

COMMUNITIES PERCEPTION ON URBAN AND AGRICULTURAL WASTE DUMP ON ENVIRONMENT ALONG RIVER CHANCHAGA, MINNA, NIGERIA

WAKILI, B. Y.; NSOFOR, G. N.; SULEIMAN, Y. M.; & EMIGILATI, M. A.

Department of Geography, Federal University of Technology, Minna, Nigeria

Email: balawakili4real@gmail.com Phone No: +234-813-158-7607

Abstract

River Chanchaga is the major effluent receiving stream in Minna. It receives effluents from urban and agricultural wastes such as domestic and agro-allied chemicals that flow into the natural source of drinking water inducing pollution stress and degradation of aquatic environment. The study investigated the communities' perception of agricultural and urban pollutants on aquatic environment of the study area. Field surveys, interview and observation methods were used for the study. A total of 250 people accounting for 0.47% approximately 0.5% of the total population were interviewed, making it eight per each community in thirty communities along the study area. Reconnaissance survey was conducted to get acquainted with physical characteristics of the river. The result indicates that indiscriminant operation of agricultural activities and urban wastes discharge posed great public health risk to the inhabitants of the area. The identified health risk causing agents were insects and rodents attracted by garbage heaps (wastes dump) and diseases attributable to different forms of water pollution related problems like malaria, cholera, unpleasant odour and aquatic environment degradation of River Chanchaga. The result is that the communities along the study area are concerned with agrochemical usage (chemical content) with 59.7%, endanger to malaria cases with 12.3%, besides unpleasant odour with 7.4%, seasonal bed water taste with 4.1% and proliferation of pest and diseases with 16.5%. Since aquatic ecosystem provides food and water for consumption, the study recommended the improvement in the operation of agricultural practices as well as regulating and monitoring of urban discharge to control or reduce environmental damage that can affect aquatic ecosystem of the study area. It is therefore, necessary to plan and coordinate human activities along this river in a manner that their negative effects on water quality are minimized as much as possible.

Keywords: Environment, Agricultural, Pollution, Urban, Degradation, waste dump

Introduction

The dominant communities along River Chanchaga are mostly farmers, where occupations are predominantly rural activities. In rural areas, the major or principal water pollutants are often from agricultural activities and domestic wastes that flow into natural sources of drinking water like streams, wells and other rivers to deplete water quality while as urban areas the water pollution is understood to come mostly from population pressure, industrial activities and other agricultural activities that induce pollution stress on water reservoirs (Adakole, et al 2002, Kinnura, 2005, Tiseeret al, 2008). The water in this river is directly for use or utilized without subjecting it to any treatment. The alteration of water environment through agricultural practices and contamination of water source (biological chemical and physical characteristics) degrades the natural quality of water and subsequently causes adverse health effects on the respective users. When the physical and chemical conditions of ecosystem are altered, this may affect individual organisms, population and communities of the ecosystem (Lenat, et al, 1980).

The effect of agro-chemicals on human beings was reported in 1997, when the case of 'poisoned beans' consumed by some people in several states of Nigeria resulted in deaths (Kolo and Lami, 1998). They went further to state that the agro-chemicals have caused unwanted fish kill and residues were often being found in tissues of fish sometimes at concentration, which have given cause for concern because they might be approaching long term and sub lethal adverse effects (Alabaster, 1981).

The management of wastewater in Nigeria is ineffective as it does not receive the attention it deserves (Tiseeret al, 2008). The release of domestic wastewater through drainages into streams and reservoirs that supply drinking water without subjecting it to any treatment is becoming enormous of water threat to the people (Tiseer, 2008). Agrochemical substance from agricultural activities (fertilizers, nematocide, herbicides, pesticides) at the upstream and downstream catchment reservoir may discharge nutrients and heavy metals at higher concentration than that which environment can handle (WHO, 2005).

