The Need to Increase Irrigated Agriculture in the Benin-Owena River Basin Development Authority Area

Odiase, G.E[1], Oria-Usifo, E.E[2]
[1]*Civil Engineering Department, Faculty of Engineering Benson Idahosa University, Benin-City, Nigeria*
[2]*Civil Engineering Department, Faculty of EngineeringUniversity of Benin, Edo State Nigeria.*

Abstract- The pressure of survival and the need for additional food are necessitating a rapid expansion of irrigation throughout the world. Irrigation is required mostly during dry season when there will be less moisture in the soil for crops to germinate and grow. In this period some essential food stuff almost disappears in the market and available ones become expensive for the common man to afford. This paper presents irrigation practices in some humid countries of the world and the distributions of the existing irrigation projects in Nigeria, which is low and very low in the southern part of the country. Some irrigation projects and potentials for irrigation in Benin-OwenaRiver Basin Development Authority (BORBDA) area of operation were also discussed. The need for increased irrigation practices is of necessity due to reduced rainfall and high temperature in the study area during the dry season of the year. In this regard the paper present the rainfall and temperature of some selected towns as well as the hydrological data of some rivers that were gauged. It concludes that water can be made available for dry season farming by construction of dams to store excess runoff during the rainy season and releasing the water during dry season. This will enable farmers plant their crops and engage in all-year round agriculture, therefore stabilizing the prices of food stuff and less dependent on importation of food items into the country.

I. INTRODUCTION

The earlier misconception that rainforest region of Nigeria (to which Benin-Owena River Basin area belongs), does not need irrigation to feed their crops has been proved wrong by the experience of scarcity of certain food items like rice, maize, melon etc during the dry season resulting in the escalation of their prices (Akinro and Olarewaju 2007). Also, due to increasing population growth the need to bridge thegap between food supply with the number of consumers will necessitate increasing the volume of production by irrigated agriculture. Though irrigation is of importance in the arid regions of the earth, it is becoming increasingly important in humid region(Israelsen and Hansen 1962). Irrigation practice in some humid countries in Africa and Asia is presented in Table 1.

Table 1: Food and Agricultural Organization (FAO) estimate of irrigation potential, irrigated area and traditional farm area in some selected countries in Africa and Asia in 1000 ha as at 2015.

Countries	Potential	Total Excluding Traditional	%	Total Including Traditional	%
Nigeria*	3,137	219.6	0.7	956.5	3.05
South Africa *	1,500	1270	84.5	1270	84.5
Zimbabwe*	331	116	35.23	136.6	41.27
India	4,273.4	1538.4	36	4273	100
Philippines	3,100	1,731	55.84	2,041	65.84
Thailand	2,652	49.6	18.7	1,822	68.7

*Source: FAO irrigation and drainage paper 42: consult on irrigation in Africa 2015 p170-196.

From Table 1, it shows that the land use for rain fed agriculture (traditional) and irrigation is about 3.05% in Nigeria of the total potential of 3.137,000 ha but only 0.7% (219.6 ha) is irrigated. In Zimbabwe the total available land is about 331,000 ha out of this 41.27% is put into use both for irrigation and rain fed but 35.23% is irrigated. However, in South Africa 84.50% of available land is irrigated. This shows that irrigation is highly practiced in South Africa, moderate in Zimbabwe and very low in Nigeria.

The above scenario confirmed the report by FAO that Nigeria would be technically unable to sustain its population through rain fed agriculture between now and year 2025 unless something is done to increase substantially the agricultural production March the population increase (FAO, 2010).

The analysis above shows that Nigeria is lagging behind some developing countries, such as South Africa, Zimbabwe, India, Philippines, Thailand, to mention a few in Africa and Asia, in irrigation development. This paper

intends to evaluate irrigation development and factors inhibiting accelerated irrigation development in Nigeria, particularly in the Benin-Owena River Basin area of operation and recommend the needs for improvement in irrigation practices.

1.1. The Purpose of Irrigation Include The Following

1. To add water to soil to supply the moisture essential for plant growth
2. To provide crop insurance against short duration droughts
3. To cool the soil and the atmosphere there by making more favorable environment for plant growth
4. To wash out or dilute salts in the soil
5. To reduce hazard of soil piping and aid chemical activities in the soil
6. To soften tillage pens
7. Make double cropping possible
8. Improve plant quality and aid control of crop pest and disease especially vegetable, tomatoes etc(Israelsen and Hanssen 1962)

1.2. Background of Study:

i. Mandate of Benin-Owena River Basin Development Authority (BORBDA).

Today there are twelve River Basins Development Authorities (RBDA) in the country. They have basically the same function as enunciated in section of River Decree 35 1987.

