population increase and the influence of inheritance (mainly of karu lands), and the selling of land that could be caused by migration, the uneconomic size of the land or in settlement of debts. Both of these interconnected changes indicate the formation of two distinct social groups, an increasing group of small holders and land hirers and an emerging class of landlords.

Migration loss of land and the incoming of some nomads from the northern Butana to settle by the river banks, have also contributed to the presence of wage labourers in the area. Again although the ratio of farms entirely dependent on wage labourers, is generally small (about 12%), it is almost double its size before the dam (7%). Another development in

agriculture was the replacement of traditional tools and implements such as selluga, gussabiya and the wooden plough by more modern equipments such as tractors that increased gradually with the increase of landlords and private scheme owners. It can thus be said that, the increase in the intensity of land hiring and renting, the use of wage labourers and the hiring of modern agricultural technology (pumps and tractors) all led to the breaking down of the "self-sufficiency of the farm unit that in the past used to operate on its own land using family labour and privately owned agricultural equipments.

#### 5.2. Livestock :

It was mentioned previously that the numbers of livestock were cut drastically over the last two decades. Under the pressure of droughts from the late 1960's onwards a large proportion of the Aliab and other nomadic groups that used to occupy the extreme northern parts of the Butana started to move southwards putting more pressure on the natural pastures around wadi el Hawal and el Awtaib. In fact the heavy concentration of indigenous and incoming tribal groups around the few water points in the area .

Um Shadida and the concomitant overgrazing resulting from the imbalance of animal/land ratios has been accused for causing desertification in the area.<sup>1/</sup>

On the riverine lands, animals decreased as mentioned previously, gradually with the diminishing of fodder production and the demand for their power in agriculture declined. The ratio of settled population raising animals dropped from 84% in 1964 to 65% in 1978. Most significant, perhaps, was the drop in the average number of animals raised per household as will be shown later. A large number of cattle died during the 1968-69 season when an epidemic disease, locally known as el Hud, hit the area. In fact about one third of the population surveyed in 1978, reported losing their herd during that season as a result of the disease, but the remaining two thirds accused water shortages and poor pastures for that decline.<sup>2/</sup> This seems to indicate that water shortages and pastures have influenced the nomadic and semi-nomadic population that represent the largest proportion of animal owners.

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<sup>1/</sup> The Northern Region, A Report on the Natural Resources and the Development of Nomads in Shendi Rural Council, Ed Damer, Jan. 1982, pp.13-16.

<sup>2/</sup> See H.A. Abdel Ati (1978), Op.cit., pp.66-69.

In a report in 1969, El Sabooni mentioned that a total of 11,965 heads of animals, representing about 93% of the animal wealth of Al Magran Omediya, were lost between 1964 and 1969.<sup>1/</sup> From table 6 below it is clear that the least affected among the Sheikhships was Gersi, that was basically a nomadic area and goats were the least hit among the raised animals. This, however, does not mean that the loss wasn't enormous, as the loss ratio in Gersi area was 85.7% and over 90% of goats were lost, (See table 6).

Table 6  
Animals lost in the Lower Atbara 1964/1969<sup>2/</sup>

Sheikhship	No.	Camels		Cattle		Sheep		Goats		% loss: Ratio
		1	2	1	2	1	2	1	2	
Al Magran	88	-	205	1	618	7	755	48	96.6	
El Gubba	22	3	89	10	845	78	969	26	93.9	
Gangari	1	2	140	4	681	55	660	65	91.5	
El Bosli	19	1	174	10	744	23	689	81	92.9	
El Omerab	5	-	154	1	786	-	645	35	97.7	
Umm Sunta	10	-	7	-	567	27	1070	87	93.1	
Gersi	59	2	46	-	706	52	1210	235	85.7	
<b>Al Magran Omediya</b>	<b>204</b>	<b>8</b>	<b>816</b>	<b>26</b>	<b>4947</b>	<b>242</b>	<b>5998</b>	<b>577</b>	<b>93.5</b>	
Loss Ratio by Type			96.1%		96.8%		95.1%		90.4%	
1984 年 No.	4		12		112		267		395	
Loss Ratio	98.0		98.5		97.7		95.6		96.7	

\*(1) before the dam, (2) after the dam

\*\* The 1984 figures are based on an assumption of a 5% annual loss rate based on the 1969 figures

<sup>1/</sup> See I.A.El Sabooni, A Report on the Problems of the Lower Atbara, Nile Province Headquarters, Ed Damer, 1969 (in Arabic)

<sup>2/</sup> Ibid., p.4.

Although one doubts whether the loss was as big as that reported by El Sabooni, no evidence to disprove it is available. The drop in the numbers of nomads and semi-nomads is quite noticeable and the productivity and quality of these animals has obviously been negatively influenced by the long distance and durations they travel. Furthermore, in 1978, it was found that about 5% of the population does not raise any animals at all, which is quite strange by all standards for any rural community in northern Sudan.