River Chanchaga have undergone alteration of land use and land cover changes since the attainment of independence and subsequent growth. This is because land uses like residential mining, commercial agricultural lands have increases due to population increase and activities expansion. The development has induced pollution stress and has been a threat to the sustainability of its natural resource population endowments. River Chanchaga in Bosso Local Government Area of Niger State is a major effluent receiving stream with many drainages inflow with urban and agricultural wastes from towns and farm lands into it. It is also used for irrigation of crops as well as source of drinking water for cattle during the dry season period. (Maureen 2002). Other environmental challenges along River Chanchaga include bank side mining, deforestation, farming (irrigation) overgrazing and decline in the number of aquatic resources. These require attention to reduce environmental degradation and water pollution so as to achieve sustainable health development and making good use of aquatic resources.

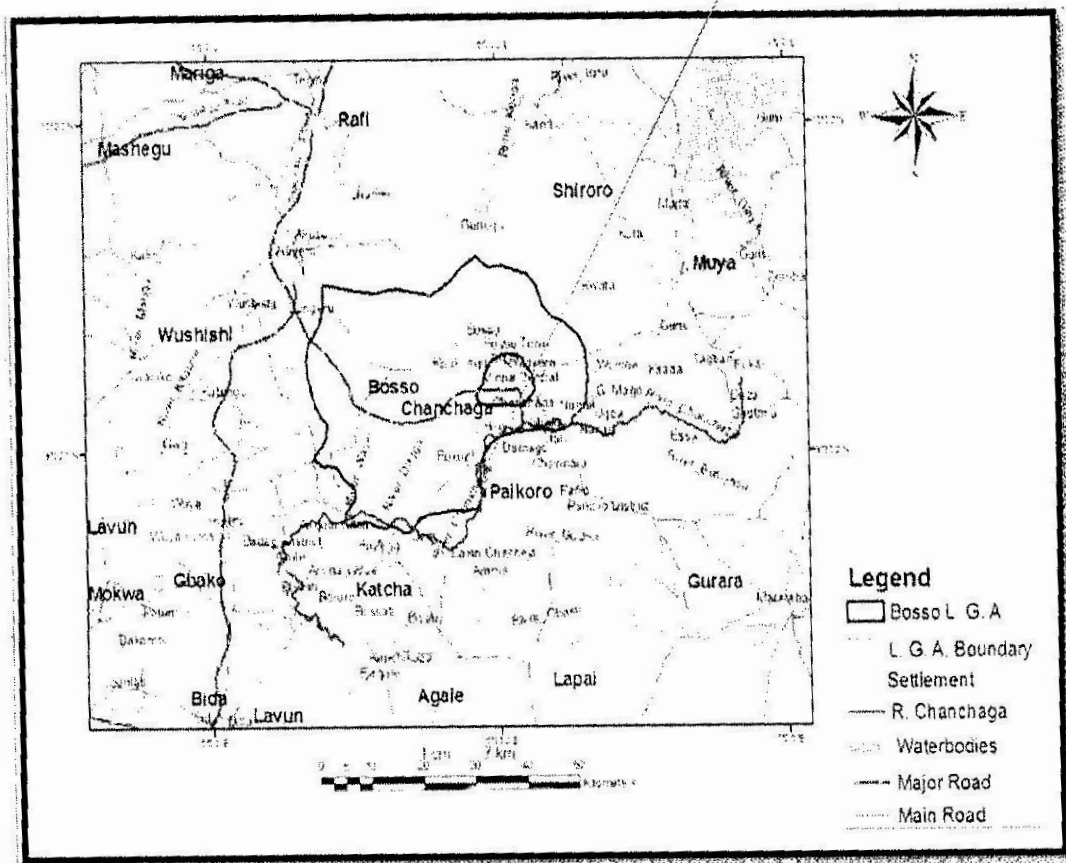
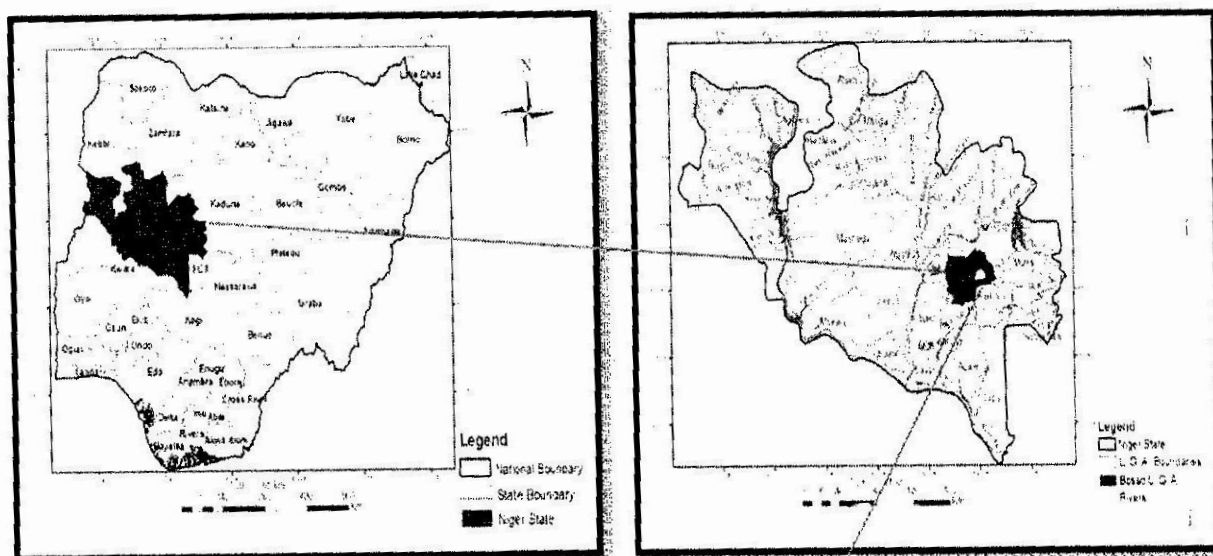
River Chanchaga connects Tagwai Dam with Chanchaga water works (where Minna Main Water Works Plant -MMWWP is situated) through River Numui. This study will help to reduce the cost of water treatment distribute to entire Minna Town and environs. The water pollution would be reduced and aquatic resources improves to achieve sustainable socioeconomic and health development through improve operation of agricultural practices and urban activities. This will improve the lives of those earning their living from aquatic ecosystem, fishing businesses and general water users from this river.