These functions include, carrying out compressive development of surface and groundwater resources for multi-purpose use with particular emphasis on the provision of irrigation infrastructure and the control of flood and watershed management. The mandate requires the River Basin Development Authorities to develop the irrigation infrastructure and hand over all land to be cultivated under the irrigation scheme to the farmers.

The Authorities are also required to provide water supply through borehole development, Dams and reservoirs as may be approved by the minister.Furthermore, the River Basin Development Authorities are to keep up-to-date compressive water resources master plan, identifying all water resources requirement in the Authority's area of operation through adequate collection and collation of water resources, water use, social-economic and environmental data of the River Basin. (River Basin Decree 1987).

ii. Study by Japan International Co-operation Agency (JICA).

A study carried out by JICA (1993) shows that the total irrigated agricultural area nationwide is very small, (69,000 ha) or achievement ratio of 13 percent. Table 2 shows the distribution of existing irrigation projects nationwide.

S/N	REGION	HYDROLOGICAL AREA (HA)	STATES INCLUDED	NO	IRRIGATED AREA (1000HA)		
					P.A	D.A	I.A
1	North west HA II	Niger North	Kebbi, Sokoto, Katsina(3)	20	117.84	31.97	7.65
2	North east HA VIII	Lake Chad	Kano, Jigawa, Yobe, Borno, Bauchi(5)	25	84.65	40.94	27.05
3	Central west HA II	Niger Central	Niger, Kwara, Kaduna, Kogi, Abuja FCT (5)	39	57.54	13.76	11.84
4	Central east HA III & IV	Upper Benue And Lower Benue	Adamawa, Taraba, Plateau, Benue (4)	14 + 18	63.26 15.08	10.37 6.41	9.24 2.49
5	South west HA VI	Western Littoral	Oyo, Ogun, Oshun, Lagos, Ondo, Edo, Delta	24	46.43	4.22	1.38
6	South – East HA V and HA VII	Niger South & Eastern Littoral	Anambra, Imo, Rivers, Enugu, Abia, AkwaIbom, Cross Rivers (7)	14 + 19	21.30 18.92	9.86 1.82	9.02 0.33
TOTAL				173	525.01	119.35	69.50

Table 2: Distribution of existing irrigation projects nationwide
Source: JICA 1993.

Remarks on Table 2
1. P.A: planned area (planned net irrigation area)
2. D.A. developing area (area with completed irrigation canal system)
3. I.A. actual irrigated area (area carrying out irrigated agriculture) (JICA 1993)

A cursory look at the south west region (HAVI) to which Benin – OwenaRiver Basin Area is situated shows that out of the 24 existing irrigation farm,46,400 ha is the net area planned for irrigation, 4,220 ha has been developed with irrigation facilities while only 1,380 ha is the actual area where irrigation is carried out. When compared with other hydrological area, the south west region has much to be desire in terms of irrigation development. The BORBDA has some existing irrigation schemes while others are at various stages of planning, design and implementation.
Rainfall and stream constitute major source of water available for irrigation. Annually, onset of rains is between April and October in the southern part of the country (Okoli 2007). The annual rainfall in a year varies from 1278 to 2823 mm in the south (JICA 1993). This implies adequate water and stream-flow which may affect the dam storage for municipal water supply, hydropower generation and irrigation. Hence development and regular maintenance of dams for dry season irrigation and water supply should be accorded high priority. (NEMA 2012).
This paper discuss the low level of moisture from precipitation for plant growth during the dry season and elucidate the need to store excess water available during the rainy season in dams for dry season farming or irrigation in the Benin-Owena River Basin catchment area.

II. METHODOLOGY:

2.1Study Area:
The study area is the Benin – Owena River Basin catchment area. The Benin– Owena River catchment lies between Longitude 5o 01’ and 5o45’ East and latitude 7o17’ and 8o15N. The basin area is about 51.40km2 and covers 4 states; Edo, Ekiti, Ondo and the northern senatorial district of Delta state (River Basin Decree 35) .The major rivers in the basin area are Benin River and Owena River and drain into the two main rivers are many other tributaries (River Basin Decree, 1987).

