

Analysis of Economic Benefits of Flooding in Alor Uno Community, Nsukka, Enugu State

Christopher Ihinegbu

Department of Geography, University of Nigeria, Nsukka, Nigeria
Email: christopher.ihinegbu@unn.edu.ng

Godslove S. Nnadi

Department of Geography, University of Nigeria, Nsukka, Nigeria
Email: godslope.nnadi@unn.edu.ng

Ignatius A. Madu

Department of Geography, University of Nigeria, Nsukka, Nigeria
Email: ignatius.madu@unn.edu.ng

Corresponding Author: Christopher Ihinegbu

Abstract

Flooding causes huge economic losses, yet it could be beneficial. This paper examined the economic benefits of flooding in Alor Uno. Structured questionnaires (380) were distributed equally among the four quarters of Alor Uno and was used to elicit information on the benefits of floods, flood adaptive measures amongst others. Interviews were conducted with the residents engaged in flood generated economic activities as well as with Nsukka Town Planning Authority. Chi-square statistics was used to test the relationship between the benefits and the quarters of Alor Uno. Results revealed that residents who benefitted from the floods in terms of employment, improvement in agriculture, addition of nutrients to soil and provision of cheap sand for building; do so due to the quarters they resided. However, the benefits of critical infrastructure, landscape modification and provision of new lands were not dependent on the quarters the residents lived. Majority of the inhabitants of Alor Uno wants the flood to stop irrespective of its acclaimed benefits. We recommended that government implement measures to ameliorate flood in the study area and that inhabitants explores alternative livelihood for sustainable economic development in the region.

Keywords: *Flooding, economic benefits, livelihood, Alor Uno.*

1. Introduction

Flooding is a natural process and can happen at any time in a wide variety of locations. They are sudden, accidental events that may cause deaths or injuries (Adetunji and Oyeleye 2013). Floods have been defined as hydrological disaster that result in a sharp increase in water flow or a rising water level that exceeds the capacity of rivers, lakes, and reservoirs to accept the water (Burrell et al., 2007; Zhang et al, 2018). Globally, disasters are said to have devastating effect on economic development, livelihoods, agriculture, health, social and human life (Wood, 2005).

However, when floods cause economic losses or threaten human survival and social development, they are considered to be “disastrous” (Shrestha, 2008; Shrestha et al., 2008; Zhang et al, 2018). It is a natural hazard like drought and desertification which occurs as an extreme hydrological (run off) event (Nwafor, 2006). It can happen when dam fails, rainfall or snowmelt more rapidly than it can either infiltrate, evapotranspiration or run off. The excess of these runoff or snowmelt accumulates in place, sometimes hazardous resulting serious externalities such as damages, losses, deterioration of environment, retardation to development, loss of livelihood sources and a times human life (Jeb and Aggarwal, 2008). World-wide statistics indicate continuously increasing flood damages, and losses of human lives at unacceptably high levels (CRED, 2014). One-third of the world's terrain is considered flood prone, and 82% of the global population lives on this land, (Giriraj Amarnath, 2015). Social and economic stability of those regions has been adversely devastated most especially by flood.

Flooding as a natural hazard is not new in the rural areas of West Africa as some inhabitants live in flood prone areas, and indigenes have been known to invent means of protecting themselves against flood hazards (Armah et al, 2010; Cookey and Ukpong, 2018). However, different types of flooding present different forms and degrees of danger to people, property and the environment, due to varying depth, velocity, duration, rate of onset and other hazards associated with flooding (Tawari-Fufeyin,2015). With climate change, the frequency, pattern and severity of flooding are expected to change, becoming more uncertain and more damaging (Odjugo 2011; Saul 2015). Flooding can also arise from the failure of infrastructure designed to store or carry water (for instance, the breach of a dam, a leaking canal, or a burst water main), or to protect an area against flooding (for example, breach of a flood defense, failure of a flap valve or pumping station or blockage of a pipe or culvert) (Aderogba 2012; Adetunji and Oyeleye 2013).

Flooding, although a common phenomenon all over the world is more rampant and distressing in the developing countries like Nigeria (Oluwatayo and Olatunji, 2015). Consequently, many researchers (Andjelkovic, 2001; Adedeji, 2008; Adedeji, 2010; Abolade et al, 2013; Aladelokun and Ajayi 2014; Hula and Udoh, 2015; Ikechukwu, 2015; Oluwatayo and Olatunji, 2015; among others) have delved into the impacts of floods as well as preventive measures to ameliorate the same.