In summary, however, the massive reduction in the number of livestock in the area as indicated above, can be attributed to: (a) the epidemic of 1968, (b) the migration of nomads and semi-nomads southwards towards the inner Butana, (c) the large sales of animals by the settled population under the pressure of crop failures and the loss of other income sources, (d) the death incidence caused by the drought and (e) the rocking prices of grain (dura) that is to be covered, at least partly, by the sales of livestock. For example in 1983 the price of a sack of dura was between 50-60 Sudanese pounds and that of a sheep was in the same range. In 1984 the dura prices shot up to LS. 150-180 while

livestock prices remained at the same level and even declined over the last few months under the pressures of drought, higher grain prices and competition from the drought hit livestock of Western Sudan.

The large scale of the drought's effect, has also caused various conflicts between various tribal groups as, for example, those occurring around water points in the southern parts of Northern Butana, and those between nomads and settled population close to the Atbara river. These latter occur as the inner Butana nomads are compelled, under drought conditions and the expansion of Khashm el Girba scheme, to drive their animals around the scheme from the extreme south-east to the extreme north-west of the Butana, i.e. the lower Atbara.<sup>1/</sup> By so doing these nomads come into direct contact with the settled population for long periods and so frictions occur. The long dry seasons are known to be times of high animal sales, so the nomads prefer to stay close to the market, at Ed Damer, as long as possible. Since the River Nile is blocked by urban settlements and the deep and probably, wet Butana is too far, these nomads find no alternative watering place other than the river Atbara, thus, going into conflicts with farmers, especially when crop damage occurs.

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<sup>1/</sup> See M.Sh. Osman and M.E.El Hag (1974) Op.cit., p.100

6. The Economic Significance of Ecological Changes in the Lower Atbara :

An ecological change of the magnitude described above will obviously influence the overall socio-economic patterns existing in the area where that change take place. In the Lower Atbara that was reflected in the various aspects of the economy but most markedly it appeared in the changes in the types of economic activities practiced, income levels and the demographic structure, that are discussed below.

6.1. Occupational Changes :

The change of economic activities was a natural response to the changing environmental conditions that, as mentioned earlier, included the drop in rainfall levels and the shrinkage of arable lands that caused the drop in the number of livestock and its owners as well as that of the farming population. Table 7 below provides a summary of these occupational changes that occurred in the area between 1964 and 1978 :

Table 7.  
Major Occupations in the Lower Atbara Area  
1964 and 1978<sup>1/</sup>

: Type of Ec. Activity :	% of Population engaged :	
	1964	1978
Agriculture	92.0	69.3
Nomadism & Animal herding	2.0	0.7
Fishing	2.0	0.7
Wood cutting & collection	0.7	0.0
Commerce and Trade	0.0	4.0
Handicrafts	0.0	11.3
Wage Labour	3.3	14.0
All activities	100.0	100.0

1/ Source: H.A. Abdil Ati (1978) Op.cit., p.78.

Note: These represent the economic activities considered "main" by the population and a large number might be practicing another activity but as a secondary activity.

From the above table the following can be noticed:-

- a) Over half the population experienced a change of occupation,
- b) there is a massive reduction (by about a third) in the farming population ratio,
- c) the handicrafts that was only a subordinate activity or a source of extra-income in the pre-dam period, developed into being the major activity of over 11% of the population,<sup>1/</sup>
- d) there is a substantial drop in the ratio of those practicing nomadism or animal herding as their major economic activity,
- e) the presence of trade as a major economic activity in the area for the first time,<sup>2/</sup> and
- f) the enormous increase in the ratio of wage-labourers that is more than tripled. This is one of the most serious economic and social consequences of that change as it influences income distribution and reflects inequalities in land distribution and/c ownership.

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<sup>1/</sup> It might be interesting to note that during a visit in 1984, it was found that the Sa'af, the main raw material for handicrafts in the area is usually bought from Ed Damer urban market, for which it is supplied from the upper areas of the River Atbara.

<sup>2/</sup> This doesn't mean the absence of trading altogether in the area, but it could have existed as a secondary job. However, this might be explained by the close location of the area to the urban markets of Ed Damer and Atbara, the subsistent nature of the local economy and, probably, the lack of any marketable surplus that could have encouraged the growth of shops and local markets.

## 6.2. Income Levels and Distribution :

The disappearance of certain economic activities in the Lower Atbara, and the shrinkage of others, has caused a real drop in output and hence in the level of incomes and the standard of living in the area. According to El Sabooni the per capita income decreased in the five years immediately following the construction of the Khashm el Girba dam, to 49.7 Sudanese pounds in 1969, as opposed to 137.6 pounds before the dam.<sup>1/</sup> Without any regard to inflation, changes in crop prices or any other factor that could have influenced the per capita income level, the drop is substantially high (about 64%). Although these figures contradict the estimated number of population in the same report and although no clear definition of income or how it was calculated is provided, the thing that could have made the results less reliable, a survey conducted in 1978 seem to confirm El Sabooni's findings though in a far/<sup>less</sup>significant way. It was found that :-

- a) 56% of the population in 1978 earned under 100 Sudanese pounds per year, as opposed to 51% in the same income bracket prior to 1964, and

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<sup>1/</sup> See I. A. El Sabooni (1969), Op.cit., Supplementary 6, p.2.

