

THE HYDROLOGY OF AND AGRICULTURAL DEVELOPMENT OPPORTUNITIES IN IVO-RIVER BASIN OF SOUTHEASTERN NIGERIA

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Abstract: River basins have gained wide-spread recognition as relevant and suitable natural units for research; planning and development purposes. This paper examines the hydrology and opportunities for large-scale agricultural development in a rural; largely agrarian, medium-sized river basin in southern Nigeria. The objectives are to describes the natural water resources endowment of the basin; the physical and other opportunities for large-scale agricultural development; the factors which limit the utilization of the basin for agricultural development and suggest possible strategies which may aid the utilization of the inherent opportunities in the basin for large-scale crop production. Data on the basin morphology were extracted from both topographic and Google maps while data on other attributes of the basin were obtained through an elaborate field surveys, involving field observations, interviews, and consultation of published documents. The data were analyzed through diverse graphical and statistical tools. The results of the study reveal the basin's unique abundant, diversified and unique water resources, the agricultural operations and the opportunities and constraints which limit the use of the basin for large-scale farming purposes. Recommendations on how to overcome the constraints and the planning implications of the findings were discussed.

Keywords: river basin, water, agricultural operations, opportunities food security.

INTRODUCTION

A drainage basin is the topographic region from which a stream receives runoff, through flow and groundwater flow (Aper, 2007). Maria (2007) described it as region of land where water from rain or snow melt drains downhill into a body of water such as a lake ,river ,dam ,estuary, wetland ,sea or ocean. Similarly, Ozdaamir and Bird (2008) described a river basin as an area of land drained by a river and its tributaries whose boundary is marked by a ridge or highland, known as watershed or basin divide (see Figure.1). It is an area of land that drains water, sediments and dissolved materials to a common outlet. The drainage basin includes both the streams and land on which streams flow as well as the plants, insects, and animal life within the land surfaces from which

runoff drains into the main stream channel (Mesa, 2006). The drainage basin acts like a funnel- collecting all the water within the area covered by the basin and channeling it into a waterway

The number, size, and shape of drainage basins found on the earth surface vary widely (Obeta, 2010). A major drainage basin system is made up of many smaller drainage basins, which in turn comprise even smaller basins, each divided into specific watersheds (Goldstein et al, 2007). Each drainage basin gathers and delivers its precipitation and sediment to a larger basin, concentrating the volume into the main stream. Each contributing tributary, large or small, adds its discharge and sediment load to larger river.

Development agencies and governments frequently adopt and use the drainage basin for research and planning purposes ,especially for agricultural production (Maeve and Dereck, 2005; Goldstein et al, 2007).Agricultural planning and/ or research on a watershed basis are valuable for several reasons. First of all, it is on this level that natural and human-related activities most directly affect one another and where land use patterns and activities are more frequently investigated (Mark et al, 2007).

