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EFFECT OF DRY SEASON WATERSHED ANTHROPOGENIC ACTIVITIES ON ATTAH STREAM SIZE IN OBANLIKU LOCAL GOVERNMENT AREA OF CROSS RIVER STATE.

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Abstract

The removal, destruction or impairment of natural ecosystems are among the greatest causes of critical impacts on the sustainability of our natural water resources, However, it should be emphasized that the ecosystems with which we interact are directly linked to the well-being of our natural water resources. Attah watershed was divided according to land use type (Forested land use type, Settlement land use type and farming land use type) Stream width and depth was measured using measuring tape (and rope for larger streams) and graduated ruler respectively. The result in year 1 shows that forest land use type had a width mean of 10.76 ± 2.05^{b} as compared to its width mean in year 2 which was 9.94 ± 1.55^{c}, the farming land use type width mean in year 1 was $11.75^{c} \pm 1.55^{b}$ as compared to the farming in year 2 which is 12.85 ± 2.05^{b}, while for settlement land use type, the width mean in year 1 was 19.39 ± 2.75^{a} as compared to the width mean in year 2 which was 21.15 ± 2.15^{a}. For stream depth forested land use type had a depth mean of 8.18 ± 0.65^{a} in year 1 as compared its depth mean in year 2 which was 7.95 ± 2.25^{a}, in farming land use type in year 1 the mean depth was 2.43 ± 0.25^{c} as compared to year 2 depth mean which is 2.05 ± 1.15^{b}, while for settlement land use type year 1 the depth mean was 3.03 ± 0.25^{b} as compared to the mean depth in year 2 which was 2.75 ± 0.15^{b}. For DHAS, the forest mean in year 1 was 45.58 ± 2.51^{a} while in year 2 the DHAS was 43.85 ± 1.05^{a}, farming in year 1 had a mean of 2.31 ± 0.75^{b} as compared to its mean in year 2 which had 2.15 ± 0.25^{b} while for settlement, the DHAS mean in year 1 was 2.02 ± 0.54^{b} as compared to its mean in year 2 which was 1.98 ± 2.05^{b}. The result also revealed that as the width increased, the water quality in that land use type decreases. It was concluded that the major human activities in the watershed are farming, bathing, washing, logging, waste disposal, garri, palm oil processing and settlement around the stream watersheds. The study revealed that human activities around Attah watershed have reduced stream depth, width and water quality.

Key words: anthropogenic activities, stream depth, stream width, land use, farming, settlement, forest

1.0 Introduction

Humans and other living things depend on water for life and health, yet the World Health Organization (WHO, 2006) reports that about 80 percent of the world's people live in places where the only available water is unsafe. Water-related problems are increasingly important challenges to sustainable development as the United Nations recognized in declaring 2005-2015 water for life decade (Food and Agricultural Organization, 2007).

Streams are particularly vulnerable to land use change and ubiquitous exploitation (United Nations Geographical Survey, 2009 and Green facts, 2008). Understanding the relationship between land use and stream depth, stream width is helpful for identifying primary threats to water scarcity, stream depth, stream width and the relationships are meaningful for effective water quality management because they can be used to target critical land use areas and to institute relevant measures to minimize pollutant loadings.

Forested catchments supply a large proportion of all water used for domestic, agricultural and industrial needs. The availability of water is strongly influenced by forest and thus depends on proper forest management (FAO, 2007).

Natural forests and well-managed plantation can protect drinking water supplies. Managed forests usually have lower input of nutrients, pesticides and other chemicals than more intensive land use such as agriculture (Adekunle, *et al.,* 2007). Forests planted in agricultural and urban areas can reduce pollutant, especially when located on runoff pathway or in riparian zones.

Safe drinking water is essential for maintaining public health; every effort made to achieve the highest quality drinking water possible is of utmost necessity. Protection of water supply from contamination is the first step in providing clean drinking water, for a source protection program to be effective, human activities that result into pollution problems or risks within a watershed need to be identified.

Both natural events and human activities affect watersheds, natural events such as storms, fires and droughts can suddenly alter watershed conditions at large scales. Individual human activities typically have smaller and more predictable impacts, but their cumulative impact can be far greater. Increase in population, land development and economic activity increase demands for water, waste disposal, and raw material. These activities increase the pollutant release to water and air and degrade or fragment natural habitat. Without appropriate management, safe drinking water can only be accomplished through watershed monitoring, which consist of water quality monitoring and land use surveys.

