HUMAN ACTIVITIES AND NATURAL HAZARDS IN AREAS OF NORTHERN NIGERIA

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In Nigeria like most part of the world, anthropogenic activities and human interventions with the natural environment have continued to escalate both natural and human-induced hazards. These usually altered the natural equilibrium leading to alterations of the natural processes that threaten sustainable livelihood across the country. This study examines role of climate change using temperature record (1951-2014) over Kano, Maiduguri, and Sokoto to determine spatiotemporal changes and its potential impact. Shiroro hydrologic record for thirty seven years (1975-2012) were collected and analyzed in addition, hand dug well and borehole water samples were collected around Kuyi waste dump site to determine the impact of waste on the water quality. Furthermore 300 structured questionnaires were administered to the residents of Gurmana downstream settlement for the purpose of generating their responses arising from flooding and its related problems. The result affirmed temperature changes between 1950 - 1981 and 1982 – 2014; it reveals positive changes in April mean, maximum and minimum temperature values of between 0.4 to1.5°C across the study area. Similarly, the observed oscillation and positive trend of inflow and outflow from shiroro reservoir constitute a major and unprecedented shift in stream flow across the downstream communities. Thus, intensifying seasonal rainfall related hazards that threatens livelihood of the exposed and vulnerable community. Specifically, over 70% of the community population strongly agree that flood poses a great threat to their farmlands also; poverty is major factor intensifying vulnerability as about 45% of the population still live in mud houses with thatch roofs. Furthermore, urbanisation has continued to aggravate waste management challenges leading to increase concentration of pollutants that pose direct/indirect health threat to women and children. The pH values for hand dug well is 6.20 and boreholes are between 6.83 and 7.18, the hand dug well is below SON (2007)standard, Magnesium (Mg) and conductivity is generally above SON,(2007) standard value which is 100. It's crucial to understand the physical phenomena and human-induced hazards that intensify natural disaster which can cause human life disruption, loss of life, property damage, socio- economic disruption and environmental degradation. Hence, there is need for systematic development and application of policies, strategies and adoption of best practices to minimize risk, vulnerability and exposure as pathway towards disaster risk reduction.

Introduction

Human activities in Nigeria such as deforestation, emission of greenhouse gases, mining and dam constructions generally affect both natural and human-induced hazards thereby threatening the sustainable livelihood across the country. The increased human activities in recent times have continued to aggravate environmental degradation which pose great threats to sustainable livelihood, escalate natural hazard and struggle for survival. Stephen and Tobi (2014) rightly observed that Nigeria's population and economy are linked to climate sensitive activities including rain-fed agriculture. Our environment today is being degraded, polluted and destroyed at higher rate and pace by human interaction thereby altering the natural balance through emission of green house gases leading to pollution (air, water, land, and food). It is fundamental to note that the state of our environment influence or is influenced by our behaviour and thus, it's crucial for all to either nurture it for enhance and sustainable livelihood or ill-treat and destroy it for future uncertainty.

Temperatures values are generally rising in recent times; thermal comfort is reducing across most locations across the country, particularly in northern Nigeria due to its latitudinal location. Each of the past several decades has been significantly warmer than the previous one (Taalas 2016 and Hansen et.al 2010). This trend has negative impact on thermal comfort, water, vegetation and agricultural resource also, in extreme cases it leads to outbreak of epidemics like meningitis. Africa's climate seems destined to change, with far-reaching implications for water resources and agriculture (Bette et.al 2014). As it is apparent that future temperature will be associated with more extreme and increase variability hence, there is need to understand these changes at micro-levels and the human activities that are exacerbating the intensity of the changes for enhance adaptation and mitigation. Many prevalent human diseases are linked to climate fluctuations, from cardiovascular mortality and respiratory illnesses due to heat waves, to altered transmission of infectious diseases and malnutrition from crop failures (Jonathan et,al 2005). Consequently, it is fundamental to understand these changes in order to identify and develop adaptation measures as well as strategies for the attainment of sustainable livelihood.