- b) The incomes of about 9% of the population has fallen down (mostly from over 100 to under 100 pounds), in contrast to the increase in the ratio of those earning over 400 pounds from 5.3% in 1964 to 8.7% in 1978. <sup>1/</sup>

The erosion of middle income groups usually indicate the rising inequality in the distribution of wealth. Such an equality is mostly induced in rural areas, by the differential access to modern-sector facilities,<sup>2/</sup> which becomes more effective when the problems of economic growth are caused by environmental conditions rather than any other factors. The access, to the relatively modern technology, attained by some of the better off section of the population (pump owners and landlords), that resulted in further income disparities was induced by the interplay of a number of factors, among which are :

- a) The replacement of the traditional Sagias by diesel pumps as the former failed to cope with the changing circumstances caused by El Girba dam.
- b) the low incomes generated by the majority of farmers as a result of the shrinkage in cultivable lands and the decline in the non-agricultural income sources. This in fact made the dependence of small producers on pump owners inevitable as they cannot afford to buy their irrigation machinery.

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<sup>1/</sup> See H.A. Abdel Ati (1979), Op.cit., p.77.

<sup>2/</sup> For an elaboration of this, see G.D. Coleman and F. Nixon, Economics of Change in Less Developed Countries, Phillip Allan Publishing Ltd., London, 1978; Also M.P. Todaro, Economics for a Developing World, Longman Group, London, 1979.

- c) The high intensity of land sales undertaken by small holders and migrants who were pressed by factors such as high operation costs, insufficient production, low incomes or the uneconomical size of the plot operated. This, in particular, contributed significantly to the emergence of some landlords who amalgamate a number of small plots to hire them on share-crop basis, and,
- d) the policies adopted by the provincial authorities at the time, in its attempt to rescue the area. The effort was largely one of relief operation but in some cases it involved the issuance of licences and provision of financial support to some agricultural scheme owners.<sup>1/</sup>

### 6.3. Demographic Changes :

From the previous discussion of the population characteristics, it is clear that there is a high rate of outmigration from the area, imposed primarily by the environmental changes that occurred. Migration is indicated by the low rates of population growth as well as the imbalance between the two sexes among various age groups (See Section 2.2.). Migration in the lower Atbara involved two forms of human mobility and these are :-

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<sup>1/</sup> For an elaboration See H.A. Abdel Ati (1979), Op.cit., pp.80-82.

- 1) Migration involving only a part of the family, mostly the adult males, and these are directed to Khashm el Girba Scheme area, Ed Damer and Atbara towns, Khartoum and other urban centres as well as abroad. In this case migration is either seasonal or of a temporary nature.
- 2) The movement that involves all members of the household and this is represented by :
  - a: The riverine population who lost their lands or their economic base in the Lower Atbara area for a reason or another and moved outside the area, mostly to Ed Damer town.<sup>1/</sup> Here mobility is both geographical and occupational as it involves the change of economic activity, and,
  - b: the nomadic population that moved with its livestock southwards into the Butana in search for pastures and water.

The selectivity of migration in terms of age and sex, has obviously left some implications on the area. The males migration has contributed to the decrease in the intensity of marriages, thus increasing the marriage age particularly for women. In fact in some villages economic conditions has deteriorated so much that marriage takes place for a quite a number of years. In

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<sup>1/</sup> Note, A very large proportion of the inhabitants of el Frea' el Gadeed residential quarter in Ed Damer, have their origins in the Lower Atbara.

El Gmerab Sheikhship for example, it was reported that no marriage has taken place over the first five years that followed the erection of Khashm el Girba dam.<sup>1/</sup> This sex selectivity of migrants also had a negative bearing on the economy as it lead to a reduction in man-productivity and to the increase in the numbers of dependent and economically inactive population.

Furthermore the intensity of migration in some areas was so high that it led to the complete depopulation of those areas, such as the case of El Nateela and El Khalafallah villages.<sup>2/</sup> In a field trip in 1984, it was also observed that the decline of population trend is still going on as the population of some villeges such as El Basli, El Omerab and Gersi seem to be less than what it was in 1978 when the first survey was made.

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<sup>1/</sup> See, I. A. El Sabooni (1969), Op.cit., p.16.

<sup>2/</sup> Ibid., p.14, Also H. A. Abdel Ati (1979), Op.cit., p.21.