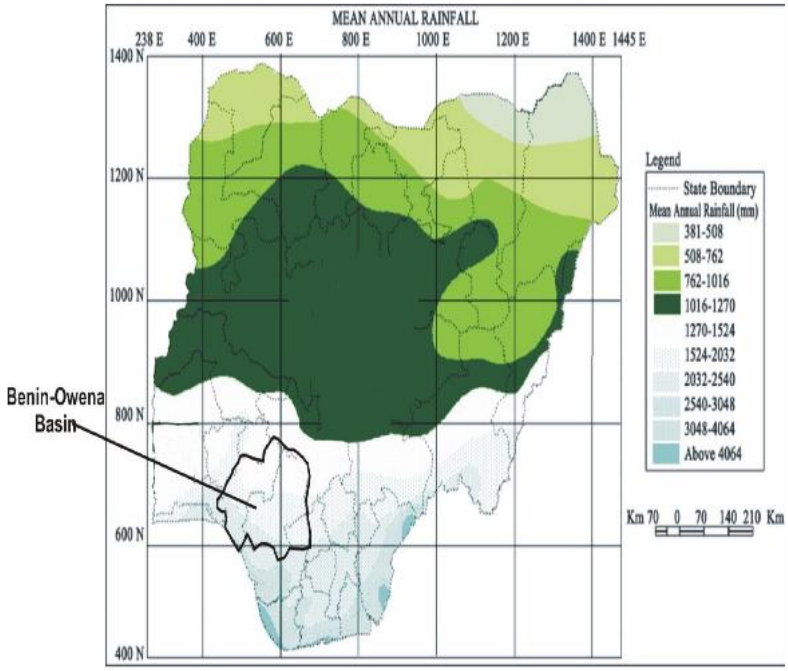


Figure 1: The study area of the Benin-Owena River Basin Development Authority.

2.2 Data Collection:

The data required for the study include:

1. The existing and proposed Irrigation projects by the Benin-Owena River Basin Development Authority. This enabled the researcher to ascertain the total area irrigated or proposed for irrigation in the catchment area.
2. Rainfall pattern in the area was required to ascertain the amount of precipitation which will be available for irrigation and other water resources projects
3. The temperature of some selected cities/towns in the study area was used to determine the temperature variation as its affects the irrigation practices in the study area.
4. The evaporation and evapo-transpiration in the basin area also has positive or negative effect on irrigation practices, hence it was considered.
5. The flood levels in the rivers in the catchment area were required to confirm the variation in the quantity of water that will be available in the river at any particular period of the year for the purpose of irrigation.

The methods used in the collection of the data were:

1. Collection from records and report at the Headquarters including Hydrological year book published by the Authority.
2. Actual visitation to the project sites.
3. Collection from the meteorological stations established by the Authority.
4. Collection from the gauging station located in some rivers in the Authority area of operation.

Table 3: BORBDA EXISING/PROPOSED IRRIGATION PROJECTS As at 2016.

SN	AREA IN HA			IRRIGATION	MODE OF DEVELOPMENT	STATUS
	PROJECT	PLANNED	EQUIPPED			
1	Illushi-Ega-Orca Irrigation Project	5,000	200	200	PPP & FG	EXISTING
2	Ero dam irrigation project (River State)	2,000	NIL	NIL	FG	EXISTING
3	Enulu irrigation project (River State)	100	NIL	NIL	PPP & FG	EXISTING
4	Illah-Ebu irrigation project	1,000	100	100	FG	EXISTING
5	Ogbese Irregation Project (Weir)	250	50	NIL	FG	EXISTING
6	Ukpoke Irrigation Project (Borehole)Cps	100	50	50	FG	EXISTING
7	Obayantor (borehole)	250	-	-	FG	PROPOSE
8	Ewulu (pumping fro river niger)	50	-	-	FG	PROPOSE
9	Ero (dam)	2,000	-	-	FG	PROPOSE
10	Ilah-Ebu (Borehole cps)	200	105	100	FG	EXISTING
11	Ukhun-Evha (dam)	200	-	-	FG	EXISTING
12	Owena ninetiipurpose dam	500	-	-	FG	PROPOSE
13	Elemi (dam)	250	-	-	-	PROPOSE
14	Erusin (dam)	200	50	-	FG	ON-GOING
15	Aisegba (dam)	200	-	-	FG	PROPOSE
16	Hakpaji (dam)	1000	-	-	FG	PROPOSE
17	Little Osse (dam)	100	-	-	FG	PROPOSE
18	Iju-Itagbolu	200	-	-	FG	EXISTING

19	Ayo-Iludun	200	-	-	FG	PROPOSE
20	Ado-Ekiti/Osun	100	-	-	FG	PROPOSE
21	Ilobi	100	-	-	FG	EXISTING
22	Oye	100	90	10	FG	EXISTING
	TOTAL	14,250	540	460		

Table 3 shows that 14,250 hetres (ha) of land is planned for irrigation but only 540 ha is equipped and 460 ha actually irrigated, (BORBDA Brief).This is about 3.2%.