Flood is common phenomena in Nigeria that usually affects the riverine communities. This crop up when the flow rate exceeds the carrying capacity of the river channel, particularly at the lower course of the river and low-lying parts of flood plain. The flood plain areas are national assert across the globe but are highly vulnerable areas in Nigeria because emphasis are mainly reactive rather than being proactive. Nott (2006), correctly points out that a flood event is not considered to be a natural hazard unless it threatens human life and/or property. Furthermore, floods constitutes a major hazard in Nigeria because of the high human population densities that inhabit these vulnerable areas, lack of capacity and adverse human activities (lack/ blockage of drainages, building on water ways and poor planning) which are aggravating flood hazard and disaster in most urban centres' across the country. Okori et.al (2009) affirmed that disasters arising from human-induced and natural hazards are growing global threats affecting millions of people annually, with devastating impacts on vulnerable communities.

Similarly, man's unguarded development initiative and ineffective waste management in urban centre across the country have continued to accelerate environmental degradation and outbreaks of epidemics. Illegal dump site and illegal dumping of waste is a common problem particularly in peri-urban areas thereby threatening society safety and security. Generally, illegal dumping of waste can cause serious environmental problem by polluting the environment with toxic substance in the dumped waste. In Minna like any other urban area in Nigeria, enormous amounts of solid waste are generated, collected and dumped at Minna Solid Waste Dumpsite nearer Kuyi Village near Maikukele, Bosso Local Government Headquarter in Niger State. This could have negative impact on the available resource particularly land, water, air and vegetation which may as well lead to outbreak of disease. The most common method of solid waste disposal practice in Nigeria is open dumpsite or land filling.

Further, technology and urbanization has been significantly escalating the emission of Green House Gases (GHGs) such as Carbondixiode (CO_2) in most urban areas across the country. Christopher *et.al* (2014) stated that Cities are major sources of Green House Gas (GHG) emissions and the effects of mass urbanization upon the environment have now become clear. Concentration of GHGs in the atmosphere is aggravting changes in the world's climate which is a prime factor that determine economic livelihood across the country. Our planet is sending a powerful message to world leaders to sign and implement the Paris Agreement on climate change and cut greenhouse gases now before we pass the point of no return (Taalas, 2016). Similarly, deforestation of forest cover which sequesters and store more carbon than any other terrestrial ecosystem is on increase due to intensification of human thereby escalating the CO_2 concentrations in the atmosphere.

Generally, these changes coupled with increase human activities are aggravating the intensity of natural hazard which could be disastrous. ICSU (2007) defined natural hazard as a potentially damaging physical event, phenomenon, or human activity that can cause loss of life or injury, damage to property, social and economic disruption, or environmental degradation. Similarly, UNISDR (2009) define hazard as a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. These hazards commonly result to disaster across the study area thereby leading to destruction of live and properties. More than 90 per cent of natural disaster related deaths are to be found in developing countries (ISDR 2003). Climate change and human activities are increasingly threatening both sustainable development and poverty-reduction initiatives in northern Nigeria. UNISDR (2004) stated that sustainable development is generally recognised as the optimum way to harmonise humankind's interactions with and dependence on our environment to the ultimate benefit of both (UNISDR 2004). Thus, it's crucial for institution and relevant stakeholders to identify and take proactive measures that can help in the mitigation of hazards thereby reducing disasters. As well as, improving living standards and opportunities for more fruitful livelihood across the vulnerable areas.