The deterioration of stream water quality due to unsustainable human activities has become a key environmental concern. Anthropogenic activities are directly reflected in land use characteristics (Gleeson *et al*, 2012).

The removal, destruction or impairment of natural ecosystems are among the greatest causes of critical impacts on the sustainability of our natural water resources, However, it should be emphasized that the ecosystems with which we interact are directly linked to the well-being of our natural water resources. Although it is difficult to integrate the intricacies of ecosystems into traditional and more hydrologically-based water assessment and management processes, this approach is being strongly advocated in some sectors scientific domains (Bautista and Rahman, 2016).

2.0 Materials and methods

2.1 Location

The study area is Obanliku Local Government Area of Cross River State It is Located on latitude $6^0 23'$ 48^0N longitude $9^0 24'$ 30^0E.

It shares boundaries with Benue state to the North, Obudu Local Government to the West, to the East by Cameroon Republic and to the South by Boki local government area (Andem *et al., 2013*).

2.2 Sampling method

Attah watershed is located in Obanliku Local Government Area of Cross River State and flows across two villages which include Blukonu and Bayuluga villages

The Attah watershed was purposively selected (based on size and rate of human activities in the stream watersheds).

2.3 Data collection

Attah watershed was divided according to land use type (Forested area, Settlement and farming area) and each land use type was sub-divided into three replicates. The distance from each land use type was 500m apart while the distance between each replicate (R_1 R_2 R_3) was 100m apart.

Stream width and depth was measured using measuring tape (and rope for larger streams) and graduated ruler respectively and the points where measurements were taken were labeled R_1 R_2 R_3 in each land use type as used by Kashaigili and Majaliwa (2013). The above measurements taken were to determine the effects of human activities on stream depth and width.

Questionnaire was also used to generate information on the effect of anthropogenic activities on stream size.

2.4 Data analysis

A multivariate analysis was used to determine the effect of human activities on stream depth, distance of human activities from the stream (DHAS) and stream width across the land use type.

Spearman rank correlation analysis was also used to address the significant relationship between land use type and stream depth and stream width in the study area.

3.0 Results and Discussion

3.1 Human Activities in the Study Area

The result from the table below (Table 1) revealed that out of 98 respondents, 52 respondents strongly agreed that farming activities takes place in the stream around the study area, 25 out of 98 respondents agreed that farming activities takes place around the stream while 3 of the respondents were undecided 10 of the respondents disagree that farming activities takes place around the streams in the study area while 8 out of the 98 respondents strongly disagreed that farming activities takes place around the streams in the study area.

In terms of logging activities, the result indicates that out of 98 respondents in the study area 38 strongly agreed that logging activities takes place around the streams in the study area, 32 respondents agreed that logging activities takes place around the streams in the study area while 15 of the respondents were undecided whether or not logging activities takes place around the streams in the study area meanwhile 10 of the respondents disagreed to it that logging activities takes place around the streams in the study area and 7 of the respondents strongly disagreed that logging activities takes place around the streams in the study area.

In terms of washing activities, the result from the table showed that 48 of the respondents strongly agreed that washing activities takes place in the streams in the study area, 22 respondents out of the 98 respondents agreed washing activities takes place in the streams in the study area.

For waste disposal, the result revealed that 25 out of the 98 respondents strongly agreed that waste disposal takes place in the streams in the study area, 55 respondents agreed that waste disposal takes place in the streams in the study area while 0 of the respondents were undecided whether or not waste disposal takes place in the streams in the study area meanwhile 9 of the respondents disagreed that waste disposal takes place in streams in the study area and 9 of the respondents strongly disagreed to it that waste disposal takes place in the streams that are in the study area.

Garri and oil production take place around the stream, 29 of the respondents strongly agreed to it, 34 out of 98 respondents agreed that garri and oil production take place around the stream while 4 respondents were undecided, 15 of the respondents disagreed to it that garri and oil production take place around the stream and 16 of the respondents strongly disagreed that garri and oil production take place around the stream.