Hula and Udoh (2015) assessed the impacts of floods in Makurdi, Nigeria and discovered that floods in Makurdi occur at the event of high rainfall intensity and mostly between September and October. They also stated that floods causes severe damages to personal properties and public infrastructure. In the same vein, Abolade, Muili and Ikotun (2013) in their study of the impacts of flood disaster in Agege Local Government Area of Lagos State, revealed the non-functionality of the drainage system as the major cause of flood in Agege. Their study also shows that residents in Agege claimed to suffer health issues as well as other socio-economic related problems.

In line with the above, an appraisal of the socio-economic impacts of urban flood in Ado-Ekiti metropolis in Ekiti State identified the loss of lives and public infrastructures as well as the collapse and submergence of houses, market places and roads as impacts of floods in Ado-Ekiti metropolis (Aladelokun and Ajayi, 2014). Oluwatayo and Olatunji (2015) studied the effect of flooding on livelihood and consumption of households in Oyo State, Nigeria. Their study revealed that flooding affects the consumption expenditures of households in Oyo. Studies by Ikechukwu

(2015) in Port Harcourt, Nigeria spotted property damages and income reduction as adverse impacts of flood in the metropolitan area. Flooding causes huge economic losses however, few researches (Cookey and Ukpong, 2018; Zhang et al, 2018) have shown that floods can be beneficial. Cookey and Ukpong (2018) attested to the fact that flooding in rural communities of Rivers State have brought about the provision of critical infrastructures, relief materials and improved landscape modification. Zhang et al (2018) stated that flash floods in arid China has been beneficial in areas of harvesting water for future use and combating desertification.

Consequent on the above body of literature, it is obvious that only few studies have focused on the benefits of floods. These few studies payed emphasis on the social benefits resulting from flood management strategies such as the provision of critical infrastructure and new lands by the government, and donation of relieve materials to affected households by Non-governmental Organizations. However, what is lacking is the economic benefits resulting from the sale of flood deposited materials. Flooding in Alor Uno has been a recurring event over the years and has triggered certain economic activities in the flood affected area and this formed the basis for this study. Therefore, this study examines the economic benefits of floods in Alor-uno, Nsukka, Enugu State, Nigeria.

2. Methods

2.1 Study Area

Alor Uno is one of the rural communities that make up Nsukka Local Government Area of Enugu State (see figure 1). It is geographically located in the region of latitude 6° 51'39"N and 6°53'49"N and longitude 7° 21'39"E and 7° 23'35"E. The town Alor Uno is bounded on the east by Nsukka town, on the west by Ibagwa Ani, on the North by Obukpa and on the South by Edem Ani. Alor Uno comprises of four quarters namely: Ejuona, Uwani, Amikpo and Ugbene-Ero. It is situated at four kilometres distance towards the west of Kogi State. The location of Alor Uno is central within Nsukka LGA, as a major road from Nsukka to Idah in Kogi State passes through Alor Uno.