River Chanchaga presently is receiving huge volume of effluents, sediments, raw sewage and solid wastes that influence the physical, biological and chemical characteristic of the river. There is overgrazing and defecation of farm animals in river water and timely outbreak of water born diseases like cholera, malaria, typhoid fever and dysentery. Many pumps are used to suck the polluted water for irrigation purposes in surrounding crop-land putting the agriculture and soil resources at risk (Qadiret al., 2007).

The populations along River Chanchaga have increase over time and expectedly the land used also increase. This consequently brings about increase in inflow of pollutants to the river. To address the challenge of pollutants inflow in the river required understanding of the perception of communities around the river. Consequently, this study aimed to investigate the communities' perception on agricultural and urban pollutants on the aquatic environment of the study area.

The Study Area

River Chanchaga transverses Muya, Shiroro, Paikoro, Bosso and Katcha Local Government Areas and can be located on Longitude 6°33'E - Longitude 6°38'E and latitude 9°37'N -Latitude 9°40'N. The total land area covered by the basin is 159,259 km (Muhammad, 2012).



Materials and Methods

The data used for this study were acquired largely from field work. The field work involved administering of questionnaire and physical observation. The questionnaire cover a range of area from the socio-economic background, nature of chemical used on the field and the communities general awareness of implication of use of pollutants on crops land. The total number of respondents selected for this study was 250. This was arrived from using the equation below

$$Total\ Respondents = \left(\frac{250}{52143} \right) 100\%$$

$$= 0.47945\%, = 0.5\%$$

The questionnaires therefore account for 0.47% and approximately 0.5% of the total population of 52, 1 43 making it a total of eight person per community in the thirty (30) settlements to ascertain salient environmental features along River Chanchaga. However, seven of the questionnaires were not returned. Identification of different types of urban and agricultural activities using camera to take the photograph of the affected areas, ranging poles and stones for easy identification of reference points as well as Global Positioning System (GPS) for taking the coordinate of areas were conducted, investigated and analyzed. The study area was also digitized to ascertain the total length of area.