3.2 Effect of Human Activities on Stream Depth, Width and Quality in selected Watershed, Cross River State.

The result from the table below (Table 2) reveals that out of 98 respondents, 38 respondents Strongly Agreed that human activities has reduce water quality, 32 respondents agreed that human activities has reduce stream water quality, 15 of the respondents were undecided whether or not human activities reduces water quality in the study area while 10 respondents out of the 98 respondents disagreed to it that human activities has reduce stream water quality and 7 out of the 98 respondents strongly disagreed to it human activities has reduce stream water quality in the study area.

In terms of stream depth, the result indicates that, out of 98 respondents 48 respondents strongly agreed that human activities affects stream depth, 22 respondents agreed that human activities affects stream depth while 13 of the respondents were undecided whether or not human activities affects stream depth, 5 of the respondents disagreed that human activities affects stream depth and 10 respondents strongly disagreed that human activities affects stream depth.

For stream width, the result from the take showed that out of 98 respondents 52 of the respondents strongly agreed that human activities has affected stream width, 25 respondents also agreed that human activities has affected stream width, 3 of the respondents were undecided whether or not human activities has affected stream width while 10 of the respondents disagreed that human activities affects stream width and 8 of the respondent strongly disagreed that human activities affects stream width.

In terms of stream pollution, the result pointed out that out of the 98 respondents in the study area 29 strongly agreed that human activities causes stream pollution, 34 respondents agreed that human activities causes stream pollution, 4 of the respondents were undecided whether or not human activities causes stream pollution meanwhile 15 respondents disagreed that human activities causes stream pollution and 16 of the respondents strongly disagree that human activities causes stream pollution.

In terms of stream volume, the result from the table revealed that 25 of the respondents strongly agreed that human has reduce stream volume, 55 of the respondents agreed that human activities has reduce stream volume while 0 of the respondents were undecided on whether or not human activities has reduce stream volume meanwhile 9 of the respondents disagreed to it that human activities has reduce stream volume and 9 of the respondents strongly disagreed to it that human activities has reduce stream depth.

Table 1: Human Activities in selected Watershed, Cross River State

S/N	Items	SA (5)	A (4)	U (3)	D (2)	SD (1)	N	WS	WMS	Rmks
1	Farming activities take place around the stream	52 (260)	25 (100)	3 (9)	10 (20)	8 (8)	98	397	3.9	Agree
2	Logging activities take place around the stream	38 (190)	32 (128)	15 (45)	10 (20)	7 (7)	98	390	3.9	Agree
3	Washing activities take place in the stream	48 (240)	22 (88)	13 (39)	5 (10)	10 (10)	98	387	3.9	Agree
4	Waste disposal take place in the stream	25 (125)	55 (220)	0 (0)	9 (18)	9 (9)	98	372	3.8	Agree
5	Garri and oil production take place around the stream	29 (145)	34 (136)	4 (12)	15 (30)	16 (16)	98	339	3.5	Agree

Note: Values outside the brackets are the frequency of respondents; values inside the rackets are the Likert weighted or rating scores (i.e freq. x Likert rating points)

N = is the to the number of the respondents

WSS = Likert weighted score

WMS = Likert weighted mea score

Table 2: Effect of Human Activities on Stream Depth, Width and Quality in selected Watershed, Cross River State

S/N	Items	SA	A	U	D	SD	N	WS	WMS	Remarks
1	Human activities have reduced stream water quality	38 (190)	32 (128)	15 (45)	10 (20)	7(7) (48)	98	390	3.9	Agree
2	Human activities have affected stream depth	48 (240)	22 (88)	13 (39)	5 (10)	10 (10)	98	387	3.9	Agree
3	Human activities have affected stream width	52 (260)	25 (100)	3 (9)	10 (20)	8 (8)	98	397	3.9	Agree
4	Human activities have cause pollution to the stream	29 (145)	34 (136)	4 (12)	15 (30)	16 (16)	98	339	3.5	Agree
5	Human activities have reduce stream volume	25 (125)	55 (220)	0 (0)	9 (18)	9 (9)	98	372	3.8	Agree

Note: Values outside the brackets are the frequency of respondents; values inside the rackets are the Likert weighted or rating scores (i.e freq. x Likert rating points)
N = is the to the number of the respondents
WS = Likert weighted score
WMS = Likert weighted mean score