Study Area

Generally, Northern Nigeria is located between Longitudes 3^0 to 15^0 East of the Greenwich meridian and Latitudes 9^0 and 14^0 North of the Equator (Fig.1). The climate of Northern Nigeria is influenced basically by two air masses - The Tropical Maritime air mass (South West trade winds) and the tropical continental air mass (North East trade wind). The boundary zone between these two air masses is called Inter-Tropical Discontinuity (ITD) (Adejuwon, 2012). This area has three distinct seasons: The hot dry season from March to May, and the warm rainy season from June to September, and a cool dry season from November to February with an average relative humidity of 36% during the dry season and 79% during the wet season (Yamusa, *et.al* 2015). The seasonal and latitudinal variations affect diurnal and seasonal temperature ranges, the highest maximum air temperature is recorded in the northern part usually areas north of latitude 9° and occur in March /April and minimum temperatures are recorded in December/January North of latitude 9°N. Kano, Sokoto

Maiduguri and Minna are headquarters of four states among the nineteen states in northern Nigeria. Minna solid waste dumps site is an example of open dump site operated by Niger State Environmental Protection Agency (NISEPA) which is approximately 03km to Kuyi Village at the opposite side of the main road.

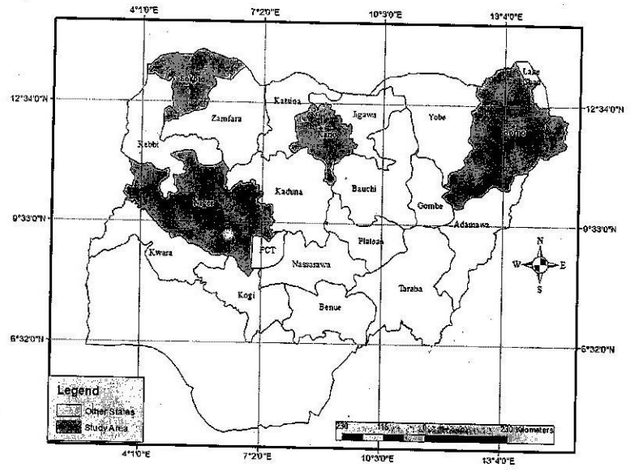

Fig.1 Location of the Study Area

Material and Method

This study examines the human activities, temperature changes and other natural event aggravating natural hazards in northern Nigeria. Maximum and minimum temperature records of three selected globally reference meteorological weather stations were sourced from Geography Department, Federal University of Technology, Minna. Specifically temperature records of Kano, Maiduguri, and Sokoto were used to investigate spatio-temporal temperature changes in northern Nigeria between 1951- 2014. Descriptive and inferential statistics were used to summarize, analyze and visualize the spatiotemporal changes across the study area. In addition, Gasman CO_2 sensor device was used to determine carbon dioxide emission at various locations within Minna and its environs. The mean values were plotted graphically to visualized human activities and carbon dioxide emission within Minna and its environs.

Similarly, hydrologic record of the Shiroro dam area was collected for 37 years (1975-2012), summarized and analyzed using inferential statistic to visualized trend in the hydrological parameters. Furthermore, 300 questionnaires were administered to residents of Gurmana downstream settlement of the dam in order to examine the community flood risk perception and its impact. The entire data was analyzed using IMB Statistical Packages for Social Sciences (SPSS) 21

Finally, groundwater quality of settlement close to dumpsite in Minna was investigated to determine the impact on hand-dug well and borehole water samples in Kuyi village. The analysis of heavy metal and other chemical elements concentrations such as Mg, Pb, Cu, Cr, Ni, Zn, Cd, Na, Mn, Ca, Cl, in groundwater sampled was conducted using atomic absorption spectrophotometer, conductivity and pH were determined. Also, the values were compared to Nigeria Industrial Standard (NIS, 2007).

Results and Discussion

The result reveals the spatio-temporal variability and gradual temperature changes in mean temperature values across the study area (fig. 2). In addition, Pearson correlation analysis shows that there are strong positive corrections between the temperature values of the three locations; Maiduguri and Kano .69, Sokoto and Maiduguri .62 and Kano and Sokoto correlation coefficient is .51.