The methodology used for this research employed the use of descriptive analysis, which involved the use of tables, charts and simple percentages. Field technique involves the methods adopted for selecting sampling sites for measuring variables and for making other observations, which cover a wide range of qualitative and quantitative aspects of the environment (Mohammad, 2012)

Results and Discussion

The results indicate that the agricultural pollutants and urban wastes are two major pollution sources that are responsible for the degradation of environment of River Chanchaga and its water quality.

Agricultural Wastes

The pollutants generated from agricultural practices include agrochemicals like fertilizers, herbicides, insecticides, pesticides as well farm and animal wastes. These pollutants are the major contaminants commonly found along River Chanchaga, which when transported into the river degrade the quality of the water. The major agricultural pollutants along River Chanchaga that contribute in degradation of water environment quality are indicated in Table 1. These include fertilizer, manure spreading, irrigation practices and bush burning. The rate of pollutants inflow served as an indicator for increasing level of pollution of the study area.

Table 1: Degradation Cause by Pollutants due to Agricultural Practices

S/No	Pollutants	Frequency	Percentage (%)
1	Fertilizer application	98	40.0
2	Manure spreading	52	21.0
3	Irrigation	72	30.0
4	Bush burning	21	9.0
	Total	243	100

Source: Field Survey (2016)

Fertilizer Application

Fertilizer application ranked the highest in Table 1 with 98 accounting for 40.0% of the total respondents. The farmers along this river use different types of fertilizers like NPK, DPK as well as systemic or contact agrochemicals. The fertilizers and agrochemicals use for farming along the river especially irrigated farm lands are transported directly into the riverbank, which have subjected the study area to elevated level of water pollution. The implication of huge volumes of agricultural wastes transported by contaminated surface runoff could exert excessive nutrients, like phosphorous that could lead to eutrophication of river water channel. The plants that grow due to eutrophication process cause biological and chemical oxygen demand (BOD and COD) which eventually result in water pollution of the study area

Manure Spreading

Manure spreading ranked third with 52 respondents accounting for 21.0% as source of pollutant due to agricultural practice depicted in Table 1. Organic manure used to improve soil fertility was being washed or transported in surface water and results in high increase of contamination of the study area. This may possible responsible for the change of water colour and odour of River Chanchaga.

Bush Burning

Bush burning ranked the least with 21 (9.0%) as source of pollutant due to agricultural practice in the study area depicted in Table 1. The result indicates that bush burning for farming and hunting for capturing riverside animals are responsible for 9.0% of water environment degradation of River Chanchaga. The continuously clearance and killing of riverside animals through bush burning for farming activities could turn river to seasonal stream. The implication of such activities force some river side animals that aid to sustain water body all years round to migrate or die and subsequent washing the ashes of these wastes to contaminate and degrade the quality of water and environment of River Chanchaga. The communities perception on agricultural pollutants is depicted in Table 2.

Table 2: Communities Perception on Agricultural Pollutants

S/No	Chanchaga		Shakka		Gada		Kakakpengi		Bosati-Bororo	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
1. Fertilizer spread	27	11.11	12	4.90	20	8.20	15	6.20	24	9.90
2. Manure spread	5	2.05	8	3.30	15	6.20	14	5.80	10	4.10
3. Irrigation	21	8.64	15	6.20	13	5.40	14	5.80	9	3.70
4. Bush Burning	3	1.20	5	2.10	7	2.90	2	0.70	4	1.60
Total	56	23.00	40	16.50	55	22.70	45	18.50	47	19.3

Source Authors work (2016)

Table 2 shows that Chanchaga were of opinion that fertilizer is the highest with agricultural pollutants of 11.11 % flowed by irrigation farming with 8,64% after which is manure spreading with 2.05% and bush burning with 1.20%. Shakka community said irrigation farming practice is the highest with 6.20%, followed by fertilizer application, after which is 3.30% and bush burning with least of 2.10%. Gada were of opinion that fertilizer is the highest with 8.20% followed by manure spreading with 6.20% and bush burning with least of 2.9%. Kakakpengi community also said fertilizer is the major contribution of agricultural pollutants with 6.20% followed by manure spreading and irrigation with equal value of 5.80% and with least value of 0.70%. Bosati-Bororo were pinion that fertilizer application is the major inflow of agricultural pollutants with 9.9% followed by manure spreading with 4.00% , after which is irrigation farming practice and bush burning with least value of 1.60%.