#### 6.4. The Perception of the Problem<sup>1/</sup> :

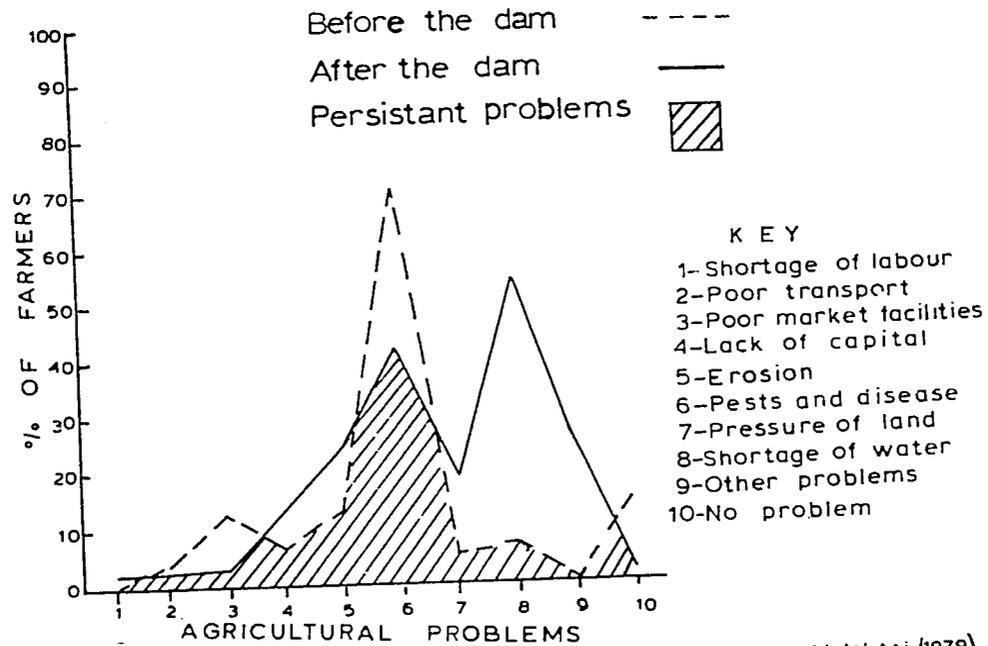
In the survey conducted in 1978, the farmers of the Lower Atbara were asked about the problems they face at that time as well as those they use to experience prior to the construction of the Khashm el Girba dam. The results are summarized in Fig. vi below. It shows a number of problems that can be described as persistent, including erosion of agricultural land, pests and disease, lack of capital and water shortages. But after the construction of the dam, some of these problems became more acute or were considered so by the farmers. Before the dam, the spread of pests and disease was considered to be the major problem by over 70% of farmers, followed by land erosion (12%), poor market facilities (9%), lack of capital (7%), and shortage of irrigation water (5%). Although rats, and sueid (smut) and asal (stickiness) disease, that are typical of dry soils and environments where they cause considerable crop damage, were widely spread in the area in 1978, they were rated second to the problem of water shortages that was considered to be the most important by

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<sup>1/</sup> All the information in this section was compiled from H.A. Abdel Ati (1979) Op.cit. pp.66-68, 91-94, and 96-100.

Fig(VI) PROBLEMS OF AGRICULTURE BEFORE AND AFTER  
THE DAM

(FARMERS PECEPTION)



Source: H.A. Abdel Ati (1979)

about 55% of the farmers interviewed. Other problems emphasized include land erosion (25%) shortage of agricultural land (20%) and the lack of capital (12%). Furthermore, no respondent mentioned having no problem in 1978, as opposed to about  $\frac{1}{10}$  th of the population for the pre-dam period (See Fig. VI).

This change of attitude can be explained by the heavy dependence on irrigated agriculture on the riverine lands in the post-dam period when the atmur lands were lost as a result of the rainfall deficiencies. Shortage of water also imply the shrinkage of riverine cultivable lands and lack of capital (i.e. irrigation machinery). It also implies the loss of cash sources such as floating wood collection, fishing and magat cultivation that were rendered by the River Atbara before the erection of the Khashm el Girba dam.

Since the long-term effect of the dam in the area downstream to a large extent depends on the responses of the local community there, the people were also asked about their feelings or attitudes towards the dam and to explain why they felt so. The results of that is shown in Fig. VII below, and can be summarized as follows:-

- a. 79% of the total farming population consider the dam to be harmful to their area both economically and ecologically, 9.50% consider beneficial, 6.5% see it as not effective either way, and the remaining 5% gave no opinions.
- b. those who viewed the dam to be beneficial attributed that to: higher incomes (4%), the introduction of new agricultural techniques into the area (3%) and the better marketing opportunities (2.5%).
- c. those who consider the dam to be harmful to the area, accuse it for causing a drop in production (44%), a drop in income levels (23%), low marketing opportunities (5%), unemployment (3.5%) and other problems (3.5%).