2.3 Rainfall Pattern

The Benin Owena River Basin Development Authority (BORBDA) established meteorological stations at various locations in its area of operation. Ad-hoc personnel are engage at each of these locations to take the record of rainfall and temperature twice at the different location. Rainfall data were obtained from the meteorological stations located in Benin-city, Auchi, Akure, and Ikere-Ekiti.

Trained personnel from the headquarters regularly move round the stations to collect the data for the production of Hydrological Year Book produced by the Authority

The same process is adopted by the Authority in gauge readings at the gauging stations located in the rivers.

The Meteorological Stations where data were available are:

1. BORBDA Headquarter, Obayantor near Benin, Edo State.
2. Auchi Polytechnic, Auchi, Edo State.
3. BORBDA Area Office Akure, OndoState
4. BORBDA Area Office Ikere, Ekiti State.

The data were collected from the above listed Meteorological Stations. The locations selected represent the three of the states of BORDBA operational area.The data were collected from the meteorological stations, analyzed and presented in figures 2 to 5. Rainfall data were also collected from the Nigerian Meteorological Agency at the Airport in Benin and were found to be the same with those from BORBDA Meteorological Station in Obayantor near Benin.

III. RESULTS AND DISCUSSION

3.1 Mean Monthly Rainfall

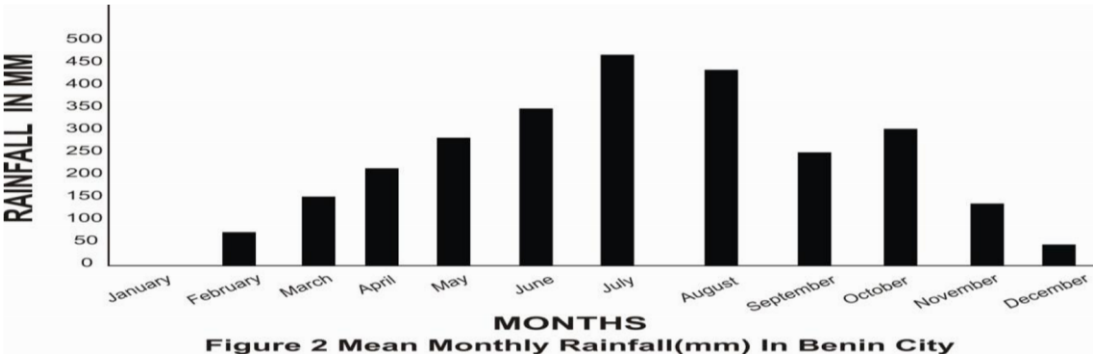
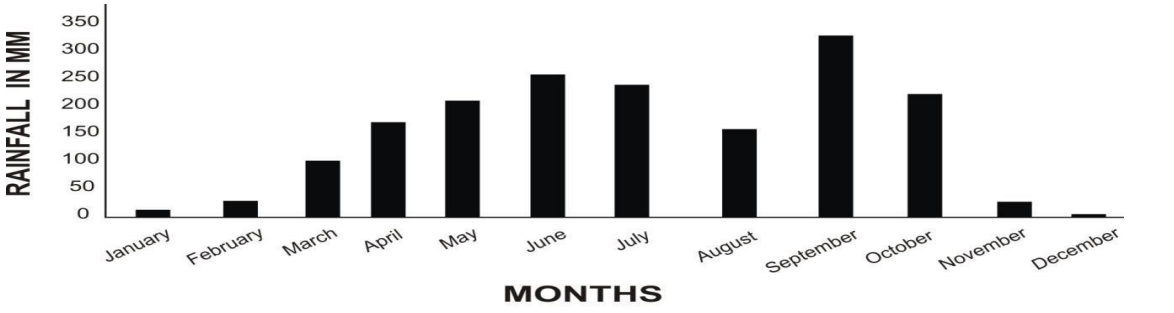