The study reveals that fertilizer application and other modern agrochemicals used on farm land are the major agricultural pollutants and bush burning is the least inflow into the study area. This is because the occupation of people living along the river is dominantly farming business. The increasing rate of anthropogenic activities is as a result of population growth which exerts pressure on natural environment degrading the fertility of land. It is because of the pressure on

the land that give rise to the need of fertilizer application and other agrochemical for improve yield of farm produces, which create adverse environmental effect on aquatic lives and the communities along the river.

Urban Waste Water

Urbanization areas along River Chanchaga include Chanchaga Town, Korokpa, and Talba farm Area that have impact on hydrologic regime of catchment but also have a profound influence on the quality of surface water runoff. Consequently, urbanization also alter water quality in the study area, rainfalls, surface runoff, cleanliness of the air and then transports variety of materials of chemical and biological origins to the nearest water body (River Chanchaga).

These contaminants cause detrimental impact on aquatic organisms and altered the characteristics of the ecosystem. This ends up in River Chanchaga and changes natural state of aquatic environment. The pollutants source in urban area that contaminate the study area is from street surface, light industries/factories, construction, demolition activities, erosion materials, vegetation input, litter, spills and erosion found around site D (under Chanchaga Town Bridge) to site G (under Gada Bridge along Minna-Bida road) as presented in Plate I and Figure 2.