However, a slight differences existed when the views of farmers under 40 years of age were taken seperately, although the general trend was the same. Among these younger farmers, the ratio of those who gave no opinion or viewed the dam as not effective is considerably high when compared to the ratio of the total population, amounting to 20% and 11.9% respectively. All those who consider the dam to be beneficial (4.2%) attributed that to the better marketing opportunities than (1978) existing in the area.

But, similar to the total population the ratio of those who view the dam as harmful is extremely high (64%), and their reasons for that were the drop in production (38.6%), drop in incomes (23.6%) and the lower market opportunities (1.7%) (See Fig. VII).

The major reason for the difference between the elder and younger groups views, seems to be the greater awareness of the farmer with the problems, as they were economically active before the construction of the dam and hence knew better the scale of change. This in fact might be the reason why none of the population over 40 years gave "no idea" as an answer.

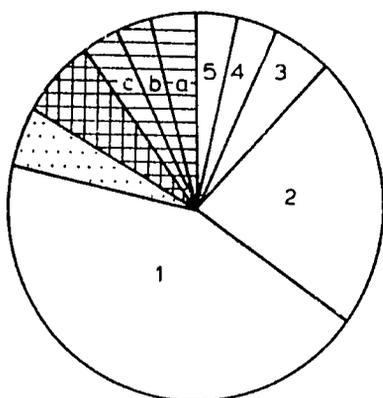
Ironically, perhaps, when asked about the things most needed for the development of their villages and the Lower Athara area in general, the inhabitants' responses didn't match the problems they stressed previously. A list of ten selected services was given for each individual to rate the four of them he feels feasible and necessary for the development of his village.<sup>1/</sup> Schools and agricultural cooperatives were the most needed and were rated first and second

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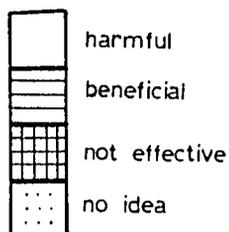
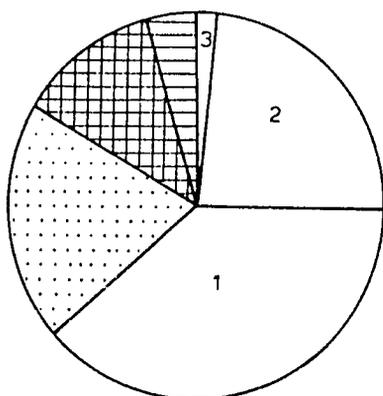
<sup>1/</sup> The rating system was 4 points to the first one, 3 to the second, 2 to the third and one point to the fourth.

Fig(VII)

(a) KHASHM EL GIRBA DAM AS PERCEIVED BY THE LOWER ATBRA POPULATION



(b) THE DAM AS PERCEIVED BY THE POPULATION UNDER 40 YEARS OF AGE



- 1 lower production
- 2 lower income
- 3 lower market opportunities
- 4 unemployment
- 5 other reasons

- a Higher Incomes
- b New Agricultural Techniques
- c Better market opportunities

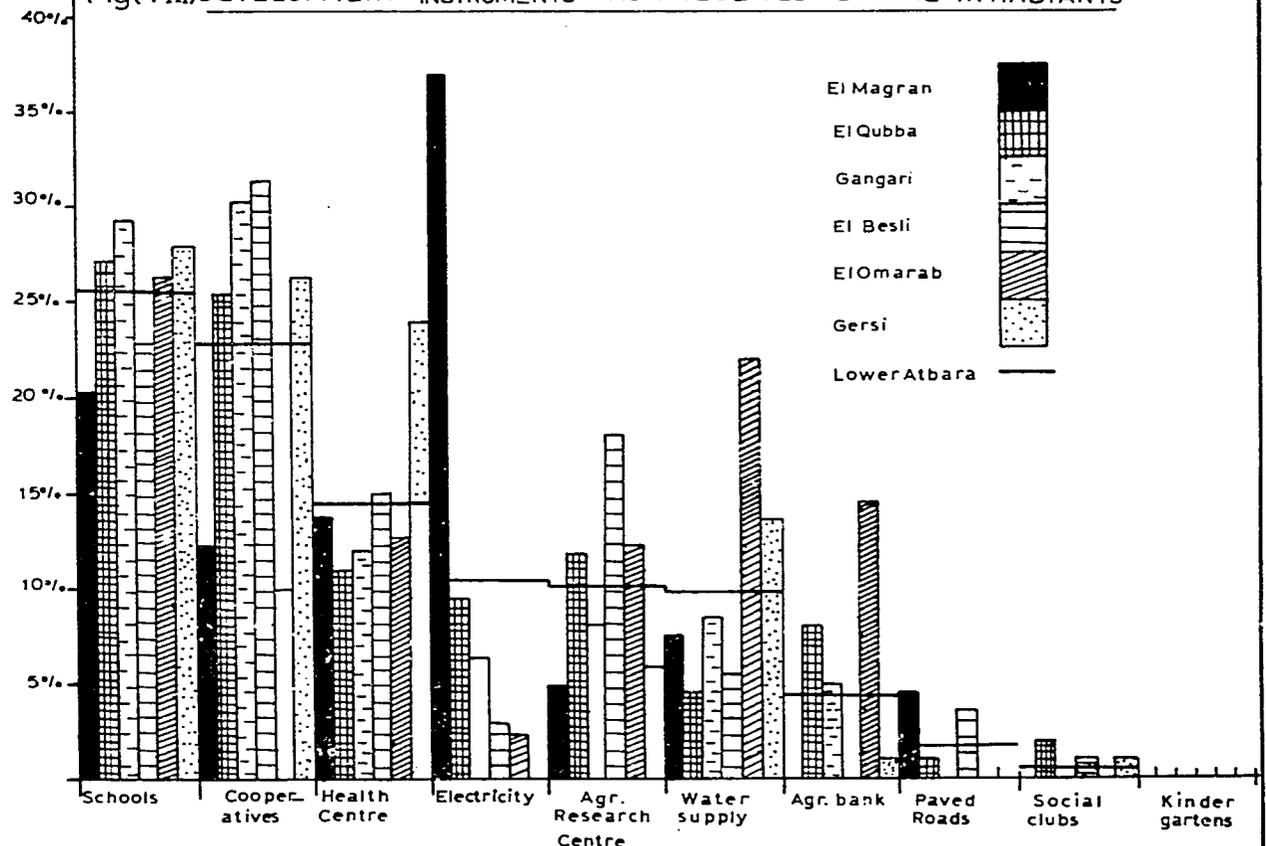
Source H.A. Abdel Ati (1979)