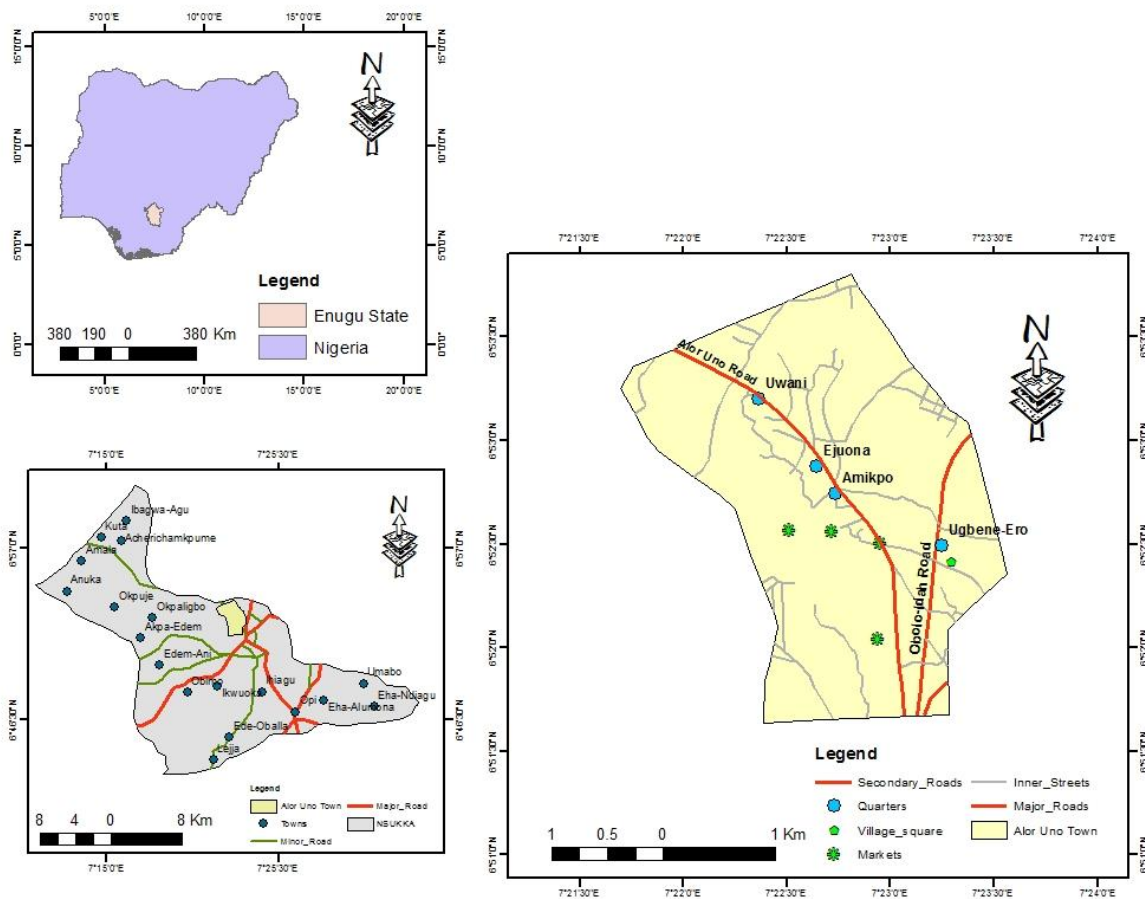


Figure 1: Map of the Study Area

The climate of Nsukka of which Alor Uno is a part belongs to the tropical wet and dry climate (Phil-Eze, 2004). The average daily minimum and maximum temperature of the area are about 23.3°C and 27°C respectively, (Inyang, 1978). Generally, the study area experiences two main climatic seasons yearly, namely; the rainy and dry season. The beginning and end of rainfall in the study area is always associated with violent thunderstorms (Anyadike, 2002). Alor Uno is a part of the Nsukka-Okigwe cuesta range which stand as a distinctive mark on the landscape of the south-eastern Nigeria with a spectacular combination of highlands and valleys and a symphonic diversity of saddles and convex summits (Ekechukwu, 2009). The cuesta could conveniently be divided into three sections; namely: the Nsukka Plateau, the Udi- Agwu highland and the Okigwe scarpland. The Nsukka plateau which forms the Northern part of the cuesta is said to exhibit a distinct upland topography consisting of a summit of between 360 and 480 meters above sea level (Ekechukwu, 2009). The landform of the Nsukka area is generally characterized by broad valley (wide bottomed valleys) and lateritic capped residuals. The dry valleys occur between the outliners and they are of U or V-shaped valley types (Amah, 2006).

The study area lies in a transistional zone of the savannah vegetation of the North and the rain forest belt of the South. This gives the area a look of “derived savannah” which is a combination of the savannah vegetation of the north with the rain forest of the south (Phil-Eze, 2004).

Alor Uno has a population of 6530 (National Population Commission, 2006) and this was projected to 8441 for 2019 using the 2.6% annual growth rate of Nigeria. Economic activities in Alor Uno includes agriculture, sand and stone mining, trading, teaching among others.

