Agrosearch (2004) 6 No. 1 39 - 47

EVALUATION OF IRRIGATION FARMING AT OKE-OYI, KWARA STATE. NIGERIA.

[1]GBADEGESIN, A.S. and [2]ORIOLA, E.O.

[1]Department of Geography, University of Ibadan, Ibadan. Nigeria. E-Mail: adeniyig@yahoo.com

[2]Department of Geography' University of Ilorin, Ilorin, Nigeria : lolaoriola2003@yahoo.com

ABSTRACT

This paper examines farming activities under irrigation technology at Oke-Oyi Kwara state. Soil samples were randomly selected from 30 quadrats (20m X 20m) and analysed using appropriate laboratory techniques. Furthermore, copies of structured questionnaires were also distributed among the 135 participating farmers at Oke-Oyi irrigation scheme and the officers of the irrigation agency (Lower Niger River Basin Development Authority, Ilorin). The result of the soil analysis revealed high variability and low nutrient status, alarming rate of soil deterioration, dwindling farmers' participation and inefficient management of the irrigation infrastructure in the study area.

Keywords: Irrigation, Sustainable Development, Sub-humid, Kwara State

INTRODUCTION

The world is undergoing a climatic change (Middleton, 1997). A major tell tale of this change is the widespread increase in global temperature. Such change in climate and by implication the temperature would influence an increase in moisture deficit particularly in semi-arid and even the more humid areas. Consequently, the change will imply that existing agriculture regions would increase reliance on irrigation. With the global climatic change, with the rapid encroachment of the Sahara into hitherto wet areas of the middle belt, the need for irrigation becomes more pressing considering the desire of government to assure food security and improve rural welfare.

The government of Nigeria has shown great interest with the objective of promoting agriculture in water deficient areas in recent time. Scholars also continue to address the relevance of irrigation in agriculture and also evaluating government's strategies in improving agricultural productivity through irrigation.

The works of Olokesusi (1991) and Sangari (1991) on irrigation in the semi arid parts of Nigeria addressed the technology and methods of assessing irrigation environment vis-à-vis the socio-economic implications. Oriola (2004) examined the dynamics, translocation and distribution of soil chemical properties in Oke-Oyi irrigation project of the Lower Niger River Basin Development Authority, Ilorin. This paper tries to evaluate irrigation projects through a study of the physico-chemical properties of the soils and the socio-economic parameters of irrigation farming that could facilitate sustainability of crop production in a sub-humid part of Nigeria using Oke-Oyi irrigation scheme as a case study.

THE STUDY AREA

The study was carried out at Oke–Oyi Irrigation project site of the Lower Niger River Basin Development Authority (LNRBDA) Ilorin, Kwara State, Nigeria. The LNRBDA was re-established in January 1994 as the twelfth River Basin Development Authority in the country. The activities of the Authority cover the entire geographical boundaries of Kwara State and part of Kogi State south west of river Niger (LNRBDA, 1999). The project is located at Oke–Oyi, the Headquarters of Ilorin East Local Government Area of Kwara State (Fig 1). It is about 25km away from Ilorin on Ilorin – Share road. The project area is bounded in the north by a rivulet flowing into Oshin River. It is bounded by the old Ilorin – Jebba road in the south;, in the east by river Oshin and in the west by National Electric Power grid line.

The project is a viable small scale irrigation scheme, which became fully operational in 1994. Presently, the land area (about 250 ha) falls in the western upland physiographic region of the state. Oke-Oyi irrigation scheme land has an average height of about 360m above sea level and a slope of less than 10 degrees. The terrain slopes down along the N.W. and S.W. direction, draining into river Oshin which forms the eastern boundary. Intermittent streams giving rise to prominent depressions within the project area characterize the land. The area is completely under the influence of moist maritime southwesterly monsoon from the Atlantic Ocean between April and October. This endows the area with tropical climate of distinct wet and dry seasons. This area experiences high temperatures all the year round by virtue of its location within the tropics. The highest air temperature of 35^0 C is often recorded in March/April and the lowest (25^0 C) is recorded between July and August. The area belongs to dry sub-humid climatic regions (Olaniran, 1988). This climatic condition no doubt dictates the human activities in the study area with various agricultural practices including traditional irrigation agricultural system dominating the rural landscape.