Plate I: Urban Waste Water along Chanchaga

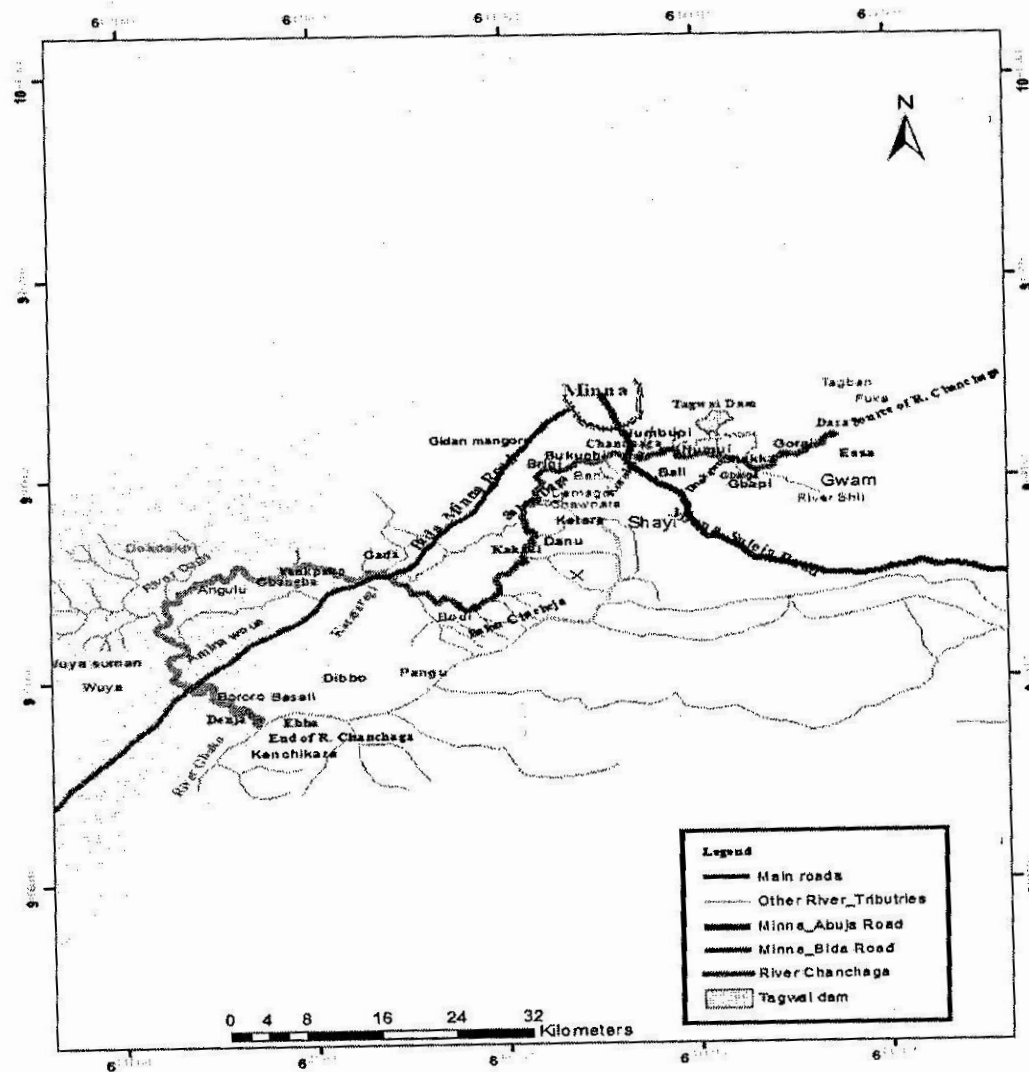


Figure 2: The Pollutant sources and Length of River Chanchaga (about 115.706 Km)

Source:
Author's Work (2016)

Drainage and Washing of Domestic Materials

Chanchaga Township residents empty numerous domestic effluences into River Chanchaga channel. The numerous drainages(gutters) drain directly into river, deteriorate the water quality, and increase metals content, which attracts high cost of water treatment before distribution to Minna Town. This has reduces the oxygen content of the water body of river and eventually increases the biological oxygen demand (BOD) and chemical oxygen demand (COD) water. These activities degrade the environment of aquatic habitat and water quality in the river. The study revealed that 28.8 % (evident from mosquitoes breeding ground and pest and diseases proliferations together in Table 3) of residents in Chanchaga Town residing close to river environment have no soak-ways to absorb their domestic wastewater which find their ways directly into the study area degrade the water quality and cause adverse health effect such as malaria, typhoid, dysentery, cholera and other water-borne diseases as affirmed in Table 3.

Physical Observations of Municipal Wastes along River Chanchaga

These include solid, liquid, and gaseous materials from industrial, commercial, residential, mining and agricultural operations and from community activities. It was observed during physical visitation that spatial distribution of municipal wastes along the river is more at where urbanization and urban activities are at high rate as affirmed in Plate II. Solid wastes found along River Chanchaga are categorized into two:

(i) **Organic or combustible matter:** This includes dry animals and vegetable refuse, animal excreta, tree leaves, sticks and rags. These wastes are subject to decay for long periods and involve highly offensive odour and gas. The main neighborhood dumpsites are found located by Chanchaga Township Market. There are 27 average sizes of refuse dumpsites by the residents along the rivers and some even within the bank of the river as depicted in Plate II. The largest dumpsite behind gold mining sorting site off Minna-Paiko road, Korokpa has a setback (distance between) of about 250 to 300 m from the site to the river (study area).

(ii) **Inorganic Waste:** This consists of non-organic, non-combustible materials such as graft, dust, mud, metal, nylon, plastic, broken glass, tide and building material wastes. It is not subject to decay and, therefore, stays so long. The heaps of solid wastes dumping sites near River Chanchaga and within the riverbank contribute significantly to river pollution. These solid wastes transported by torrential down pours of rain (surface runoff) into the receiving water body (River Chanchaga) could altered the physical, chemical and biological property of water. Solid wastes observed are in close proximity to the river, some directly on the river, which degrade the quality of river environment. The opinions on solid wastes and gutter inflow health risk implication on people and environments are as presented in Table 3. The implication of waste dumps along the bank of the river is that, the more the water is exposed to the pollutants the higher the risk of degradation of natural quality of water and aquatic environment. This subsequently causes health risk issues to communities along the study area.