Figure 2 Mean Monthly Rainfall(mm) In Benin City



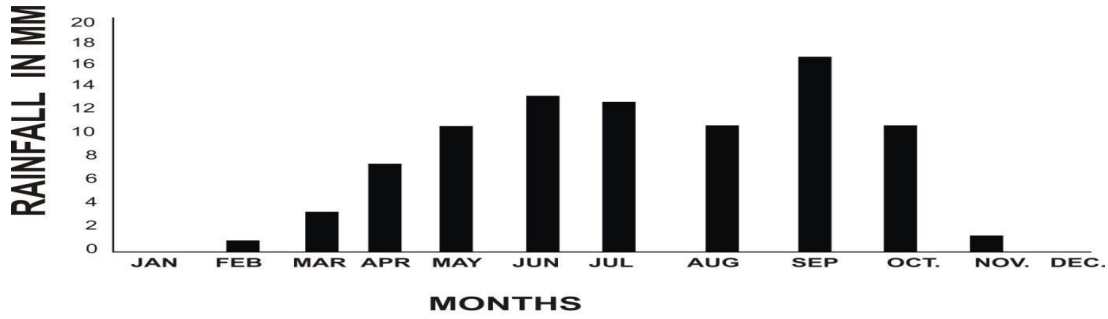


Figure 4 Mean Monthly Rainfall In Akure

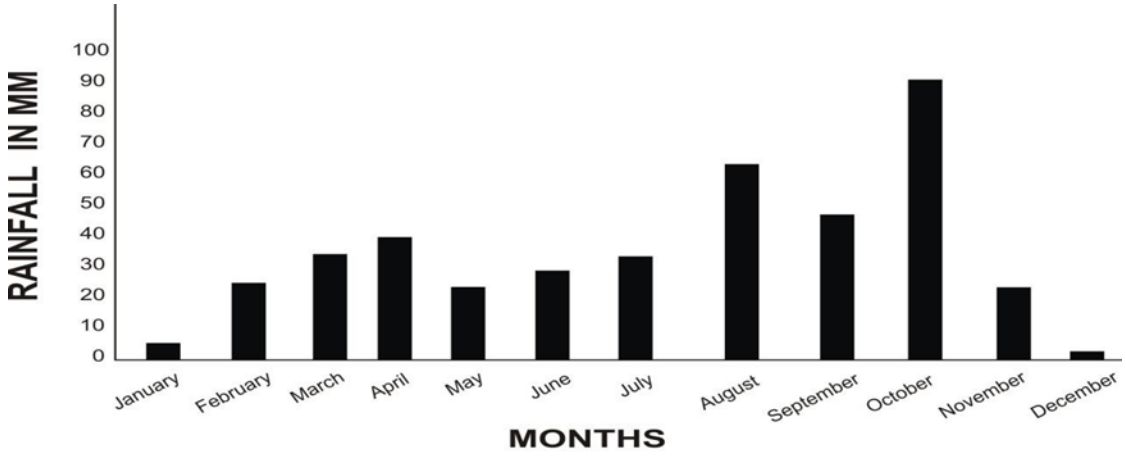


Figure 5 Mean Monthly Rainfall in Ikere-Ekiti (mm)