MATERIALS AND METHODS

Soil samples were taken from irrigated farmland. Thirty (30) quadrats, measuring 20m x 20m each were demarcated on irrigated maize farmland. Fifteen quadrats were selected systematically (at every other quadrant). In each of these fifteen quadrats, five sample points were randomly located and the 75 soil samples were bulked to 15 at pre-determined depths of 0-15cm and another 75 samples for 15-30cm soil depth. Sampling from predetermined depth was to ensure comparability between samples collected from different sample quadrats (Gbadegesin, 1984). This study confines analysis of soil characteristics to the top 30cm of the soil profile because the roots of plants such as maize are usually concentrated in the top 30cm of the soil profile where the bulk of plant nutrients are concentrated (Ekanade, 1994). For example, maize roots concentrate in this zone. (Babalola, 1980 and Gbadegesin, 1984). The 30 soil samples were collected in polythene bags and later air-dried in the laboratory.

Emphasis was placed on both the physical and chemical soil properties directly reflecting soil fertility conditions and the productivity of soils. The soil properties include particle size distribution, bulk density and water holding capacity, exchangeable cations (Ca^{2+}, Mg^{2+}, Na^+, K^+), exchangeable acidity, soil pH, available phosphorus, cation exchangeable capacity, organic matter content and total nitrogen. All these were analysed using standard routine laboratory procedures. The particle size distribution was determined by the hydrometer method (Bouyoucos. 1965); bulk density was determined by the core method (Blake, 1965). Water holding capacity was determined by first saturating the soil samples with water and later subjected to gravitational draining for 24 hours. To prevent moisture loss, the samples were covered with polythene. The samples were later weighed and oven-dried for 24 hours at 105^0c temperature. The loss in weight was expressed as a percentage of the oven-dried soil.

pH was determined potentiometrically in 0.1 M calcium chloride solution using a soil to calcium ratio of 1:2 (Peach,1965) Organic matter content was determined by the Walkley and Black (1934) method to obtain organic carbon before multiplying by a factor of 1.724 to obtain organic matter content. The Kjeldahl analytical procedure was used to determine the total amount of nitrogen in the sampled soils. The method involves the digestion of soil samples with concentrated sulphuric acid (H_2S04) and auto analysis of the digest to determine the nitrogen concentration in the soil samples while available phosphorous was by Bray No. 1 extraction (Bray and Kurtz, 1945) and Osborne (1973) colorimetric method. Extracts of soil samples were leached with 1 N ammonium acetate; the concentration of calcium, potassium and sodium were then determined by flame analyzer and Magnesium by atomic absorption spectrophotometer.

All the 135, (participating) farmers at Oke-Oyi irrigation site, at the time of data collection, were included in the questionnaire survey. Farmers that were allocated plots where the soil sample quadrats fell were identified and interviewed specifically on the management of their farms, in addition to the copies of questionnaire that were distributed to all the farmers using irrigation facilities. The data collected from the 15 farmers were further subjected to inferential statistical analysis.

Two sets of questionnaire were used in collecting socio-economic data. The first set was designed for the management of LNRBDA. The questionnaire-sought information from the river basin authority on the background of the project, the activities, and services provided to the farmers and communities in their area of operation, prospects and problems among others. The second set of the questionnaire was administered to the participating farmers in the project site. This was used to gather information on crops planted, reason for their choice of crop, site, crop output for their farm, income from their farm, fertilizer usage, water supply and assistance from government agencies (LNRBDA, Kwara State Agricultural Development Project and Ministry of Agriculture and Natural Resources) soil maintenance methods, health related problems and prospects of the project as perceived by the people.

Mean and standard deviation were used to summarize the data while coefficient of variation was used to test the variability of the soil nutrients and organic matter on irrigated farmlands.

RESULTS AND DISCUSSION

Soil Fertility Condition.