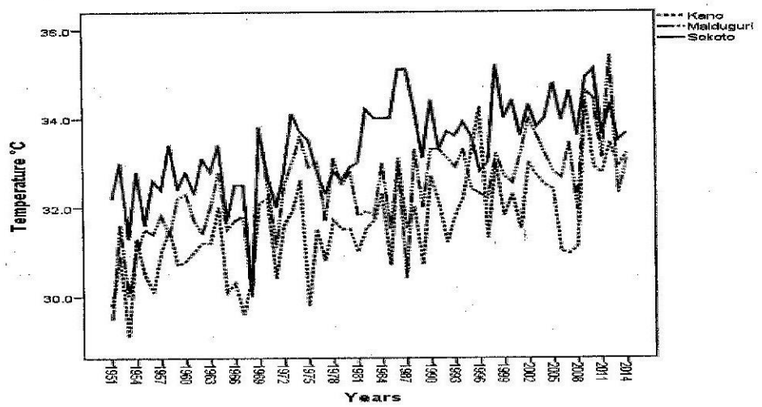

Fig.2 Mean Temperature Value (1951-2014)

The differences in mean temperature values between 1951 to 1982 and 1983 -2014 confirmed the observed gradual temperature changes (Table 1). It indicates that temperature changes are .99 in Maiduguri, Sokoto 1.28 and Kano 1.2. This is in agreement with IPCC (2007) projection that by 2050, average temperatures in Africa are predicted to increase by 1.5 to 3°C, and will continue further upwards beyond this time. Carlowicz (2010) stated that one-degree global change is significant because it takes a vast amount of heat to warm all the oceans, atmosphere, and land by that much. By implication, this percentage seems small but could have adverse impact on man and the physical environment. In addition, the decadal rate of change is higher in Sokoto and Kano (.41 and .39) than Maiduguri (.32) and this affirm decadal changes in mean temperature values across the zone where agriculture is primary occupation. Oladipo (2008) concluded that large rural population that is directly depending on the natural resources for their subsistence and livelihood which are climate-sensitive are highly vulnerable.

Table 1: Mean Temperature changes between 1951-1982 and 1983-2014.

Station	Annual Mean Temperature	Decadal Rate of Change
Maiduguri	.99	. 32
Sokoto	1.28	. 41
Kano	1.2	. 39

Similarly, the January mean minimum and maximum temperature values also unveils the spatio-temporal variability and gradual changes in January mean temperature values which is one of the coldest month in the region. The mean minimum and maximum temperature values across the study area are generally characterized by high variability as well, the figure signals gradual temperature changes (figure 3 & 4). The mean minimum temperature changes is apparent than the maximum values which is an indication of decline in temperature range and a warmer temperature trend.

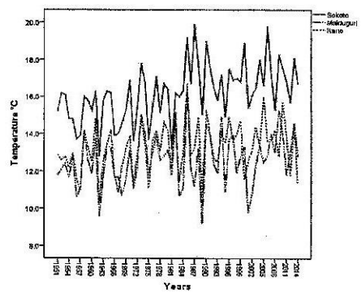

Fig.3 January Minimum Temperature

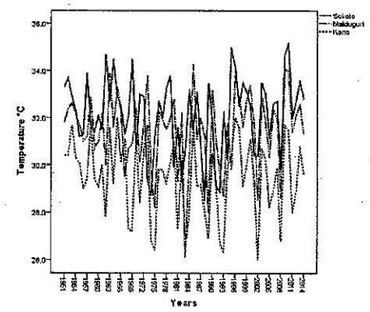

Fig.4 January Maximum Temperature

The April mean minimum and maximum temperature values also shows the variability and gradual changes typical of temperature values across the study area (Figure 5 & 6). The figures signal a warmer temperature across the study area. IPCC (2007) reported that by 2020, between 75 and 250 million people in Africa are projected to be exposed to increased water stress due to climate change. As high temperature values aggravate aridity, moisture stress and reduced thermal comfort as already apparent in the study area.