2.2. Survey Method and Description of the Sample

Both primary and secondary data were used in this study. The primary source of data for this research work includes field observation, questionnaire surveys and oral interviews. The structured questionnaires were administered to the residents of Alor Uno and was aimed at eliciting information on the benefits derived from floods, flood adaptive measures among others. In other to get a true representative sample of the target population, this study employed the same sample framework used by Thecla et al, (2015) and that is the Yamane (1964) formula for sample size determination. This formula states that the sample size of any population that is more than 100,000 is 400. Thus using the Yamane’s equation below at $\pm 5\%$ level of precision, the sample size was determined as follows:

$$S = \frac{N}{1 + N (e)^2} \dots \dots \dots (1)$$

Where, S = Sample size

1 = Constant

N = Population size (8441)

e = Margin of error, usually 5% (0.05)

$$S = \frac{8441}{1 + 8441 (0.05)^2}$$

Therefore, the sample size is 381. However, for the purpose of convenience, a total of 380 copies of questionnaires were distributed; and for equal representation, 95 copies were purposely distributed to each of the four quarters of Alor Uno (Ejuona, Uwani, Amikpo and Ugbene-Ero). However, 340 (85 from each quarters) was retrieved for the study and the simple random sampling technique was adopted in administering the copies of questionnaires.

2.3. Data Analysis

ArcGIS was used to digitize the base map of the study area that was sourced from the Town Planning Unit of Nsukka Local Government Area. The data generated from the residents and sand/stone traders were analyzed using descriptive statistics such as percentages, pie charts etc.

The chi-square statistics was used to determine whether the benefits of floods to Alor Uno inhabitants was depended on the quarters they resided.

3. Results and Discussions

3.1. Materials Derived From the Flood in Alor Uno

Our fieldwork revealed that the flood deposits materials that are of economic value. The two major materials deposited are sand and stones of different sizes. This is very noticeable in Onuakachi, Ugbene-Ero, Alor Uno where the flood is most intense. This is also noticed in other parts of Alor Uno along the flood channels (Umueze Jesus (Amikpo), Amahu (Ugbene-Ero) etc). The flood deposits these materials in commercial quantities which is then gathered and sold as can be seen in Plates 1 and 2 below. The sands and stones are used in building construction.



Plate 1



Plate 2

Plate 1: Accumulated sand/stones by flood in Onuakachi, Ugbene-Ero

Plate 2: Blockage of culvert by accumulated sand and stone along Obollo-Idah Road, Alor Uno

3.2. Economic Activities Generated by Floods in Alor Uno

Flood generated economic activities in Alor Uno include sand and stone extraction, load carriers and sales of sand and stone. The extractors in Onuakachi, during the rainy season extract the sand/stone that blocks the drainage channel and dig deep into the culvert during the dry season. The stone is then separated from the sand by handpicking/ use of sieve. The load carriers are usually young men who help in packing the sand/stone into bags and then move them from the point of extraction to the point of sale using wheelbarrows (see Plates 3-5). Another economic activity observed during our fieldwork was the trade of empty cement bags used in bagging the extracted sand/stone.



Plate 3

Plate 3: Bagged sand/stones for sale in Onuakashi, Alor Uno



Plate 4

Plate 4: Woman separating stone from sand with a sieve along Obollo-Idah Road, Alor Uno



Plate 5

Plate 5: Heaps of sand and stone for sale at Umueze Jesus Community, Amikpo, Alor Uno

These flood generated economic activities have been a source of livelihood to some people in Alor Uno. An oral interview with some of the stone/ sand traders in Onuakashi, Ugbene-Ero revealed that a 50kg bag of sand is sold for two hundred Naira (₦200) while that of stone is sold for three hundred Naira (₦300). These traders sell an average of ten 50kg bags of sand/stone on a daily basis. This means they make an average of ₦2000-₦3000 Naira on a daily basis. Another interview

with sand traders in Umueze Jesus Community in Ejuona revealed that flood favours banana and oil palm cultivation as well as deposit smooth sand in commercial quantities.

These economic activities are very lucrative to the rural inhabitants engaged in them as they don't pay any form of tax from the sand/stone extraction stage to the stage of sale. In fact, some of the interviewed traders in the study area attested to the fact that their main source of livelihood come from the money generated from selling of sand/stones.