The results of the soil analysis presented in table 1 revealed that the fertility status of the soils under irrigation at Oke –Oyi is low (Okalebo et al, 1993) and highly variable. This is because the contents of the entire soil nutrients relating to soil fertility are very low and vary highly except potassium and total nitrogen whose contents are moderate and high respectively. Generally, the silt and clay contents account for less than 20% of the textural composition of the soils. The bulk density values in the study site varied between 1.7 Mg/m^3 and 2.2 Mg/m^3 with a mean of 1.8 Mg/m^3. According to Kumar and Roland (1993), bulk density in excess of 1.6 Mg/m^3 will seriously inhibit roots growth in many plants. This suggests that high bulk density will reduce crop yield level. Furthermore, the water holding capacity is relatively low for crop survival in both layers. The holding capacity is homogenous but slightly variable in the topsoil.

The low soil fertility condition being experienced at Oke-Oyi irrigation site can be improved upon through better soil management and controlled agriculture practices. The report from the River Basin Authority was that a routine soil test is done every three years to check the anomalies that may be detected and make recommendation for appropriate action. According to the project officer, the last test was carried out in 1994. Furthermore, all the soil nutrients deficiencies and excesses are to be controlled and monitored with the involvement of the participating farmers. Daniel (1987) observed similar anomalies in the soils of Kano irrigation project and recommended regular soil test as a monitoring process for good harvest. Such a test will give adequate and regular information on the soil conditions and assist in the strategy for maintaining a good soil nutrient status on irrigation fields. There is no doubt that this action is very important for sustainable crop production on irrigation farmlands

Irrigation Infrastructure Maintenance and Management.

The Lower Niger River Basin Development Authority has the mandate to provide irrigation infrastructure at their various irrigation project sites, Oke-Oyi inclusive. In the light of this, a weir (47m long) and other irrigation gadgets were built and provided respectively. The weir is to impound adequate water for irrigation activities at Oke – Oyi project site (LNRBDA, 2002).

The condition of the irrigation farming equipment is presented in table 2. The weir is already silting up while the pumping machine is old and it breaks down very often. The water pipes are old and insufficient to meet the demand of the participating farmers. Funds are not readily and adequately released on time for the day to day maintenance of the irrigation infrastructures. In fact, at the time of this study the project vehicle was grounded. Consequently, water distribution has not been regular.

However, the Authority as part of maintenance and management measure evacuate the silt from the weir occasionally (when fund is available), increased the height of the first weir and recently constructed a new weir (50m long) to impound greater volume of water (10million m^3) for irrigation. The design keeps the old weir as silt trap and prevents the new one from silting. As part of the design, the new weir has a sway trap that gives way for easy flow of excess water when the volume of water is high. Two new tractors were purchased in 2001 and the 2.5km road network in the project site is maintained regularly for easy accessibility of tractors and the farmers. Other equipment provided for irrigation at the site includes irrigation water pipes and pumping machine.

It is apparent that the sustainability of the irrigation infrastructures requires adequate funding. However, government has been finding it difficult to provide such fund. Therefore, the goals and objectives of the Basin Authority are not being fully achieved.

Participating Farmers as Stakeholders.

Over the years, farmers have been growing crops on the land prepared by the LNRBDA. The common crops grown are maize, rice, okro, tomatoes, pepper, onion, watermelon, beans and guinea corn among others. There is no doubt that the enthusiasm of these farmers was greater when the re-organisation policy made Ilorin the Headquarters of LNRBDA in 1994. As many as 400 farmers registered during the 1995/96 farming season (Table 3). It is very clear that production has not been consistent (Table 3). The production was highest in 1995/96 farming season (280 tons of maize). The period can be regarded as the beginning of a new era in the life of LNRBDA. Four hundred (400) farmers participated and the Authority was perhaps better funded as a 'new creation'. The anticipation of the farmers was that they would have adequate access to irrigation facilities and other inputs for increased crop production.

The following season was poor and the maize yield dropped to 2.07tons /ha compare to the previous 5.6 tons per hectare during 1995/96 growing season. Although production increased gradually to 4.05tons / ha in 1997/98, 4.13 tons /ha in 1998/99 farming season and 4.50 tons/ha in 1999/2000 but it could not be sustained it dropped drastically to 0.9 ton/ha in the year 2000/2001, farming season.