Plate II: Dumping of solid waste within the Bank of the Study Area

Table 3: Solid Wastes and Drainage inflow Health Risk Implication to Aquatic Lives and Communities along River Chanchaga Water Environment

S/N	Pollution Health Risk	Respondents	Percentage Distribution
1.	Chemical Content (agro Chemical)	145	59.7
2.	Odour	18	7.4
3.	Mosquitoes Breeding Ground (Solid Wasted)	30	12.3
4.	Pest and diseases Proliferation	40	16.5
5.	Water Taste	10	4.1
	Total	243	100

Source: Field Survey (2016)

Table 3 reveals that residents in communities along River Chanchaga disposes solid wastes at open dumpsites within the study area such as building sites along the River bank and unauthorized places that pose health risk not only on the aquatic environment but also among the river water users. Therefore, the result shown in Table 3, explain the health implications in relation to how agrochemicals usage and solid wastes are disposed among residents living along the study area.

With regards to the effect from Table 3, it was discovered that 59.7% of the people were concerned with agrochemical usage (chemical content), which affect aquatic organisms by causing biochemical oxygen demand. This form of degradation products cause pollution stress in form of oxygen deficiency and fish kill, 7.4% of people were worried about unpleasant odour, 12.3 % were disturbed about mosquitoes breeding and 16.5 % were of the opinion on tendency of causing pest and disease proliferation. Moreover, 4.1 % of respondents were worried about seasonal changes in the water taste of River Chanchaga. Indiscriminate use of mineral pollutants and improper disposal of solid wastes pose great public health risk as it provides the breeding ground for diseases vectors. Improper solid wastes disposal and release of huge volumes of untreated agricultural wastes causes substantial adverse environmental problems such as contamination of air, water and sand as well as generating greenhouse gases from landfills. This can further create health risks such as spread of insects and rodents attracted by garbage heaps and diseases attributable to different forms of problems to the water usage.

The Result in Table 3 implies that majority of people were much concerned about use of excessive modern agrochemicals followed by those on pest and diseases proliferation as well as those worried about mosquito breeding ground as a result of open dumpsites in and along the study area. As a result, the communities along the study area are endangered with malaria cases, beside the unpleasant odour, seasonal bed water taste and proliferation of pest and disease. This poses health risk not only to the ecosystem of river environment but also to the dwellers along River Chanchaga.

Construction Activities

Construction is one of the urbanization related activities that affect water quality of River Chanchaga. During the field work, it was observed that five major roads were under construction and many demolished building structures. These constructions and demolished buildings were thought to be responsible for the generation of debris and mud into the study area; they are:

- i. Tagwai Dam road
- ii. Brighter-Himma School road
- iii. Talba Farm bye-pass
- iv. Tutugo road and
- v. Daza-Kaffikoro road
- vi. Residential building constructions (demolished building structures).

This generates mud and debris transported by runoff into river through other smaller tributaries. This raises the river turbidity and subsequently degrades river water. The study also reveals that water taste of study area do affected especially at the beginning of wet season period when huge volumes of contaminants are washed into the river.

Land use modifications attributed to concretization are directly detected in the stream flow regime. This is because of alteration to the characteristics of the surface runoff hydrograph. The quantity of impacts of concretization can be directly attributed to the physiographic variation to the catchment. This change includes-

- i. Vegetation clearance which results in:
 - Reduced evaporation losses
 - Reduced surface roughness and catchment storage
- ii. Increase impervious area, which results in
 - infiltration losses
 - reduced depression storage.
 - more uniform surface slopes.

It was reveal that inflow of mud from construction sites clouds irrigation crops; raise the turbidity of water, which affect fish life by blocking their breeding ground and habitat damage after torrential rainfall by surface runoff. The transporting of hazardous wastes like insecticides, pesticides, plant solvent, grease, used oil and volumes of debris from construction site affect aquatic life, like fishes, animals and even people most especially at the onset and towards the end of wet season period along the study area.