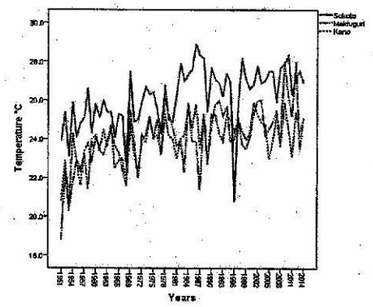

Fig.5 April Minimum Temperature

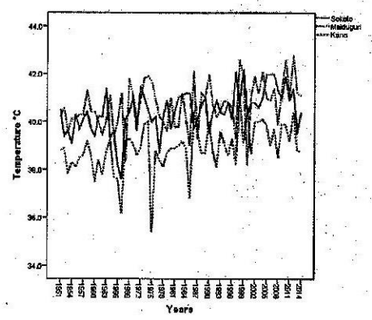

Fig.6 April Maximum Temperature

The observed changes in minimum and maximum temperature values were confirmed between 1951 - 1982 and 1983 – 2014 as evident in January and April values (Table 2). Positive changes in April mean maximum and minimum temperature values were between 0.4 and 1.5°C across the study area. The negative changes in range (-0.4 to -1.5) is an indication of warmer temperature since the margin between maximum and minimum temperature is declining. FAO (2008) forecasted that for each 1°C rise in average temperature, dry land farm profits in Africa will drop by nearly 10%. These increments in average temperature values will certainly aggravate moisture stress and environmental stress in a region where large proportion of the population are dependent on environmental resource. Consequently, these have continued to aggravate poverty, famine as well as food, socio-economic and political insecurity across the region. Furthermore, Nick et.al (2005) indicated that the most vulnerable nations are those situated in sub-Saharan Africa and those that have recently experienced conflict.

Table 2: Temperature changes between 1951-1982 and 1983-2014.

Stations	Jan max	Jan min	Jan mean	Jan range	April max	April min	April range
Maiduguri	-0.1	0.2	0.1	-0.3	0.6	1.4	-0.8
Sokoto	0.2	1.4	0.5	-1.7	0.4	1.5	-1.5
Kano	-0.6	0.8	0.1	-1.3	0.8	1.2	-0.4

Similarly, there was increasing carbon emission with increase human activities; from 200 at the outskirt to 600 and 700 ppm at central areas and location of small scale industries (Figure7). The alarming rate of change we are now witnessing in our climate conditions as a result of greenhouse gas emissions is unprecedented in

modern records (WMO 2015). As the over reliance on fossil fuel; increase use of automobile in recent time is escalating emission of GHGs across the country.

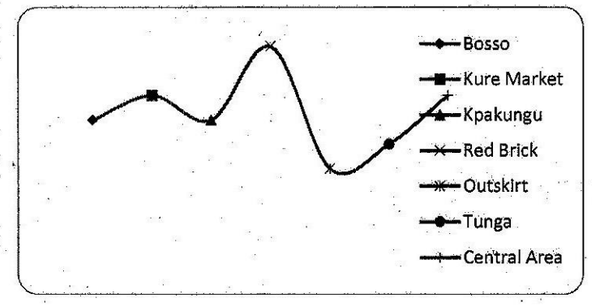

Figure 7: Carbondioxde Emission at Various Locations in Minna

By implication, the ongoing population growth, urbanization and socio-economic development signal higher rate of emission and significant impact on future climate. While climate change is now considered by many to be the most pressing challenge facing the human society today, total anthropogenic GHG emissions have continued to increase (Kevin, 2014). He added that about 78% of the total GHG emission increase from 1970 to 2010 was due to CO2 emissions from fossil fuel combustion and industrial processes. This trend is hazardous to human livelihood particularly in a region where large proportion depends on environmental resources coupled with low capacity will certainly escalating vulnerability. Consequently, Akinwande (2014) identified carbon tax as policy instruments canvassed for the reduction of greenhouse gases (GHGs). Implementing this will reduce emission, mitigate climate change, and enhance sustainable livelihood and resilience to climate change as well as climate-related hazard.