3.2 Temperature of the Study Area

The temperature as recorded at the meteorological are presented in figure 6-8

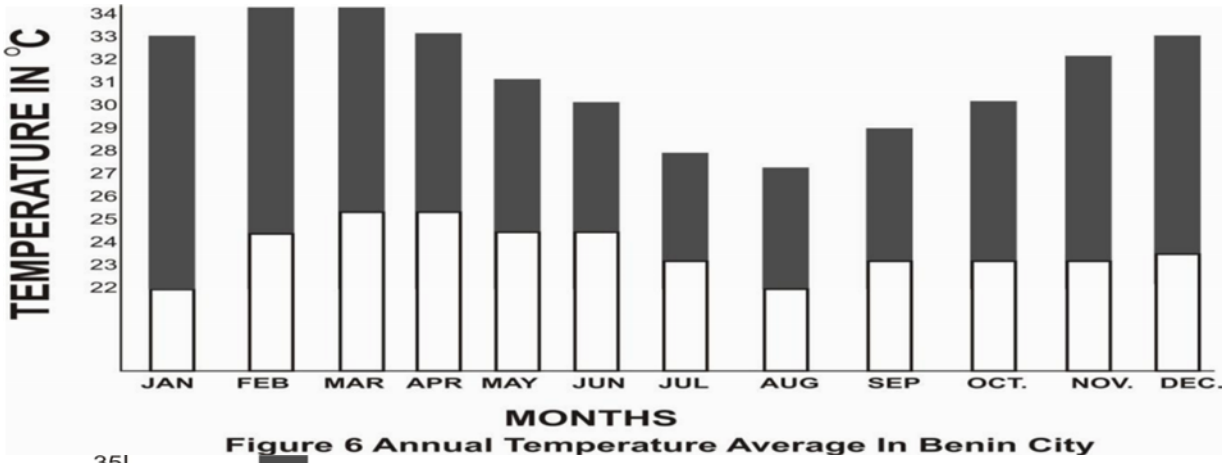


Figure 6 Annual Temperature Average In Benin City

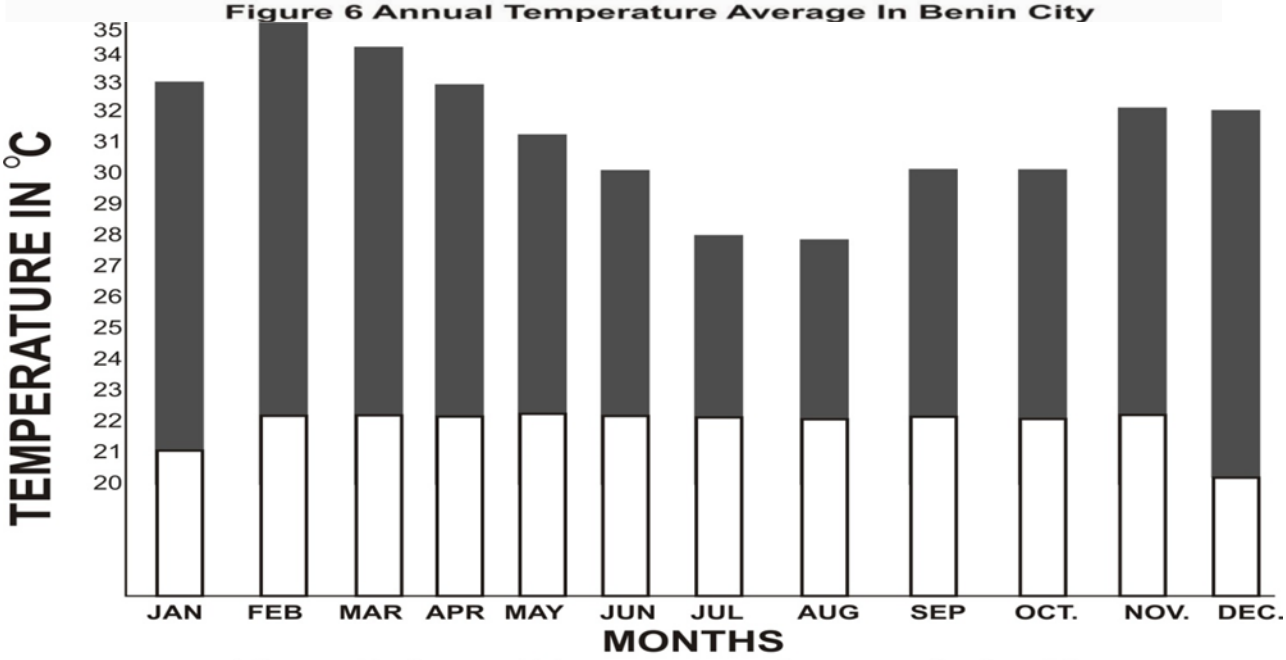


Figure 7 Annual Temperature Average In Auchi

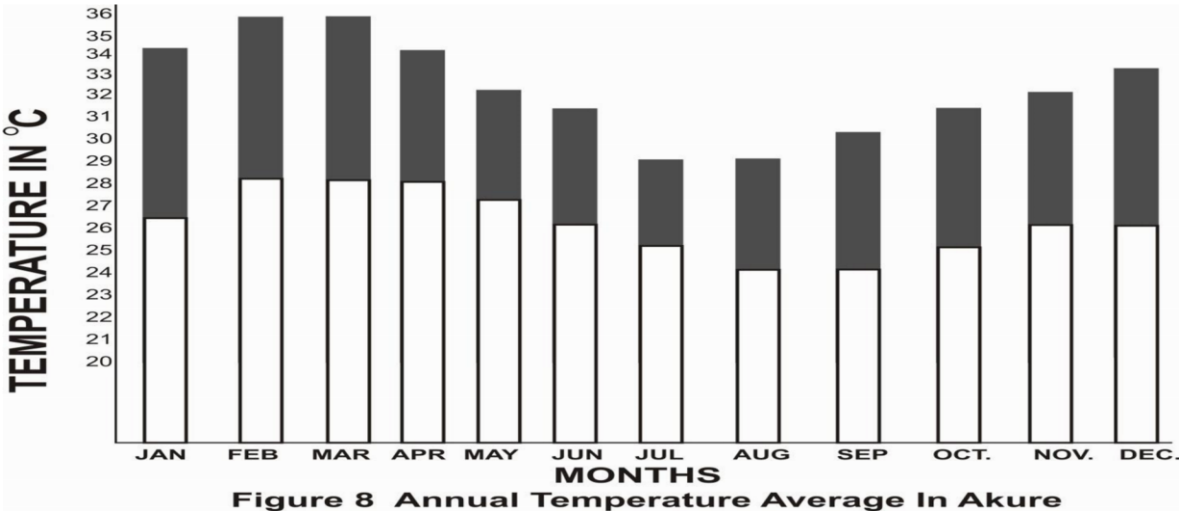


Figure 8 Annual Temperature Average In Akure

3.3 Evaporation

Evaporation is dependent on the temperature of the area. The average monthly evaporation"Cuss A" pen evaporation from Benin is shown in figure 6. Also the value of potential Evapo-Transpiration in NIFOR and those by the modified penman equation are shown in Figure 9 and 10.