Fig 1:Aschmati

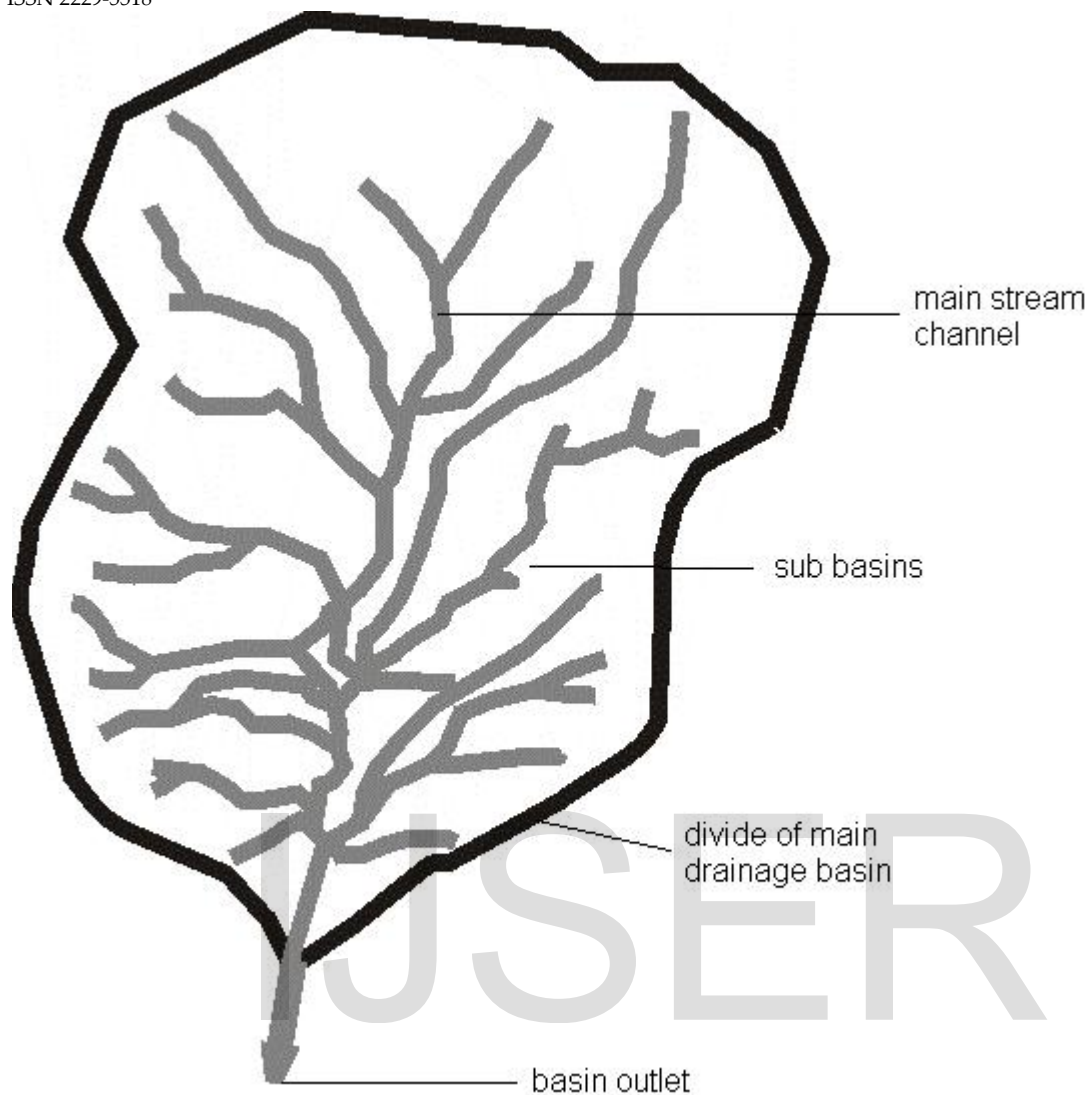


Fig.1:Aschmatic Diagram of a river basin

Secondly, the strong forward and backward linkages within the rural sector and with other sectors of the economy are more conveniently studied within drainage basins (Henshaw and Derek, 2000). Thus, the river basin system provides a convenient and natural unit area within which meaningful data on natural resources, hydro-meteorological characteristics, land use planning and agricultural operations etc can be meaningfully studied (Gold et al, 2001).

In Nigeria, the potentials of many urbanized basins have been thoroughly investigated and the development potentials quantified (Obeta, 2010). Anyadike, (2008) for instance, examined *irrigation potentials of Mamu River basin*; Aper (2007) studied *stream discharge characteristic in Benue Lower Drainage basin* while Emeibe (2006) examined *stream flow variability in Abonyi Drainage basin*. Unfortunately, the same cannot be said for many, remote, rural, largely agrarian river basins like the Ivo River basin, where research activities have been few and far between. In particular, Ivo river basin characteristics and potentials for massive crop production are not fully known, neither do we know enough about the factors which may aid and/ or limit agricultural operations in the area.

This rural, largely agrarian river basin was chosen for this study because of the limited information available on the hydrology of the basin and because of the need to support *the* agricultural transformation agenda of the current government in Nigeria which promises to unlock jobs for young people in agriculture, to diversify the rural economy, to massively increase food production and to help the country's masses move from the state of poverty to a state of financial prosperity and economic growth. Consequently, the aim of this research is to describe the basins water resources, examine the basin's potentials for large-scale agricultural operations and assess the factors which promote and/or hinder such initiative. Information generated from the study on will;

- 1) Provide useful diagnostic and decision making materials for governments, investors and development agencies, operating in or planning to operate in the basin and
- 2) Also ensure that agricultural development and poverty alleviation policies in the region capture the indigenous basis for cultural and economic development and arrest the alienation of the rural communities. Studies of this nature are few in Nigeria even though the national economy was, until the discovery oil, largely agricultural (Adeleye, 2003).