Conclusion and Recommendations

The study investigated the communities' perception on both urban and agricultural pollutants on aquatic environment of the study area. It assessed the nature of threat of agricultural practices and its wastes generated on environment of River Chanchaga. It reveals that the major pollutants from agricultural practices include application of fertilizer, excessive use of agrochemical on farm lands, manure spreading, bush burning and general farm wastes from land clearance degrade the natural water environment of the study area. Organic manure used to improve soil fertility has being washed or transported in surface runoff water. These could results to high levels of contamination of River Chanchaga by pathogens, metals, phosphate and nitrogen leading to eutrophication and potential contaminants.

It also examined the effect of urban wastes dump on River Chanchaga water environment. The result indicates that indiscriminant operation of urban activities and its wastes discharge posed great public health risk to the inhabitants of the area. The identified health risk causing agents were insects and rodents attracted by garbage heaps and diseases attributable to different forms of water pollution related problems like malaria, cholera, unpleasant odour and aquatic environment degradation of River Chanchaga.

There should be modern ways of wastes treatment to reduce toxicity of the generated waste from urban and agricultural activities along the study area. It is therefore, necessary to plan

and coordinate human activities along this river in a manner that their effects on water quality are minimized as much as possible. This can control huge inflows of contaminants from construction sites and different land uses along the study area. The people should be enlighten on consciousness of wastes reduction and pollution prevention through improve agricultural practices and discharge of urban wastes into source of drinking water river. There should be proper monitoring of aquatic ecosystems as it provide food and water for consumption, maintain better habitat for aquatic plants and animals to keep the system balance and for the sustainability of the aquatic community of River Chanchaga.

References

- Alabaster, J. S. (1981). Review of the state of Aquatic pollution of East Africa Inland Water. CIFA Occasional Paper Nov. 9 FAO Rome. *Journal of Environmental Science*, 1, 56-58.
- Adakole, J. A., & Annue, P. A. (2003). Benthic macro invertebrates as indicators of environmental quality of an urban stream Zaria, Northern Nigeria. *Journal of Aquatic Science*, 18(2), 85-92.
- Adekole, J. A., Balogun, A., & Lawal, F. A. (2002). Water quality impacts assessment associated with an urban stream in Zaria, Nigeria. *NISEB Journal*, 2(3), 195-103.
- Kimura, H. (2005). The Japanese new law for preservation of lake water quality. In order of Proceeding World Lake Conference, Nairobi Kenya. Pp 13-15.
- Kolo, R. J., & Lamai, S. L. (1998). Degradation of aquatic environment by agro-chemical in Middle Belt of Nigeria, Annual Conferences of Environmental Perfection of Nigeria 29th-30th October, University of Ilorin, Nigeria. pp 9-11.
- Lenat, O. E., Smock, L. A., & Penrose, O. L. (1980). *Use of benthic macro invertebrates as indicator of environmental effect*. Douglas, Toronto. L.W (Ed) Pub. Lexington Books,
- Maureen, I. (2002). Water pollution and its implication for aquatic resources and conservation on River Chanchaga, Minna, Nigeria. *Environ, Monitoring and Assessment*, 107, 56-64.
- Muhammad, B. Y. (2012). An assessment of the effect of channelized river suka drainage project on the physical environment downstream in Minna, Niger State, Nigeria.
- Qadir, A., Malik, R. N., Ahmad, T., & Sabir, A. M. (2007). Impact assessment of anthropogenic activities on fish assemblage and strgucture in NullahaikandNullahPalkhu-Tribu-Quaidtributance of rujer Chenab, Pakistan 27th Pakistan congress of zoology (feb 27-march 01, 2007) Held at BZU, Multan, Pakistan.
- Tiseer, F. A., Tamimu, Y., & Chia, A. M. (2008). Seasonal occurrence of algae and physiochemical parameter of Samaru stream, Zaria, Nigeria. *Asian Journal of Earth Science*, 1(1), 21-27.
- World Health Organization (WHO) (2006). *Guidelines for drinking water quality*. Geneva, Switzerland. (Addendum to Vol. 1) Recommendation WHO Press.