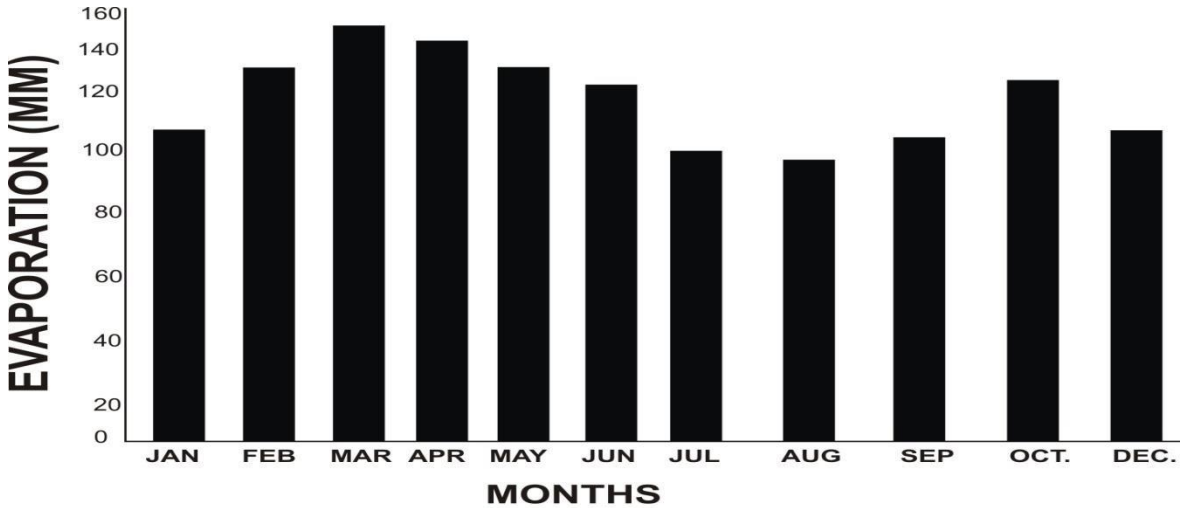


Figure 9 Evaporation (mm) in Benin City

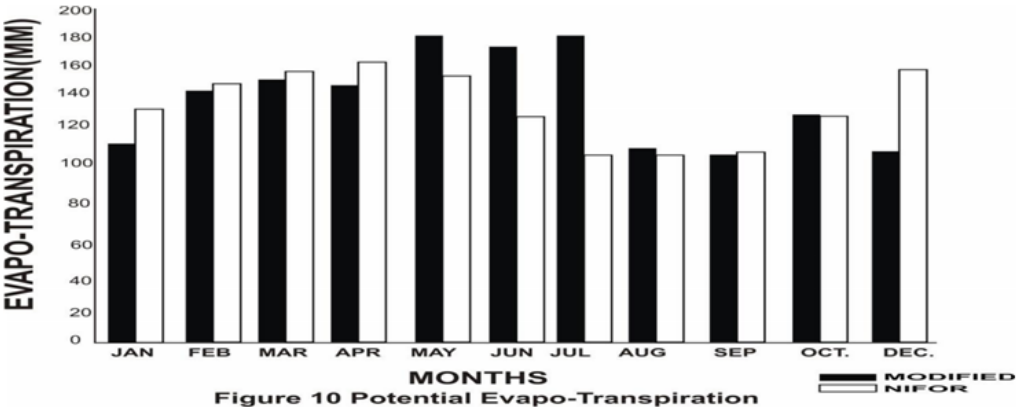


Figure 10 Potential Evapo-Transpiration

3.4 Hydrological Data:

The hydrological data obtained from major rivers in the basin area shows that the water available in the rivers reduced during the dry season (November to April) because run-off into the rivers reduces or completely stop due to absence of rains. Some smaller rivers or streams have been observed to completely dry up during this period.
The water level or stages of some of the major rivers are presented in Table 4.