The very low output in 2000/2001 was as a result of the abandonment of the irrigation farm for daily paid labourers' at the new weir construction site. According to the project officer, "the land was prepared in anticipation that farmers will come over to cultivate the plots". It was late before the Basin Authority decided to cultivate the plots by itself. Aside from that, there was no labourer to harvest the crops after maturity hence a considerable proportion of the poor harvest was lost to rodents. The output in 2001/2002 season was better when compared with the previous year, though it was still poor because of the various problems faced by the farmers such as inadequate water distribution, poor accessibility of other farm inputs e.g. fertilizer, agriculture extension services among others.

Table 4 shows the accessibility of participating farmers to irrigation input facilities required by the participating farmers for adequate crop production in percentages. From the list, only land was readily available to the farmers. In fact, more than 75 percent of the farmers have full access to irrigated farmlands, while others have partial access with none of the farmers denied access to land at the project site.

Those with partial access are those who did not have enough. Access to other inputs was low because of the bottlenecks in acquiring them. For example, less than 10 percent of the farmers have ready access to fertilizer. Perhaps these are those who either work or have close contact with those people or agency distributing fertilizer in the State or local Government. More than 85.2% have partial access, while the remaining proportion (5.9 percent) did not have access to fertilizer.

In an informal discussion with the farmers, 80 percent of those with partial access to fertilizer remarked that they have to lobby and tip officers' in-charge of fertilizer distribution either at the State Ministry of Agriculture or Local government before they are able to get few bags allocated to them and still not at the subsidized price.

Other inputs such as seedlings, chemical/pesticides and extension services are only accessible readily or partially to those that can afford the price. The supervising agency has not been rendering these services since the re-establishment of the organisation in 1994 and abiding by the new policy that removed agricultural production and its allied services from its mandate. This has in one way or the other created some problems for the farmers. Once the inputs are inadequate one should not expect an adequate and bounty harvest.

Agricultural credit facility is another major input that the farmers do not have access to. Only about 8 percent of the farmers claimed to have access to agricultural credit facility and another 26.7 percent have partial access to this input. Majority of the farmers did not have access to agricultural credit. The source of credit has always been from friends, family and co-operative society. It is true that commercial banks and other finance houses have agricultural credit facilities but it is not accessible to the farmers in the study area because of the stringent collateral often demanded by these banks.

Another issue that is fundamental to the sustainability of irrigation is the perception of the farmers that Oke - Oyi irrigation project is a Government investment. However, the cooperative attitude of the farmers both within and outside the project area in relation to land tenure and harmonious coexistence of the irrigators and the natives can be seen as part of the farmers efforts to sustain the system. No communal clash or disturbance has been reported or recorded in the area. This is contrary to the situation in some other irrigation projects e.g. Kano, Sokoto (Jega, 1987) Omi (Afolabi, 1984).

CONCLUSION

The soils of Oke-Oyi irrigation project can be described as sandy with high bulk density and low nutrient content to support adequate maize production. Its fertility status is therefore rated low. The irrigation infrastructures at the project site were insufficient and in deteriorating condition. Therefore, water distribution has been irregular and the agency has not been able to meet the demands of the participating farmers. This was due mainly to the poor funding of the Agency. Eighty percent of the input parameters were not readily accessible to the participating farmers. Consequently, there has been a decline in the number of farmers on the scheme. Therefore, the goal and objectives of the basin authority are yet to be achieved.

References

Adefolalu, D. O. (1990) "Desertification studies (with emphasis on Nigeria)" in R. A. Vaughan (ed) *Microware Remote Sensing for Oceanographic and Marine Weather Forcast Models*, pp. 273 – 323

Afolabi J. B. (1984) "Problems of Land Acquisition and Resettlement On A Large Scale Agricultural Projects: A Case Study of Omi Dam Irrigation Project in Oyi Local Govt. Area. Kwara State. Nigeria". Unpublished M. P. A. Dissertation. University of Montana U. S. A.

Babalola, O. (1980) "Root Development in Maize and Cowpea related to Penetrometer Measurement and Soil Water Depletion" *Nigeria Journal of Soil Science* 1: 79- 93.