by 26% and 23% of the population respectively, but water supply whose shortage was considered the most important problem (Fig. VI), and for which the Khashm el Girba dam was considered harmful (Fig. VII), came sixth in the rating (See Fig. VIII).

The increase in the intensity of migration, the development in the means of transport and the closer contact with the neighbouring urban centres seem to be the major reasons for the deviation of choice here from the problems stressed earlier. This is further emphasized by the enormous variations in the services rated first in the different Sheikhships, which again reflect the influence of contacts with the urban centres and urban attitudes. To illustrate this point let us compare the service priorities of the inhabitants of Al Magran, the nearest to Atbara and Ed Damer, with those of Gersi which <sup>is</sup> the most nomadic and remotest from urban centres. For Al Magran population, electricity supply have the first priority followed respectively by schools, health centres, cooperative societies and water supply. This in fact not only reflect the assimilation by urban attitudes, but also indicates the greater involvement of the

population in urban occupations and the abandonment of agriculture as a major economic activity. It might also indicate higher literacy levels, compared to the rest of the Lower Atbara area, made possible by that location. As for Gersi Shaykhship which is about 50 kms from El Damer, its inhabitants also rated schools and agricultural cooperatives as first and second, 28% and 26% respectively, followed by health facilities (24%) and water supply 15%, but no mention was made of electricity (See Fig. VIII).

Fig(VIII) DEVELOPMENT INSTRUMENTS AS PERCEIVED BY THE INHABTANTS



SOURCE : H-A AbdelAti (1979)