3.3. Analysis of the Benefits of Flooding to inhabitants of Alor Uno

On the benefits of flooding, data analysis shows that the most crucial benefits for the people of Ejuona is the provision of cheap sand/stone for building (39%) while the least rated benefit is the provision of new lands (1%). This can be justified by the flood deposits of sand/stones along its channels in Alor Uno. In Uwani, data analysis shows that the most important benefit is the provision of cheap sand/stone for building (36%), while the least important benefits are the provision of critical infrastructure (1%), improvement of landscape modification/tourism (1%), provision of new lands (2%) and others (1%). However, in Amikpo, the respondents attested to the fact that improvement in agricultural activities (33%) was the most crucial benefit of flooding while the provision of critical infrastructure (1.5%), improvement of landscape modification/tourism (1%), provision of new lands (0.5%) and others (1%) were perceived as having little or no benefits in the region. The most crucial benefit in Ugbene-Ero was the provision of cheap sand/stone for building (41%) while improvement of landscape modification/tourism (1%), provision of new lands (1%) and others (1%) were perceived as least beneficial.

In comparing the benefits among the four quarters (see Table 1), the results shows that the provision of critical infrastructure was highly rated in Ejuona than in other quarters. This may partly justify why they attested to low frequencies of flood occurrence when interviewed. However, the provision of critical infrastructure recorded a poor response in the four quarters. This generally low responses in 'the provision of critical infrastructure' benefit may suggest that the government have not taken necessary actions to reduce flooding in Alor Uno. Improvement of landscape modification/tourism was generally poorly rated but has its highest rating in Ejuona. In terms of the provision of employment, residents in Ugbene-Ero attested to this benefit than other quarters. This could be due to the fact that the flood is more intense in Ugbene-Ero and therefore deposits more quantities of sand/stones for sale. Improvement in agricultural activities was more rated in Amikpo than other quarters. This correlates with our oral interview in Amikpo which revealed that the flood provides moisture which favours the cultivation of Plantain, Banana and Oil palm. This interview also revealed that the flood is not experienced in all parts of Amikpo. The provision of new lands was generally poorly rated in all the four quarters of Alor Uno. Provision of nutrients to the soil was highly rated in Amikpo than other quarters. This partly explain why the residents perceived 'improvements in agricultural activities' as a crucial benefit of flood in Amikpo. The provision of cheap sand/stone for building was highly rated in all quarters of Alor Uno. However, it was most rated in Ugbene-Ero because the flood is more intense in the area.

Generally, the provision of cheap sand/stone for building (34.2%), improvements in agricultural activities (27.9%) and provision of employment (19.8%) was highly rated across the four quarters

than other benefits. This is due to the fact that the flood deposits sand/stones in large quantities which then provides jobs (sand/stone extraction, selling, load pushing etc) to these rural people. Also the flood provides moisture which favours agricultural activities. A cross tabulation of multiple responses on the beneficial impact of flooding across the four quarters is presented in Table 1 below.

Table 1: Cross Tabulation of the Multiple Responses to the Benefits of Flooding in Alor Uno (n= 340)

Benefits	Quarters								Total	
	Ejuona		Uwani		Amikpo		Ugbene-Ero		frequency	%
	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Provision of critical infrastructure	06	7	01	1	03	1.5	05	4	15	2.8
Improves landscape modification	03	4	01	1	02	1	01	1	7	1.3
Provision of employment	04	5	18	16	32	18	48	33	102	19.6
Improves agricultural activities	22	28	30	27	61	33	25	16	138	26.5
Provides new lands	01	1	02	2	01	0.5	01	1	5	0.9
Provides nutrients to soil	10	12	17	16	39	21	04	3	70	13.4
Provides cheap sand/stone for building	31	39	40	36	46	24	60	41	177	34.2
Others	03	4	01	1	02	1	01	1	07	1.3
Total	79	100	110	100	184	100	145	100	519	100

Source: Authors Fieldwork, 2019

The Chi-Square test was conducted with SPSS to determine if the benefits derived by the residents of Alor Uno were dependent on the quarters they reside. The chi-square and asymptotic significant value is shown in Table 2 below. A result can be said to be significant if the asymptotic value is less than or equals to 0.05. Therefore, the chi-square result below shows a significant relationship for provision of employment, improvement in agricultural activities, provision of nutrients to soil, cheap sand/stone for building and others. This means that the residents who enjoy these five (5) listed benefits, do so mainly because of the quarters they reside. This correlate with table 1 which show the variations in the responses of residents to the benefits of flood according to the quarters they reside. However, the chi-square test reveals a non-significant relationship for the provision of critical infrastructure, improved landscape modification and provision of new lands. This implies that the derivation of these three benefits are independent on the quarters resided by the inhabitants of Alor Uno.