2) The Geographical Setting of Ivo River Basin

Ivo Drainage basin is a sub-basin of the Cross-River basin in southern Nigeria. Geographically, the basin lies between latitudes $5^{\circ}50'$ N and longitudes $7^{\circ}30'$ and $7^{\circ}34'$ E (Figure 2), and entirely within in three LGAs (Ivo, Aninri, and Awgu) in Ebonyi and Enugu states of southeastern Nigeria .The basin is underlain by rocks which are predominantly of sedimentary formation (Awani, 2007). The topography is uneven, consisting mainly of lowlands which, in the eastern parts, are less than 100m above sea level, and cuesta landscapes, and conical hills which are up to 400m above sea level on the western parts. The rugged topography of the basin western section is a cause of high surface runoff and low sub-surface runoff in the area.

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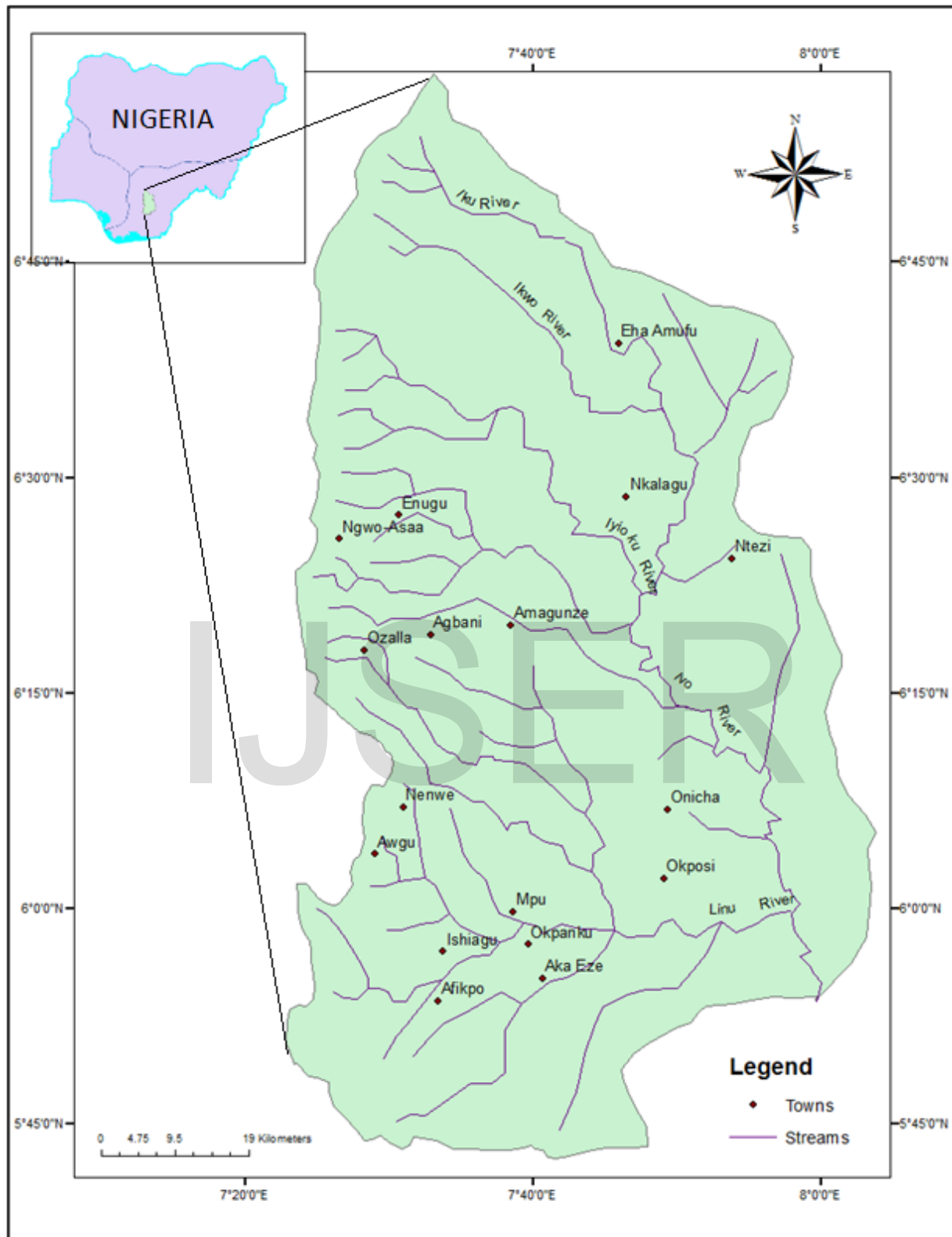