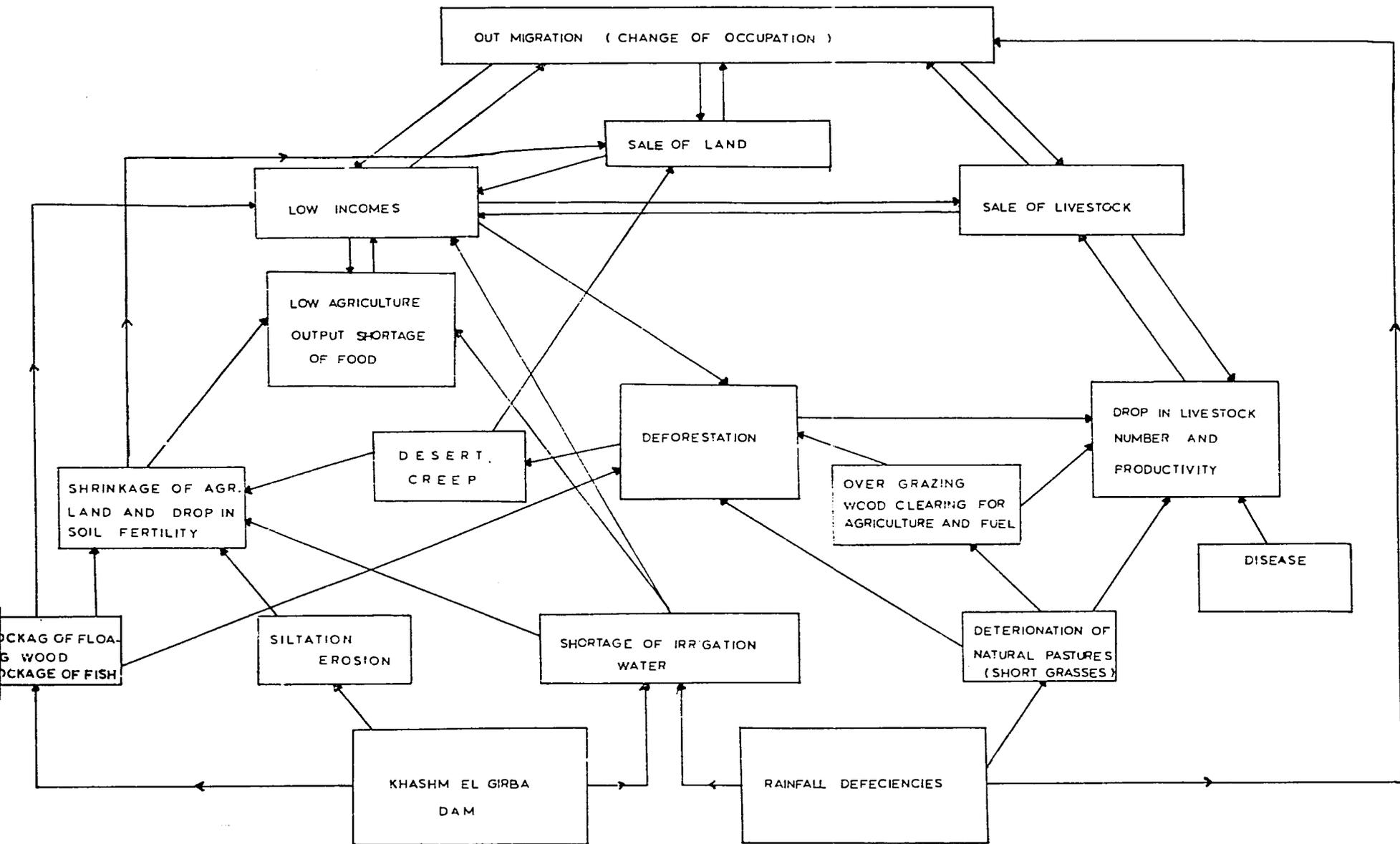
A SUMMARY OF INDICATORS AND  
CONCLUDING REMARKS

From the previous discussion a number of indicators of environmental degradation in the Lower Atbara area can be identified, varying in their intensity, significance and impact and include both physical and human factors. A number of these indicators is listed in table (8) below, in which an attempt is made to show, qualitatively, the magnitude of degradation in the study area, based on:-

- a. the quantified information provided in the text.
- b. observations made in various visits to the area between 1978 and 1984, and
- c. the perception of the local population of the different changes they experienced.

Although these indicators are subgrouped into physical, economic and demographic factors in the table, in reality it is not so easily divisible. But, as indicated in the diagram below, the problem is in fact made more complex by the interconnectedness of these indicators (Fig. IX). This interconnectedness reflects the cumulative-causational nature of man's relationship with the natural environment, i.e., his

Fig.(IX) FACTORS OF ENVIROMENTAL DEGRADATION IN THE STUDY AREA : A Schematic Simplification



impact on that environment and his response to the consequences of that impact. In some cases some indicators are so much interwoven into each other to differentiate the cause from the effect. For example, the drop in livestock numbers and the removal of natural vegetation, ignoring the drought condition, it is not easy to determine whether overstocking had caused the deterioration of pastures, or the removal of or clearance of vegetation by man had, and hence negatively influenced livestock. In other cases, it is less complex and consist mostly of a pair of factors that have a reciprocal influence on each other such as migration and change of occupation, or the low agricultural output and the drop of incomes (Fig. IX).

All these indicators share two common things. The first is their stimulation, either by the rainfall deficiencies that started in the mid 1960's, or the construction of Khashm el Girba dam in 1964. The second is that all these indicators share a trend of further deterioration, except those that have already approached the point of total collapse, such as the drop in livestock numbers of the loss of the gerf lands caused by haddam.

Table 6.  
Indicators of Environmental Degradation.

Indicators	: Magnit- : ude :	Expected : Consequences :	Explanation
1. Shrinkage of arable lands	H	further shrinkage	Caused by erosion, desert creep and areas going out of irrigation water reach.
2. Drop in farm size	M	marginal drop	Balanced mainly by out migration.
3. Water shortage	S	Continuous drop	Increase in water intake at el Girba + loss by evaporation.
4. High intensity of <u>Haboob</u> (dust storms)	H	Increase	It reflect the dryness of the area, lack of vegetation cover and disintegration of top soil particles
5. Drop of soil fertility.	M	became high	Loss of river silt + overuse of land + <u>haboob</u> .
6. Deterioration of Pastures	S	continue	Depends on rainfall conditions in Futana.
7. Deforestation	S	Slow down	Caused by blockage of river floating wood, removal and clearance of forests by men, restrictions imposed by forestry dept. and the long distance involved.
8. Change of crop system	I	Increase	Mainly a shift from food crops to Cash crops by the emerging landlord class.