Table 4: Stages Of Some Major River In (Mm)

MONTH	IKPOBA		OGBESSE		OJO (NEAR AUCHI)		OSSIOMO	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
January	2.20	1.03	1.75	1.30	0.63	0.41	2.63	2.50
February	1.91	1.20	1.67	1.30	0.41	0.33	2.60	2.49
March	1.94	1.20	1.86	1.18	0.43	0.33	2.56	2.43
April	1.71	1.70	2.20	1.46	0.42	0.32	2.62	2.40
May	1.94	1.71	2.35	1.88	0.51	0.43	2.77	2.50
June	2.47	1.90	3.50	1.85	0.54	0.46	2.95	2.65
July	2.25	2.15	4.00	2.16	0.57	0.45	3.05	2.70
August	2.14	1.81	4.47	3.17	1.23	0.57	3.23	2.81
September	2.53	1.85	4.26	2.07	1.85	0.98	3.15	2.88
October	2.48	2.14	2.30	2.03	2.21	1.61	3.00	2.87
November	2.38	2.05	2.20	1.93	2.90	1.00	2.94	2.60
December	2.26	1.16	1.93	1.91	1.86	1.25	2.61	3.39

Source: BORBDA Records for the period 2010-2016

3.5 Discussion

Generally, average rainfall in the catchment areas ranges from 120mm in November and starts declining to almost zero in January, 60mm in February the following year. It starts rising in March and in April, it may record about 200mm. During this period between November and February plants hardly survived and some completely wither away.

During the same period of low rainfall, temperature range between 31oC to 35oC which dries up the soil. The evaporation and Evapo-transpiration both on the water surface and from the plant respectively are also at the peak. Evaporation ranges between 105mm to 150mm and evapo-transportion between 110mm and 180mm resulting in plants unable to survive.

However during the months of April, precipitation rises to an average of200mm and continues the upward trend and could get up to 240mm in September. During this period there is sufficient rainfall with excess runoff that can be stored in Dams and reservoirs.The moisture is also available for rain fed agriculture with minimum supplementary irrigation when necessary.

The water impounded behind the dam and released during the dry season could make farmers embark on dry season farming. This will have multiplying effect and would lead to increase food production, higher income to the farmer, stabilize prices of food, minimize or completely eliminate importation of food items etc.

Furthermore, during the period of dry season the water level (stage) in the rivers as shown in Table 4 reduces and some smaller rivers completely dry up. A look at table 4 shows that the maximum water level at Ikpoba River, Ogbesse, Ojo and Ossiomo range from average 1.71-1.60m between January and April but between May and

December, it rises to an average of between 2.71-2.40m. It is also necessary to impound the water in these rivers during high tides for use during the dry season to irrigate the farms.
It was also observe from the result and data analysis, that when temperature increases during the dry season there is high evaporation and Evapo-transpiration which are injurious to plants. Hence irrigation during the dry season will be the solution to make plants survive during the period.

IV. CONCLUSION

It has been ascertain that irrigation is no longer a regional practice of arid region of the world, having sufficient water for crops production in humid region as well as arid contribution to productive agriculture. (Hansen, et al, 1979). Some of the benefit from irrigation include, increase in food production as it provide opportunity for dry season farming, increase income of the rural populace, curb rural urban migration, stabilize prices of food items and reduce importation of food items among others.
This can be achieved by the constructions of embankment dams to impound water during rainy season and releasing same to the farms for irrigated agriculture in the dry season.

V. REFERENCES

[1] Akinro,G.A and Olanrewanju (2007). Rainfall pattern and its on seasonal variability of Owena River in Ondo State of Nigeria.
[2] Arora, K.R. (2007), Irrigation Water Power and Water Resources Engineering Standard publisher 170 05 B nail Srak Delhi Pg.16.
[3] Benin-Owena River Basin Development Authority (1992) Hydrological Year Book vol.1 BORRBDA Brief, Brief on the activities of Benin-Owena River Basin Development to the Board of Directors 2013.
[4] FAO (2015), Irrigation and Drainage paper 42: Consult on irrigation in Africa, p170-196.
[5] Federal Republic of Nigeria Decree No 35 (1987).
[6] JICA (1993) The study on the Natural Water Resources Master Plan (NWRMP), Japan International Cooperative Agency (JICA). Pg 2-79, 2-183.
[7] Hansen V.E. Israelsen O.W. and Stringham G.E. (1979), Irrigation Principles and Practices, New York: Pg 812.
[8] Ikhue,C.I. and Ikhile, G.U. (2003): Effect of climate change on irrigation activities. A case study of the Benin-Owena River Basin Projects IAHS Publ. No.281.
[9] Isrealsen W. and Hansen V. E. (1962) Irrigation Principles and Practices, John Wiley and Sons Inc., Pg 3, 4.
[10] NEMA (2012): National Emergency Management Agency Stakeholder consultative workshop.
[11] Okoli, C.S. (2007); Comparative advantage of Irrigation in the production of Okra (Hibiscus Esculentus), Journal of Civil Engineering and Environmental system Engineering. Vol.8, No 2,pg.017.
[12] River Basin Decree (1987) FGN, River Basin Decree No 25 of 1976 amended by decree 35