Figure . 2: Ivo River Basin, showing the streams and sampled communities

Source: GIS Unit, Department of Geography, University of Nigeria Nsukka.

The geology of Ivo River catchment is constituted by shale, sandstones, and mudstones. From the headwaters to the middle of the basin are shale, mudstones and sandstones with extensive exposures of diorite intrusion mostly in the higher lying areas. There are scattered deposits of alluvium in the eastern sections. Soils in the catchment are moderately deep and vary between loam and sandy. Soil erosion is the biggest natural hazard in the upper, western section of the basin, where it poses serious threat to human prosperity (see Figure 3).



Figure 3: Soil erosion in Awgwu Community



Figure 4: Flooding in Ishiagu area

The basin has a marked rainy and dry season and high temperatures of about 27⁰C on the average (Nwite, 2007). The relative humidity is moderate, ranging between 65-70% and 80-85% in January and July respectively. The basin, as expected, has tropical rainforest vegetation that is typically marked by different layers of tree cover. The vegetation in the northern section is composed of short/scattered trees and tall grasses of the Guinea Savanna type. The population density is generally low especially in the western and northern parts. The people engage mostly in primary economic activities such as subsistence farming and surface mining. Infrastructural facilities such as electricity and pipe-borne water are either unavailable or inadequate in most of the communities within the basin.

3) Methodology

First, the entire Ivo River basin of about 1463.06 km² was covered by grids, taking the areal interval of 5 km x 5 km to aid random sampling, and facilitate the selection of communities used in the study. Then the autonomous communities within the grid spaces were isolated and numbered. A total of 62 autonomous communities were isolated. From this, 10 communities, 3 each from Ivo and Anuri LGAs and 4 from Awgu LGA (which has higher number of communities) within the basin were drawn randomly and used in the study. A total of 150 questionnaires were used to collect information from the basin residents on the existing farming practices, uses of the basin waters, factors aiding/inhibiting the uses of the basin waters for agricultural development as well as their opinion on how to improve the utilization/management of the basin waters. The choice of ten communities and 150 respondents were based on the need to collect data from every LGA and every section of the basin. The sampled communities are Ozalla, Ngwo Asaa, Agbani, Onicha Okposi, Mpu, Amagunze, Ishiagu Nnenwe and Akaeze.

The questionnaire was designed (translated into local languages) and administered by trained research assistants who were also indigenes in of the sampled communities. Secondly, field observations helped us to determine the crops grown, methods of cultivation, characteristics of streams, lakes and marshy lands, while and measurements helped us to determine the basins fluvial characteristics. Key informants in the sampled communities provided additional information on a variety of issues including the socio-economic status of basin farmers, governments' attitude on agricultural development in the basin, land tenure system, and the factors influencing agricultural development in the basin

Additionally, secondary data were collected from technical reports, government gazettes, books, journals and other published materials. The major techniques of analyzing the data obtained from the sources mentioned above included the homogenization of the data after which basic

statistical tools were such as means, totals, percentages, standard deviations, pie charts and bar graphs were used for analysis.

RESULTS

Hydrological Characteristics of the Basin

The hydrological characteristics of Ivo River basin are summarized in table 1.