Black G. R. (1965) "Bulk Density" in Black C. A. (ed) *Methods of Soil Analysis* (1):374-390 A. S. A . Madison Wisconsin.

Bouyoucos, G. J. (1926) "Estimation of Colloidal Material is Soils" *Soil Science* 64: 362

Bray, R. H. and Kurtz, L. T. (1945) "Determination of Total Organic and Available form of Phosphorous in Soils". *Soil Science* 59: 39-45

Daniel, M.B. (1987) "The significance of Post-Implementation Monitoring in Land Development Projects" in Mortimore M, Olofin E.A., Cline-Cole and Abdulkadir A. (eds.) *Perspectives on Land Administration and Development in Northern Nigeria* Proceeding of the Land Resource Workshop Bayero University, Kano pp 198-209

Ekanade, O (1994) "Preliminary Investigation of Soil Patterns in Large Scale Agricultural Project in Nigeria". in A. O. Sanda and S. B. Ayo (eds) *Impact of Irrigation Projects in Nigeria's Environment*. Anchor Print Ltd Ibadan pp 40-52.

Gbadegesin, A. S. (1984) "Soil Classification for Maize Production in the Savanna Belt of Oyo State". Unpublished Ph.D. Thesis. Department of Geography University of Ibadan.

Jega, A.M. (1987) "The State, Agrarian Reforms and land Administration in Bakolori Irrigation Project" in Mortimore M. Olofin E A, Cline-Cole R A and Abdulkadir a (eds.) *Perspectives in Land Administration and Development in Northern Nigeria* Proceedings of the Land Resource Workshop. Bayero University Kano.pp141-152.

Kumar V. and Rowland J. (1993) "The Dry land farming environment" in Rowland J.R. (ed) *Dryland farming in Africa* Macmillan Pp. 19 - 45

L.N.R.B.D.A (1999) Federal Republic of Nigeria Information Brief on Activities of the Lower Niger River Basin Development Authority.

L.N.R.B.D.A (2002) "The Journey So Far. Enhancing Sustainable Water Resource Development". *LNRBDA News Letter* p1-2

Middleton N. (1997) *The Global Casino an Introduction to Environmental Issues* 99-113. Arnold

Okalebo, J. R., Gathua, K. W. and Woomer, P. L. (1993) *Laboratory Methods of Soil and Plant Analysis*. A working Manual Marvel EPZ. Nairobi, Kenya pp104-107.

Olaniran, O. J. (1988) "Climate and the Planning of Agriculture Land Use in Nigeria.The N R B D A area as A Case Study" *Journal of Agric. Meteorology* 43 (4) 285-294.

Olaniran, O. J. *(2002) Rainfall Anomalies in Nigeria: The Contemporary Understanding* The 55th Inaugural Lecture University of Ilorin. Unilorin Press. 62p

Olokesusi, A.O. (1991) "Framework for Environmental Impact Assessment in Nigeria: Case Study of Large Scale Irrigation Projects in the Sudano-Sahelian Zone". Unpublished Ph.D thesis Dept. of Geography University of Ibadan.

Oriola, E.O, (2004) "Dynamics of Soil Chemical Properties in Oke-Oyi Irrigation Projects site of the Lower Niger River Basin Development Authority, Ilorin. Nigeria" *Geo-studies Forum*,2(1): 96–105.

Osborne, J. F. (1973) "Determination of P, K, Ca and Mg Soluble in ammonium solution (Al-solution)" *EAAFRO Methods of soil analysis*, Chemistry Division, Mugupa, p 7

Peach, M. (1965) "Hydrogen ion activity" in Black (ed) *Methods of Soil Analysis*:2914-926 A.S.A Madison Wisconsin

Sangari, D.U. (1991) "A Comparative Analysis of Traditional and Modern Systems of Irrigated Agriculture in the Donga River Basin Gongola State" Unpublished Ph.D. Thesis. Dept of Geography University of Ibadan.

Spegiel, M.R. and Stephens, L.J. (1999) *Theory and Problems of Statistics*. Schaum's Outline Series Third Edition McGraw-Hill p93.

Walkley, A. and Black, I. A. (1934) "An Examination of the Detjareff Method for Determining Soil Organic Matter and a Proposed Modification to the Electronic and Titration Method." *Soil Science* 37: 29-38.