Table 2: Chi-square test analysis between Quarters and Benefits derived by residents of Alor Uno from flood

Benefits	Pearson Chi-Square	df	Asymptotic Sig. (2-sided)
Provision of critical infrastructure	6.258	3	.100
Improves landscape modification	5.481	3	.065
Provision of employment	57.627	3	.000
Improvement in agricultural activities	42.494	3	.000
Provision of new lands	3.009	3	.390
Provision of nutrient to soil	50.896	3	.000
Cheap sand/stone for building	20.610	3	.000
Others	9.080	3	.028

Source: Authors Analysis, 2019

3.4. Adopted Measures to Reduce Flood Impact

Almost all respondents adopted one or more measures so as to cushion flooding. Results in Table 3 below reveals that the most common adapted measures to reduce flood impact were the use of sand/stone bags (34.7%), formation of local groups (28.8%) and the planting of trees (20.9%). Our fieldwork and interviews with residents revealed that the inhabitants of the study area mainly uses sand/stone filled bags to cushion flood, especially at the entrance of different households in the flood affected areas. Thus, making use of locally sourced materials to adapt to flood. We also observed that the inhabitants form local groups to deliberate and take necessary actions that would reduce flood impacts. For instance, it is the youths in Onuakachi, Amahu-Ugbene, Umudiakpoke among other communities that occasionally mount sand/stone bags along the flood direction to reduce its impact. A resident of Umueze- Jesus community, Amikpo attested to the fact that the youths occasionally clear the sand/stone and waste from the major drainage in the community so as to create more channel for easy flow of surface runoff. Another resident of Onuakachi, Ugbene-Ero revealed that the community have sent their representatives to the local government on several occasions and that no tangible measures have been taken by the government. However, construction of drainage channels (11.9%), building of soak pits (0.4%) and others (3.2%) are not commonly adopted to reduce flood impact as can be seen in Table 3 below. Interviews with some residents revealed that majority of them could not afford the cost involved in drainage construction. This made this option limited to the wealthy inhabitants of the area. For instance, the culvert in Amahu-Ugbene was constructed by a wealthy individual as the flood created a gully between the red-earthen road in that community. Other options may also be expensive to these rural inhabitants. For instance, an interviewed resident in Onuakachi community attested to the fact that he bought scrapped coal tar from old roads (which is quite expensive for him) and applied them to the load leading to his house so as to make it accessible by vehicles during his mother's funeral. This options can only be adopted by the wealthy inhabitants.

**Table 3: Cross Tabulation of the Adopted measures to reduce Flood Impact in Alor Uno
(n= 340)**

Adopted measures to reduce flood impact	Quarters				Total	
	Ejuona	Uwani	Amikpo	Ugbene- Ero	frequency	%
Use of sand bags	11	50	61	73	195	34.3
Formation of local groups	13	31	60	58	162	28.5
Construction of drainage channels	21	20	11	15	67	11.8
Planting of trees	16	29	27	46	118	20.9
Building of Soak pits	01	02	01	01	02	0.9
Others	01	04	01	14	18	3.6
Total	63	136	161	207	567	100

Source: Authors Fieldwork, 2019

3.5. Frequency of Flood Occurrence in Alor Uno

The frequency of flood during rainy season was also derived from the administered questionnaire. The result in Table 4 below shows that majority of the respondents in Ejuona 56.48% never experiences flood. This might justify why they derive the least benefits from floods when compared to other quarters in Alor Uno. In Uwani, 34.12% of the respondents attested to the fact that they have never experienced flood, 24.27% attested to the monthly occurrence of flood during rainy season while few respondents attested to flood occurring anytime it rains, twice weekly and more than twice a week. In Amikpo, 30.58% of respondents' experiences flood monthly, 20% experiences flood once a week, 15.29% never experiences flood; while few respondents opined to flood occurring anytime it rains, twice weekly and more than twice a week. In Ugbene-Ero, 35.2% of the respondents (which represent the highest frequency) attested to the fact that flood occurs anytime it rains. This result suggests that Ugbene-Ero experiences flood than any other quarter in Alor Uno. An interview with a resident in Amahu, Ugbene- Ero revealed that flood sometimes occur in Ugbene-Ero even without the occurrence of rainfall. The respondent further stated that heavy down pour in Nsukka Urban could cause severe flood in Ugbene-Ero.