Table 1: Distinctive Hydrological Characteristics of Ivo River Basin

S/No	Drainage Basin Characteristics	Numerical value
1	Basin order (order of trunk stream)	5 th
2	Total number of streams	165
3	Number of 4 th order streams	3
4	Number of 3 rd order streams	13
5	Number of 2 nd order streams	38
6	Number of 1 st order streams	111
7	Number of perennial streams	72
8	Number of seasonal streams	93
9	Number of perennial lakes	2
10	Number of seasonal lakes	21
11	Basin Area (AB)	1463.06km ²
12	Bifurcation Ratio (RB)	4.12*
13	Total Lengths of streams (LU)	227.11km
14	Maximum Basin Relief	350m*
15	Basin perimeter (PB)	68.4km
16	Drainage Density (DD)	1.10km/km ²

(1) Map analysis by the author using Awgu E, NE and SW Map sheets-produced by the Nigerian

Federal Surveys

Sources: (2)* Ezekwe, 2009, pp. 16-18

As shown in table 1 above, Ivo River basin is a 5th order basin covering an area of 1463.06km² and shaped like a mango leaf (see Figure.2). The basin has 93, tiny, fast-flowing, high-gradient streams, with approximately 227.11 kilometers length, numerous lakes, ponds and marshy lands. The east flowing Ivo River and its tributaries drain the basin. Ivo River is the main and most important stream within the basin because of its volume and coverage. The river, in general, flows in an easterly trend and after being joined by several drainage channels during its course, meets the Linu River, its most important tributary. Other streams in the basin range from the high-gradient springs in the eastern portion to the low-gradient, sand-dominated streams of the central and eastern parts. They flow largely through uninhabited, rural and undeveloped parts of the basin. The volumes of the basin streams vary widely with season due to the seasonal variation in precipitation and evaporation rates. These streams provide habitat for many of the basins aquatic species such as fishes, snails, 'water' snakes and wildlife and 'water' as well as unique plants and animal communities. The distribution of the streams in the basin is uneven, with the eastern parts of the basin having the most streams and lakes. The streams, lakes and wetlands have plants and other resources essential for domestic consumption, commerce and agriculture. The surface waters are described below.

Description of the Major Surface Water Resources of Ivo River Drainage Basin

The basin's surface water bodies are further described below.

1. The Ivo River

The Ivo River, as noted earlier, is the longest and largest surface water body within the basin. The river courses exhibit gentle gradients and the flow is supplemented by numerous east-flowing tributaries. This river traverses mostly through soft sedimentary rocks, in the foothills and terraces, and alluvial sediments on the central and eastern parts. The tributaries whose head-waters are in the lower elevated foothills of the area, feature steep gradients and incise the gray sandstone before

traversing over the younger alluvial soils on the basin floor. The river is perennial. This may be attributed to the perennial nature of some of the tributaries that flow into the river.

2. Other Streams within the Basin

The other big streams in the basin are the Ikwo Iyiodu and Linu streams and their smaller tributaries. These streams have different names within and among the communities in the drainage basin. These streams have their headwater at the foothills in the eastern parts. Many of the springs are seasonal and runoff from rural landuse is the major sources of their impairment, especially during the wet season. Runoff response is so quick that much of the precipitation is lost by direct runoff, and overland flow. The flow ranges from high, through the gentle to the low-gradient. All these streams are tributaries to the Ivo River. These streams do not yield much fish. They however, provide habitat for a few aquatic species as well as plants communities.



Figure 4: Ivo river in Ikwo Community



Figure 5: Ivo river flowing through an uninhabited area

3. Basin Lakes

Scattered throughout the Ivo River basin are circular-shaped, relatively shallow lakes which occur largely on impervious surfaces. Lakes Oku and Lake Monoun are the largest lakes. Majority of

the smaller lakes within the basin are seasonal; they dry up during the dry season. These lakes approximately cover about 24% of the marshy lands within the basin area. Lake Oku lies between latitudes $6^{\circ} 11' 34''$ "N and longitudes $10027' 14''$ "E. while lake Monoun lies between latitudes $5^{\circ} 34' 59''$ "N and $10^{\circ} 34' 59''$ "E. The lakes and marshy lands are significant ecologically. They provide habitats for various species of fish and other aquatic habitants.