Cont..

Table 8 (Cont.)

		Magnit-	Expected	
		ude.	Consequences	Explanation
	9. Sale of agric. land by small holders.	I	Intensify	Caused by migration or the uneconomic size of plot.
	10. Sale of livestock	L	Slow down or stop.	Livestock has already approached the zero level
E C O N O M I C	11. Drop in livestock No.	S	Slow down	Linked to (10)
	12. Drop in livestock productivity.	S	Continue	Drop in farmers incomes, the poorer pastures and long distance covered.
	13. Low crop output	M	Continue	Drop in soil fertility and shortage of water are the main causes.
	14. Unemployment	H	Slow down	Caused by migration & lead to migration.
	15. Change of occupation	H	Continue	Mainly away from agriculture and livestock, and strongly associated with out-migration.
	16. Drop in income level	S	Continue	Caused mainly by the loss of agric. land and secondary income sources.
D E M O G R A P H I C	17. Out-migration	H	Intensify	Caused by the combination of environmental and economic problems.
	18. Drop in marriage rates	I	Continue	Caused by migration and drop in income levels.
	19. Age Sex imbalance	L	Slow down	Migration started to involve families rather than individuals.
	20. Depopulation of certain areas.	I	Likely	Total loss of agric. land or livestock is possible, caused by any natural hazard.
	21. Disputes and Conflicts	L	Slow down	Nomads who used to compete with farmers over water, no longer move into the area and shifted southwards.

S = Severe.

H = High.

M = Medium.

I = Increasing.

L = Low.

A number of physical, economic and political factors have contributed to cause those extensive ecological changes in the area, which in turn has led to significant changes in the local economy. The most influential physical factors are the arid climate of the area and the seasonal nature of the river Atbara. The pressure to settle the Nubians of Wadi Halfa and the absence of any comprehensive pre-scheme investigation or an appraisal of the "non-economic" consequences of the dam, especially in the downstream area, represent the <sup>main</sup> political factors behind the problem. Besides, the lack of coordination and/or communication between the Dam authorities, the Provincial authorities and the local population has also contributed to accelerate the magnitude of the problem. Economically it seems that the relatively poor economic potentials of the area, seems to have made it receive less attention from both the Central and Provincial authorities at that time. Moreover, it seems that when planning the Khashm el Girba scheme, it is apparent that the preservation of the environment doesn't seem to have been rated high among other "economic" considerations.

The local authorities' position can so far be described as only peripheral to the problem and its interference was very limited and timewise far between. That role never seems to have exceeded a vision of sympathy and humanitarian grounds that materialized in some relief operations during the early 1970's. The major reason behind that "neutral" position, seems to be the lack of financial and other resources that could have been used to alleviate the problem. The only positive steps were the supply of some irrigation pumps by the Ministry of Agriculture in 1976 and the closure of some areas by the Forestry Department to protect it, and this has, in fact, denied the local population an important source of income.

To describe the position of both the local population and the local authorities, in relation to the tragic situation of the Lower Atbara, it is only fair to quote G.F. White- that "People who feel themselves unable to cope with a situation, feel it less severe than others."<sup>1/</sup>

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<sup>1/</sup> G.F. White, Organizing Scientific Investigation to deal with Environmental Impacts, in Farvar M.T. and Milton J.P. (eds) Op.cit., 1972.

That leaves the question open for research what is to be done? or more precisely, what could be done now, bearing in mind the financial situation of both the local and regional authorities? How can we revitalize the local economy and recreate its self-sufficiency? What are the necessary adjustments that could be made to rehabilitate the local environment and return back to it some of its lost properties, and prevent further degradation? How and to what extent can the local population participate in the effort of maintaining their environment?

These questions cover a wide spectrum of activities so as to enrich soils <sup>and</sup> reproduce and protect the natural vegetation in order to check or, at least, slow down the speed of the spreading desert. They also raise the need for two important qualities that must characterize any scientific investigation attempting to deal with the phenomenon. These are:

(a) the interdisciplinary nature as it requires the involvement of specialists from a number of fields, and the coordination among themselves, between them and the local authorities, and between them and the local inhabitants, and at all stages of the research;

(b) the practicality and realism both in understanding the problem and in the recommendations and future plans to be formulated to deal with the problem, i.e. to move within the financial capacities and resource base of both the local authorities and the local population.

Similar studies so oftenly boil down into a financial-constraint - explanation, which in fact reflect the inability of researchers to come out with practical and feasible solutions. But there must be a start for any effort, no matter how massive it is. Certainly there are certain things in the degeneration trend that are irreversible but many others are. Similarly, Khaskh el Girba dam is a fact and can not be remove' but doing nothing, be it by expressing unrealistic recommendations, will lead in the end to the total loss of the area, and since the whole Northern Region falls into the lower part of the main Nile, doing nothing now, means to expect the same fate now faced by the lower Atbara.

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