Table 1. Mean, Standard Deviation and Coefficient Of Variation of Soil Properties in the Irrigated Soils

Soil Properties	Irrigated 0 – 15cm			Irrigated 15 – 30cm		
	Mean	Std. Dev	C.V %	Mean	Std. Dev	C.V %
Physical						
Sand (%)	85.5	18.0	6.7	84.5	18.0	6.6
Silt (%)	5.6	17.0	94.6*	7.4	18.0	68.9*
Clay (%)	8.3	1.0	6.0	8.1	3.0	13.6
Bulk density Mg/m^3	1.8	0.5	5.6	1.9	0.6	10.5
Water holding capacity (%)	24.0	30.0	34.6*	32.5	14.0	12.0
Chemical						
Organic matter (%)	1.3	0.7	53.8*	1.4	0.8	7.1*
Total nitrogen (%)	0.3	0.2	66.7*	0.4	0.1	25.0
PH	5.2	0.7	13.5	5.4	0.6	11.1
Exchange Ca^{2+} (meq/100g)	0.5	0.3	60.0*	1.7	1.4	82.4*
Exchange Mg^{2+} (meq/100g)	0.2	0.2	100.0	0.5	0.4	80.0*
Exchange K^+ (meq/100g)	0.6	0.3	50.0*	0.3	0.3	100.0*
Exchange Na^+ (meq/100g)	0.1	0.1	0.0	0.0	0.0	0.0
Cat. Exch. Capacity (meq/100g)	1.6	0.6	40.0*	2.4	1.7	70.8*
Phosphorous ppm	2.2	1.0	45.5*	1.4	0.5	35.7*

C.V. = Coefficient of Variation * Highly Variable C. V. > 33.0%
(Spiegel and Stephens, 1999)

Table 2 Irrigation Farming Equipment at Oke – Oyi Project

Quantity	Equipment	Condition	Remark
2	WEIRS		
	47m Long	**Silted**	**Needs Refurbishment**
	50m Long	**In good condition**	**Newly constructed**
1	**ISUZU VA N**		
	(UtilityVehicle)	**Worn- out engine**	**Needs overhauling**
3	TRACTOR		
	M.F.375E	**Old**	**Needs Replacement**
2	**FIAT 56-70**	**In good condition**	**Newly Supplied**
	PUMPING MACHINE		
	One at phase II	**Old**	**Needs Replacement**
	One at phase III	**Old**	**Needs Replacement**
	IRRIGATION PIPES		
250	**6" Galvanized pipe**	**Partially O.K**	
50	**4" Galvanized pipe**	**In good condition**	
110	**3" Lateration**	**In good condition**	**Not sufficient**
60	**Hydrant Gate**		
10	**6" Elbow Joint**	**In good condition**	
6	**6" End Cap**	**In good condition**	**Not sufficient**
4	**6" Foot Valve**	**In good condition**	**Not sufficient**
1	**8" Foot valve**	**In good condition**	**Not sufficient**
5	**Raingun**	**In good condition**	**Not sufficient**

Source: - LNRBDA Oke-Oyi Project Office (2003).

Table 3. Farmers Patronage And Maize Yield 1995 – 2002

Year	No of Farmers	% Change Over Previous Year	Area Cultivated (Ha)	Maize Yield (Tonnes)	Av. Yield In Tonnes/Ha
1995/96	400		50	280	5.6
1996/97	350	-14.3	38.5	80	2.07
1997/98	320	-9.4	18.5	75	4.05
1998/99	250	-21.9	20.6	85	4.13
1999/2000	130	-92.3	40	180	4.50
2000/2001	none	n.a	50	45	0.9
2001/2002	135	n.a	50	80	1.6

Field Survey 2002

Table 4 Accessibility of Farmers To Irrigation Farm Inputs

Irrigation Inputs	Not Accessible (%)	Partially Accessible (%)	Fully Accessible (%)
Irrigated land	-	24.4	75.6
Irrigation water	25.2	56.3	18.5
Fertilizer	5.9	85.2	8.8
Seedlings	49.6	24.9	25.5
Chemicals (Pest / Disease)	44.4	20.0	35.6
Extension services	60.8	24.4	14.8
Agric credits	64.4	26.7	8.9