4. Marshy lands

Interviewees indicated that the area of marshy lands in the basin were once considerably larger than they are today. The demand for additional land for settlement, farming, road construction and mining were identified as the reasons for which the basin residents drain the marshy lands. About 38% of the marshy lands have been drained out. The marshy lands are low-lying and contain many plants; principally, palm trees which grow wide, lying idle. These marshy lands were also reported to have social and cultural importance. They provide important hydrological and biophysical functions particularly with regard to recharge of groundwater, flood protection and sediment trapping.



Figure.6: Ihie marshy land near Ishiagu: empty and wasting

Uses of the Basin Waters

The major uses of the surface waters of the basin are for domestic purposes (drinking, cooking, washing, personal and domestic hygienic requirements). The predominant agricultural uses of the surface waters were for dry season floodplain gardening, livestock watering and for aquatic life (fish farming). The intensity of these uses varies widely among and between the communities. The abundant natural water sources and the basin's plain, fertile soils are not yet used for large-scale agricultural/irrigation practices

Agricultural Activities within the Basin

The predominant economic activities within the basin are subsistence farming and sand mining. Farming is the major source of wealth, food, and raw-materials for industries in the basin. About 75% of the people are engaged in farming and related activities. The local, small holder farmers generally depend on rain-fed agriculture; grow crops, once a year, using traditional, manual methods of cultivation (implements like hoe, cutlass, digger etc). The major crops grown include rice, maize, cassava, yam and vegetable; with rice and yam being major income crops and as such receive more attention. The average number of plots cultivated by families in the basin communities range from 4-8. The sizes of the plots vary greatly, with majority being between 0.1 and 2.5 hectares. Agricultural equipments are sourced locally and the level of literacy among majority of the farmers was found to be low. The farming population generally comprise of older men and women. They produce largely for their families and not for the markets. None of the farmers interviewed has a personal tractor or a farm vehicle. The farmers also lack access to agricultural credit facility.

The available land is unnecessarily fragmented to accommodate all the male children – who according to the customs and tradition of the people are entitled to it. This cultural practice makes endless fragmentation of land necessary from time to time. This scenario does not encourage farmers to embark on large scale farming. Basic infrastructural facilities such as good roads and electricity are generally lacking. Many of the three crops (palm trees, oil bean trees) grow wide and are largely

uncared for. The farmers sourced the money they use for their farm work, principal from, personal savings (43%), loans from cooperatives “Isusu” (28%) and loan from money lenders (12%).

The Basin Potentials for Large Scale Farming

The basin’s natural and other potentials which can facilitate large scale agricultural operations include:

- 1) *Availability of expansive, plain land:* The most fundamental factor necessary for large scale agricultural production potential of any region is the availability of expansive arable land. Ivo river basin posse’s abundant, fertile, plain, irrigable lands which make it good for crop, animal and forestry production.
- 2) *Low population density:* Scattered throughout the basin are largely unoccupied, undulating lands. This makes extensive agricultural expansion possible, especially on the eastern and western parts of the basin. Although majority of the empty lands are owned communally, they can, with appropriate policies be used for large scale farming
- 3) *Availability of numerous surface water resources:* The numerous streams and rivers, described earlier, can serve as a catalyst for large scale crop production in the basin. Many of the basin communities, especially those on perennial river banks have sufficient and physically accessible surface water which can be used for agricultural production..
- 4) *Good sites for dam construction:* Literature evidence and the interviewees indicate that many of the basin streams have excellent sites for dam construction (Nwite, 2007). The lower Ivo River gauge at Ishiagu was identified as one of such sites. Currently, only one, largely defunct earth dam, constructed at Ngbowu, exist in the basin. The dam was used primarily for rural water supplies
- 5) *Presence of adaptable models:* There are more than 78 major irrigation schemes in Nigeria covering a total land area of more than 2.1 million hectare and producing crops, cereals, fruits

and vegetables in commercial quantities. These irrigation projects can serve as models to would be large scale farmers at the basin.