**Table 4: Cross Tabulation between Quarters and the frequency of Flood during rainy
season in Alor Uno (n= 340)**

Frequency of flooding	Quarters							
	Ejuona		Uwani		Amikpo		Ugbene-Ero	
	Freq.	%	Freq	%	Freq.	%	Freq	%

Once a week	09	10.58	11	12.94	17	20.0	10	11.76
Twice a week	04	4.71	08	9.41	10	11.76	16	18.83
More than twice weekly	07	8.23	11	12.94	08	9.42	14	16.48
Monthly	14	16.48	21	24.71	26	30.58	12	14.11
Anytime it rains	03	3.52	05	5.88	11	12.95	30	35.30
Never	48	56.47	29	34.12	13	15.29	03	3.52
Total	85	100	85	100	85	100	85	100

Source: Authors Analysis, 2019.

3.6. Residents Attitude towards Flooding in Alor Uno

The residents' attitude towards flood was determined by their response on whether they want the flood to stop or not. A total of 338 (99.41%) respondents want the flood to stop while the remaining 2 (0.59%) want the occurrence of flood to continue in Alor Uno. This result suggest that the residents' want the flood to stop regardless of the acclaimed benefits they derive from it. This is because flood in the study area has posed severe hazards to lives and properties. An interview with the Town Planning Unit of Nsukka LGA revealed that flooding in Alor Uno has killed at least five people since 2018.

CONCLUSION

There is no doubt that economic activities resulting from flood deposits are improving the economic livelihood of household in the study area. In the same way increase economic activity is necessary for a higher standard of living. However, even though, economic activity has been associated with flooding, flood is a disaster and should be mitigated by appropriate choice of policy, technology and institution in order to achieve a sustainable economic and environmental development. Therefore, the inhabitants of Alor Uno should explore alternative livelihood that are sustainable. Also, drainage infrastructures should be constructed in Alor Uno so as to accommodate the excess runoff from Nsukka Urban. The local government of Nsukka should maintain and clear blocked culverts on a regular basis so as to allow the easy flow of runoff from neighbouring towns. A careful and holistic implementation of the above mentioned strategies would not only ameliorate flooding in Alor Uno, but also foster a sustainable economic and environmental development.

References

- Abolade, O., Muili, A.B. and Ikotun, S.A. (2013). Impacts of flood disaster in Agege local government area Lagos, Nigeria. *International Journal of Development and Sustainability*, 2(4): 2354-2367
- Adedeji, A.A. (2008), *Environmental Hazard: Flooding and Its Effects on Residential Buildings in Ilorin*, Ilorin Fotress Press, pp. 67-78.
- Adedeji, A.A. (2010), “Anthropogenic Activities and Flood Inducement in Urban Environment: The Case Study of Kwara state Nigeria” in Ojo, S.O and Ukeje, J.E (Ed) *Africa Proceedings of Sustainable Africa Vol. 5 pp1-4* Nigeria Met Society.
- Aderogba KA 2012. Qualitative studies of recent floods and sustainable growth and development of cities and towns in Nigeria. *International Journal of Academic Research in Economics and Management Sciences*, 1(3): 1-25.
- Adetunji M, Oyeleye O 2013. Evaluation of the causes and effects of flood in Apete, Ido Local Government Area, Oyo State, Nigeria. *Journal of Civil and Environmental Research*, 3(7): 1-9.
- Aladelokun, A.O. and Ajayi, C.F. (2014). An Appraisal of the Socio-economic Impacts of Urban Flood in Ado-Ekiti Metropolis in Ekiti State. *International Journal of Asian Social Science*, 4(10): 1027-1034
- Amah, J.I. (2006). *Mathematical modelling of Groundwater Flow System of a Water Table Aquifer in Nsukka Areas, South Eastern Nigeria*. Unpublished Msc. Thesis, University of Nigeria, Nsukka.
- Annual Disaster Statistical Review. (2014). Centre for Research on the Epidemiology of Disasters (CRED), 2014.
- Andjelkovic, I. (2001), *International Hydrological Programme: Guidelines on Non-structural Measures in Urban Flood Management*, UNESCO, Paris.
- Anyadike, R.N.C. (2002). *Climate and Vegetation in Oformata (eds.) A survey of Igbo Nation*. African Publisher Limited, Onitsha. Pp. 73-89
- Armah A. F., Yawson D. O., Yengoh G. T., Odoi J. O. and Afrifa E. K. A.(2010). Impact of Floods on Livelihoods and Vulnerability of Natural Resource Dependent Communities in Northern Ghana. *Water Vol 2*, pp 120-139; doi:10.3390/w2020120
- Burrell, B.C., Davar, K., Hughes, R., 2007. A review of flood management considering the impacts of climate change. *Water Int.* 32: 342–359.
- Cookey, A.T. and Ukpong, I.E. (2018). Adaptation Strategies and Benefits of Flooding in the Rural Communities of Rivers State, Nigeria. *International Journal of Social Sciences*, 12(1): 63-73