3.3 Effect of dry season on stream depth, stream width and DHAS of Attah stream Across the land use types in year 1 of the study

The result on the effect of dry season on stream width, depth and DHAS across the different land use types is presented on the ta**b**le below (Table 2), the result revealed that **i**n year 1, in terms of stream width, forested land use type had a mean of 10.76+ 2.07[b], farming had a stream width mean of 11.75± 1.55[b], while settlement land use type had a stream width mean of 19.39± 2.76[a].
For stream depth, the result revealed that forested had a mean depth of 8.18± 0.65[a,], farming had a mean depth of 2.43± 1.48[b] while the settlement land use type had a depth mean of 3.03± 0.25[b]. for DHAS, the result showed that forested land use type had a mean of 45.54± 2.51[a], farming had a DHAS mean of 2.31±0.75[b] while settlement land use type had a DHAS mean of 2.02 ±0.54[b].

Table 3: Dry Season Mean value of width, depth and DHAS of Attah across the land use types in year 1

Parameters	Forested	Farming	Settlement
Width	10.76±2.07[b]	11.75±1.55[b]	19.39±2.76[a]
Depth	8.18±0.65[a]	2.43±1.48[b]	3.03±0.25[b]
DHAS	45.58±2.51[a]	2.31±0.75[b]	2.02±0.54[b]

Significant level 0.05; mean values in the same column with the same letters are not significantly different from each other.

P>0.05

DHAS(Distance of human activities away from stream)

3.4 Effect of dry season on stream depth, stream width and DHAS of Attah Across the land use types in year 2 of the study

The result on the effect of dry season on stream width, depth and DHAS of Attah across the different land use types is presented on the table below (Table 3), the result revealed that in year 2 of the study reveals that in terms of stream width, forested land use type had a mean of 9.94±1.55[c], farming had a stream width mean of 12.85±2.05[b], while settlement land use type had a stream width mean of 21.15±2.15[a]

For stream depth, the result revealed that forested had a mean depth of 7.95±2.25[a], farming had a mean depth of 2.05±1.15[b] while the settlement land use type had a depth mean of 2.75±0.15[b]. for DHAS, the result showed that forested land use type had a mean of 43.85±1.05[a], farming had a DHAS mean of 2.15±0.25[b] while settlement land use type had a DHAS mean of 1.98±2.05[b]

Table 4: Dry Season Mean value of width, depth and DHAS of Attah across the land use types in year 2

Parameters	Forested	Farming	Settlement
Width	9.94±1.55[c]	12.85±2.05[b]	21.15±2.15[a]
Depth	7.95±2.25[a]	2.05±1.15[b]	2.75±0.15[b]
DHAS	43.85±1.05[a]	2.15±0.25[b]	1.98±2.05[b]

Significant level 0.05; mean values in the same column with the same letters are not significantly different from each other.

P>0.05, DHAS(Distance of human activities from stream)

3.5 Comparism of year 1 and year 2 dry seasons mean for Attah across the land use types within the study area.

The result from the table (Table 4) revealed that in year 1 forest land use type had a width mean of 10.76+ 2.05[b] as compared to the width mean in year 2 which was 9.94+1.55[c], the farming land use type width mean in year 1 was 11.75[c]+ 1.55[b] as compared to the farming land use type in year 2 which is 12.85+ 2.05[b], while for settlement land use type, the width mean in year 1 was 19.39+ 2.75[a] as compared to the width mean in year 2 which is 21,15+ 2.15[a].

In terms of stream depth the result from the table indicated that Attah had a depth mean of 8.18+ 0.65[a] in year 1 as compared its depth mean in year 2 which was 7.95+ 2.25[a] in forested land use type, in farming land use type, the result showed that in year 1 the mean depth was 2.43+ 0.25[c] as compared to that of year 2 which is 2.05+ 1.15[b], while for stream depth in settlement land use type, the result revealed that in year 1 the depth mean was 3.03+ 0.25[b] as compared to the mean depth in year 2 which was 2.75+ 0.15[b].