- 6) *Large farming population:* Majority of the basin residents (75. %) are farmers who are available and can be trained to engage in large scale agriculture.
- 7) *Favorable government policies:* The current government in Nigeria is investing massively in agriculture to diversify the rural economy and to increase food production Self-sufficiency in food production is a major development objective of the current in Nigeria. This can be a boost to would be large scale farmers.
- 8) *High annual rainfall:* The basin experiences seven months of moderately heavy rainfall *which can be* collected and stored behind dams for agricultural uses.
- 10.) *Availability of cheap labour:* Interviewees responses indicate that labor (male and female)

for farming activities is available and cheap in all the basin communities

Factors which limit the use of the Basin Resources for Large- scale Farming

Two categories of constraints (natural and anthropogenic) limit the use of the basin resources for large scale farming. The *natural constraints* afflicting Ivo River Basin are complex, interconnected and caused by natural phenomena. They include:

- 1) *Disastrous Flooding:* The eastern lower course of the Ivo River is a problematic area for annual flood phenomena (see Figure 7) According to Nwite (2007) the cause of the flood lies at the upper course of the river while the lower course bears the effects. According to him the principal reason for the incidence of flood is the almost complete deforestation of the upper catchment and the heavy precipitation experienced in the basin. These frequently reoccurring flood incidents are notorious for their devastating effects on crops, farms, animals and plants (space for Figure 7).
- 2) *Soil Erosion:* The problem of soil erosion on the upper catchment of Ivo river poses a serious threat to basin residents prosperity Soil erosion in the catchment is not just confined to the removal of the top soils but has made deep incisions, creating gaping wounds in the form of

gullies and ravines (see Figure 2). The losses due to soil erosion in the basin are heavy in general but the land resource is the worst victim. They encroach on the agricultural lands, residents settlements, transport lines, etc. Numerous settlements have been ruined and thousands of hectares of fertile lands washed away in the catchments

- 3) *Land Degradation:* Apart from natural environmental hazards like flooding and erosion sand and gravel mining, animal grazing, removal of vegetation, construction of local industries also constrain farming activities in the basin. These activities have resulted in excessive runoff of water, soil loss, stream water contamination and destruction of farms in the basin
- 4) *Difficult terrain and seasonality of streams/lakes:* The basin has a very difficult terrain, hilly and broken in the western and northern parts, with very low network of local roads. Accesses to the swift-flowing, seasonal springs are very uninviting because of long travel time and physical stress. The terrain along Ikwo, Monoun lakes are also difficult to access due to the high-gradient, gully erosion and winding footpaths. Large scale farming in these parts will be very laborious and costly. In addition, some of the streams disappear completely during the dry season-making them unavailable for dry season farming.

The anthropogenic constraints: *These include:*

- 1) Intergenerational conflicts; Intergenerational conflicts among basin residents, according to our respondents, started around 1980s in Ishiagu community when their elders gave out large portions of their agricultural lands to investors for mineral prospecting. The mining activities led to environmental degradation, pollution of local water sources (streams), compromised local ecosystems and threatened peoples' health. The youths, in anger, attacked the miners and accused the elders of ignorance and of neglecting them during the decision making process. Today the age-long custom and tradition of allowing elders to oversee communal lands in many of the basin communities is frontally challenged by the youths. Land leasing for both mineral

exploitation and investment in crop production is highly politicized and literally banned. As the traditional ruler of Umuhu community observed land has pitched “sons” against their “Fathers”

- 2) *The prevailing land tenure system:* The people are intrinsically attached to their ancestral lands and are generally unwilling to let even small portions go to governments or investors. This situation is worsened by the unending land fragmentation in the basin
- 3) *Inadequate access to basic inputs for large-scale agricultural development, principally dams, reservoirs and farming machinery.* Currently, only one non-functional earth dam exist in the basin area. These basic inputs are beyond the capacity of the local basin farmers to develop and the respondents attribute their absence to government neglect and mass poverty.

DISCUSSION

The physical parameters of development within a given geographic space are best managed within the watershed context. Ivo River basin provides a convenient, natural unit area within which decision on best options for natural water resources utilization and agricultural development practices can easily and meaningfully be made. The results of this study have shown that current agricultural practices in Ivo River basin is not benefiting adequately from the abundant natural water resources of the basin .In fact, agricultural activities in the basin may be characterized as disjointed. Irrigation activities are completely lacking; the expansive, fertile lands/waters of the basin are just wasting away; residents are largely poor and practice only rain-fed agriculture; conflicts and tradition hinder agricultural development. Agricultural use of surface water in the basin is only for washing harvested crops, vegetable farming, livestock watering and aquaculture Crude tools are generally used .Production is not linked to marketing .Post harvest food losses are high .Modern storage ,packaging ,transport and handling technologies are practically non-existent. Natural and human-related constraints posse threats to expansion and modernization of agricultural practices.