Field Survey 2002

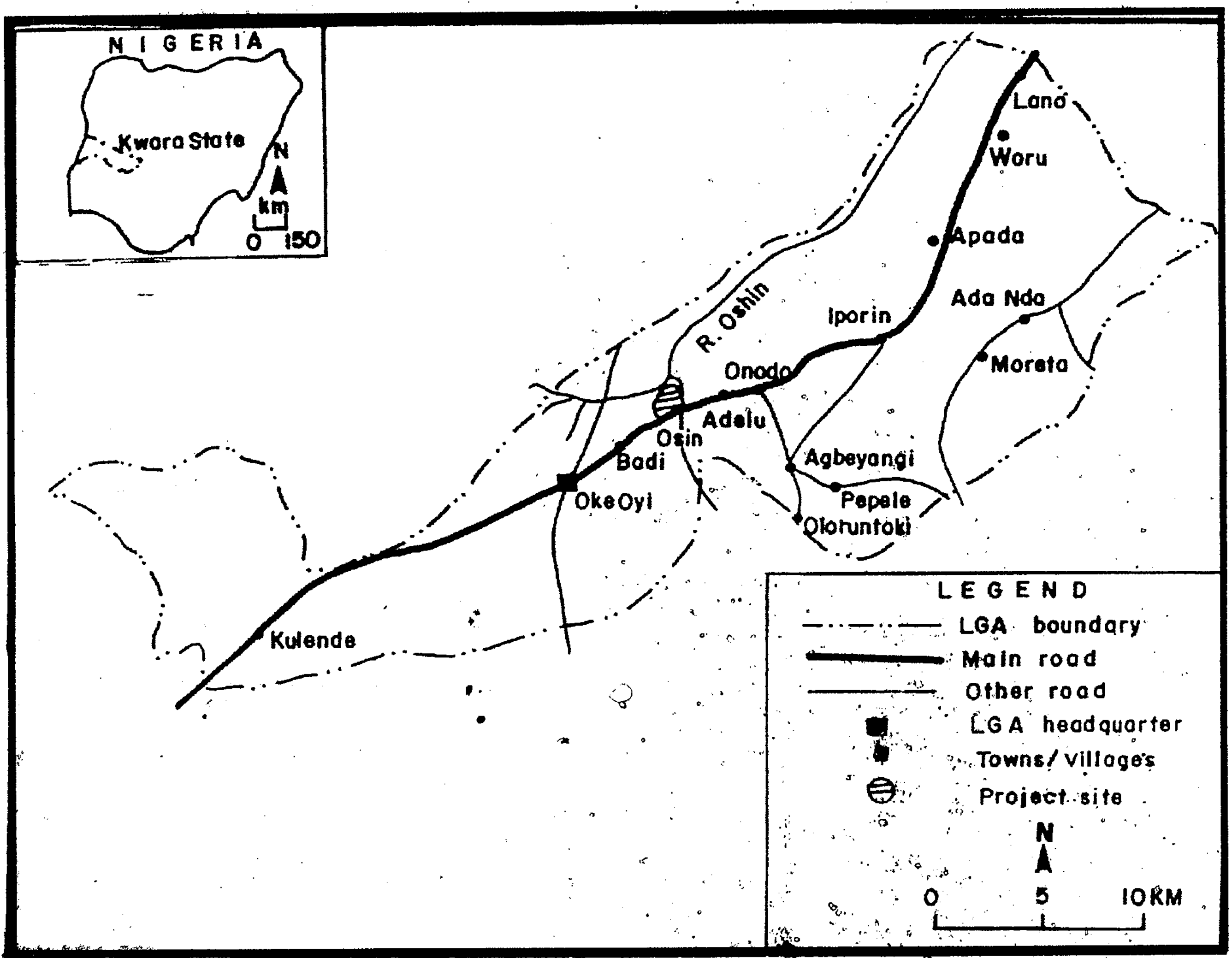

Fig. 1: Map of Ilorin East L. G. A. showing the project site.