- Ekechukwu, L.C. (2009). Pathway for harnessing the tourism potential of natural and cultural sites and features on the Nsukka-Okigwe Cuesta. *International Journal of Research in Arts and Social Sciences*, Vol. 1, No. 19
- Giriraj Amarnath. (2015). *Climate Change, Agriculture and Food Security*. A research project by CCAFS and International Water Management Institute (IWMI)
- Hula, M.A. and Udoh, J.C. (2015). An assessment of the impact of flood events in Makurdi, Nigeria. *Civil and Environmental Research*, 7(10): 53-60
- Ikechukwu, E. E. (2015). Socio-Economic Impacts of Flooding on the Residents of Port Harcourt Metropolis in Rivers State, Nigeria. *Natural Resources*, 6: 1-8
- Inyang P.E.B. (1978). *Climate of Nsukka and Environs in G.E.K.* Oformata (ed.). The Nsukka Environment. Enugu, Fourth dimension publishers
- Jeb, D.N. and Aggarwal, S.P. (2008) Flood Inundation Hazard Modeling of the River Kaduna Using Remote Sensing and Geographic Information Systems. *Journal of Applied Sciences Research*, 4, 1822-1833.
- National Population Commission of Nigeria (2006). *Population and Housing Census Priority Table, Volume IV*.
- Nwafor, J. C. (2006). "Environmental Impact Assessment for Sustainable Development: The Nigerian Perspective". Enugu EL DEMAK Publications.
- Odjugo P.A.O. (2011). *Perception of Climate Change in the Niger Delta Region of Nigeria*. A Report Submitted to the Centre for Population and Environmental Development. Nigeria, pp. 1-18
- Oluwatayo, I.B. and Olatunji, K. (2015). Effects of Flooding on the livelihood and Consumption of Households in Oyo State, Nigeria. *Journal of Economics*, 6(2): 169-176
- Phil-Eze, P.O. (2004). The vegetation of the Nsukka Plateau: Empirical Analysis of Forms and Patterns in Nwafor J.C. et al (ed.), *Geographical Report of the University of Nigeria, Nsukka*. Enugu: JAMOE Enterprise pp. 128-146
- Saul E 2015. Impact of climate change on agriculture and food security in Nigeria: Challenges and adaptation. *Global Advance Research Journal of Medicinal Plants (GARJMP)*, 3(1): 001-009.
- Shrestha, A.B., Shah, S.H., Karim, R., 2008. *Resource Manual on Flash Flood Risk Management. Module 1: Community-Based Management*. International Centre for Integrated Mountain Development, Kathmandu, Nepal.

- Shrestha, A.B., 2008. Resource Manual on Flash Flood Risk Management. Module 2: Non-Structural Measures. International Centre for Integrated Mountain Development, Kathmandu, Nepal.
- Tawari-Fufeyin P, Paul M, Godleads AO 2015. Some aspects of a historic flooding in Nigeria and its effects on some Niger-Delta communities. American Journal of Water Resources, 3(1): 1-10.
- Thecla, I.A., and Ogbodo, C. (2015). Determinants of Flooding in Port Harcourt Metropolis, Nigeria. Journal of Humanities and Social Science 19(11), 64-72
- Tinh, D.Q. and Hang, P.T. (2003), “Living with Floods in the Mekong River Delta of Vietnam”, Paper for the World Water Forum Poverty and Flood Theme.
- Yamane, T. (1967). Statistics: An introductory analysis (2nd ed.). New York, NY: Harper and Row.
- Zhang, J., Yu, Z., Yu, T., Si, J., Feng, Q. and Cao, S. (2018). Transforming Flash Floods into resources in arid China. Land Use Policy. <https://doi.org/10.1016/j.landusepol.2018.03.002>