In terms of distance of human activities away from stream (DHAS), the result revealed that, in the forest land use type the mean in year 1 was 45.58+ 2.51[a] while in year 2 the DHAS was 43.85+ 1.05[a], farming land use type in year 1 had a mean of 2.31+ 0.75[b] as compared to its mean in year 2 which had 2.15+ 0.25[b] while for settlement land use type, the DHAS mean in year 1 was 2.02+ 0.54b as compared to its mean in year 2 which was 1.98+ 2.05b.

Table 5: Dry Season Mean value of width, depth and DHAS of Attah across the land use types across the study period

	YEAR 1			YEAR 2		
	Forest	**Farming**	**Settlement**	**Forest**	**Farming**	**Settlement**
Width	10.76±2.05[b]	11.75±1.55[b]	19.39±2.75[a]	9.94±1.55[c]	12.85±2.05[b]	21.15±2.15[a]
Depth	8.18±0.65[a]	2.43±0.25[c]	3.03±0.25[b]	7.95±2.25[a]	2.05±1.15[b]	2.75±0.15[b]
DHAS	45.58±2.51[a]	2.31±o.75[b]	2.02±0.54[b]	43.85±1.05[a]	2.15±0.25[b]	1.98±2.05[b]

+P>0.05; mean values in the same column with the same letters are not significantly different from each other

DHAS(Distance of human activities from stream)

4.0 Discussion

4.1 Effect of Human Activities on Stream Depth, Width and Water Quality

The respondents agree (3.8) that human activities around watersheds in the study area have reduced stream depth, width and stream water quality (3.9) agreeing with Asami (2012) who investigated the effect of human activities on stream watershed and further revealed that the changing of landuse form has direct effect on stream width, depth and water quality.

Human activities effect on water bodies are very enormous as its effect increases health challenges, reduces water usage and increases water shortage

The respondents also agreed (3.6) that Pollution of water bodies was noticed as one of the effects of human activities around water bodies and findings agrees with the work of Douglas (2006) who revealed that one of the major effects of human activities around water bodies is that of water pollution as most people even defecate in the stream thereby reducing water quality.

4.2 Effect of Human Activities on Stream Depth, Width and DHAS

Humanity has interfered with the hydrology of streams and rivers through changes in land use, including urbanization, forest–agriculture conversions or other impacting actions. The consequences for water resources and watershed management are numerous, including changes in the share of water balance components (e.g., surface flow, infiltration/groundwater flow, and evapotranspiration), potential water scarcity problems derived there from, hydro morphological changes in stream banks and urban floods.

The study revealed that during the dry season in Attah watershed stream, there was no significant difference in width between forested and farming land use type but both were significantly different from settlement land use type in the first year of the study while in the second year of the study all the land use type were significantly different from each other, the study also revealed that the width (10.76) in year 1 of the study reduce in the second year to 9.94 while the width (11.75) in farming in year 1 increased to 12.85 in the second year of the study, the width in settlement also increase from 19.39 in year 1 to 21.15 in year 2. This increment in width in both settlement and farming land use type is because of the human activities taking place around the stream watershed and this study agrees with the report of Fiquepron *et al.*,(2013) who revealed that for streams to maintain its balance, human activities must be far from its watershed which serves as its protective layer.

In terms of depth, the study reveals significant difference among the different land use type in year 1while in year 2 there was no significant difference between farming and settlement land use type but were significantly different from forest land use type, the result also revealed that the depth for farming and settlement land use type reduced drastically from 2.43 in year 1 to 2.05 in year 2 for farming and settlement depth also reduce from 3.03 in year 1 to 2.75 in year 2for settlement land use type while for DHAS the study revealed that there was no significant difference between the DHAS of farming and settlement land use type but were significantly from the forest land use type in both year 1 and year 2 although the DHAS for all the land use type decrease in the second year of the study across the different watersheds.

5.0 Conclusion

This study assessment of human activities on Attah watersheds in Obanliku LGA in Cross River State, Based on its findings, it was concluded that the major human activities in the watershed are farming, bathing, washing, logging, waste disposal, garri, palm oil processing and settlement around the stream watersheds.

The study revealed that human activities around Attah watershed have reduced stream depth and width.

Research findings revealed that men are more involved in activities around Attah watershed than the women and this is because men are involved in logging, forest clearing, nursery beds preparation and fertilizer or chemical applications than the women who are more involved in household activities.

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