In fact the farming situation in the basin is disturbing, particularly when we realized that, the nation's economic growth is directly related to the state of its agricultural sector. The inability of governments, at all levels, to frontally tackle the problems of farm inputs, machinery and inadequate credits in Ivo River basin make rural farmers to operate at the pre-industrial age in the area. It is distressing to watch the poor basin farmers spend so much time, energy in their farms and still produce so little. Interviewees noted that agricultural productivity in the basin has been profoundly constrained, due largely to low state involvement in water resources development. He also added that food insecurity is a global threat but a preventable state of affairs.

The non- utilization of the abundant waters of Ivo river basin for large-scale agricultural activities is hindering government efforts to improve food production, diversify the economy, and eradicate extreme hunger in the area. . Food insecurity is a global threat but a preventable state of affairs. Good nutrition is essential for good health and for developing the human capacity needed to achieve other development goals. Attaining food security and diversifying the local economy of the Ivo River basin will remain a mirage unless the basin's abundant surface water resource are harnessed properly for efficient, responsive and productive agricultural system This will not only improve food production but will also reduce the cost of production, the price of food products, increase the income of rural farmers and increase food security.

The challenges which impede the utilization of Ivo basin waters of large-scale agricultural operations are enormous but they can be surmounted given the right political will. Nigeria cannot afford to ignore and/or neglect her nature given resources. Given the importance of self-sufficiency and accelerated food production currently in Nigeria, the need to intervene and radically improve farming practices in rural areas is very pertinent. An improved agricultural operation is essential not only within the Ivo river basin but even nationally in order to increase food production. To achieve

this, governments should provide the necessary boost by implementing the measures suggested below.

THE WAY FORWARD

Large scale agricultural operations are lacking in Ivo River basin. This should not be so. The several challenges hindering large scale agricultural operations in the basin need to be tackled. Effective and strong government support will go a long way in revolutionizing agricultural practices in the basin. The federal and states governments should encourage large scale agriculture in the basin. This could be achieved through the:

- i. Building dams/reservoirs and providing credit, farm inputs and basic infrastructure (fertilizers, road, machines etc) to the basin residents.
- ii. Facilitation land acquisitions for mechanized farming (using of traditional rulers, town union's official and village elder).
- iii. Building of local skills, knowledge and enterprise
- iv. Encouraging farmers to pull their resources together, form co-operative societies and undertaken large scale farming. Governments could persuade the local basin residents to modify the existing land tenure system to enable large-scale farmers acquire the needed quantities of arable land areas for their respective cultivations and other agricultural pursuits.
- v. Providing the basin farmers with relevant information on modern agricultural techniques and best practices in a format that will be comprehensive to them, taking into consideration the prevailing high illiteracy rates among them. Information provided must emphasis the likely benefit which could result for large scale agricultural operations in the area such as
 - a. Improved agricultural productivity

- b. Diversification of basin economy and creation of new opportunities for development
- c. Acquisition of new skills, knowledge and enterprise.
- d. Boosting domestic food security
- e. Increase in foreign investment/farmers income.

Ties should also be forged between all the stakeholders in water resources management within the basin to build capacities, resolve conflicts and spur new innovations in the agricultural sector.

CONCLUSION

Agriculture is the backbone of the Nigerian economy. The agricultural transformation Agenda of the current government in Nigeria promises to diversify the rural economy and to help the country's masses move from the state of poverty to a state of financial prosperity. These objectives cannot be achieved unless improved agricultural practices are introduced in farming areas like Ivo river basin. The basin has potentials for large scale agricultural operation which should be harnessed in order to empower the basin residents who rely on agriculture for their livelihood, income, health and well being. The current agricultural practices in the basin are causing poor yields, unemployment and present a major obstacle to the development process. The way forward is to harness the abundant surface waters of the basin for large scale agriculture. Judging from the identified potentials of the basin, governments will not regret the resources that she will invest for the purpose of revolutionizing the agricultural sector within the basin.

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