The annual inflow and outflow is generally characterized by variability and positive trend in recent trend which is aggravating flooding downstream (Figure 8). These oscillation and positive trend of inflow and outflow from Shiroro reservoir constitute a major a major environmental hazard downstream across the riverine communities. Changes in extreme weather and climate events are among the most serious challenges societies faced with living in a changing climate (John *et al.*, 2016). Thus, intensifying seasonal climate related hazards that threaten livelihood of the exposed and vulnerable community. Specifically, over 70% of the riverine community strongly agree that floods pose a great threat to them and their farmlands. Families living nearer to the river seem to have fewer opportunities to engage in multiple economic activities which make them more vulnerable to natural disasters and may keep them trapped in a poverty cycle (Brouwer, *et al.*2007).

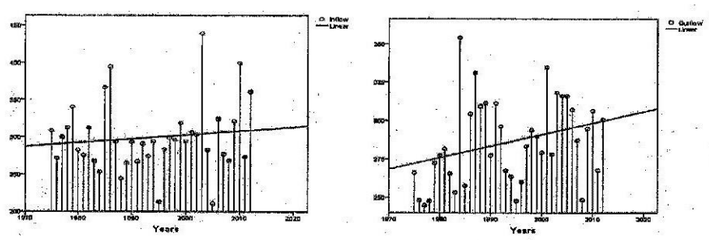

Figure 8: Annual Inflow and Outflow into and from Shiroro Dam (m^3/s)

Furthermore, questionnaire analysis shows that poverty is the major factor that increases the local vulnerability since about 45% of the population still live in mud houses with thatch roofs and 92% are mainly farmers. Correspondingly, about 82% of the respondents strongly agree that flood is an annual phenomenon that poses a great threat to their farmlands and livelihood. Thus, the high level of perception and awareness of the recurring hazards does not deny the community from being at risk because of the exposure of the physical structures, economic resources (farm land) and even live and property that could be injury or damage. Africa's climate seems destined to change, with far-reaching implications for water resources and agriculture (Bette et.al). These in addition to their low capacity to respond and adapt to extreme weather conditions whether (dry or wet) affects' and threaten rural livelihood and the country at large. Malte (2015) concludes that impacts of extreme weather events are relevant for regional economies.

Furthermore, rapid rate of urbanisation in most cities and towns have continued to exacerbate waste management challenges leading to increased concentrations of pollutants that pose direct/indirect health threat to women and children in particular. pH values for a Hand-dug Well (HDW) is 6.20 while that of boreholes are between 6.83 and 7.18; the hand-dug well is below Nigeria Industrial Standard (NIS, 2007) standard (Table 3). This indicates that heavy metal in the HDW has no impact on boreholes. Magnesium (Mg) and conductivity is generally above NIS standard value and this could be due to impact of dump site on the surrounding community. Hunter *et al.* (2009) stated that any level of conductivity above standard value can determine health risk and brain damages. This is an indication that open dumpsite are not only unfriendly, unsightly, unsanitary, and generally smelly but could cause pollutions of all kinds and capable of threatening human health and the physical environment.

Table 3: Physiochemical parameter for water samples from kuyi dumpsite.

Chemical Parameter for water samples	**HDW**	**BW1**	**BW2**	**SIN (2007)**
P^H	6.20	7.18	6.83	6.5 – 8.5
Chloride (Cl)	20.84	12.90	16.18	250
Copper(Cu)	0.12	0.11	0.20	1
Chromium(C r)	0.03	0.01	0.01	0.05
Hardness(as Ca)	17.00	28.00	24.00	150
Lead (Pb)	0.00	0.00	0.01	0.0
Magnesium (Mg)	10.36	16.80	14.40	0.20
Manganese (Mn)	0.08	0.00	0.00	0.2
Conductivity	191	307	265	100
Nitrate (NO_3)	1.26	1.73	2.21	50
Zinc (Zn)	0.00	0.00	2.17	3
Sodium (Na)	6.0	5.10	26.0	200

Hand Dung Water (HDW) and (BW) Borehole Water.

Conclusion

This study shows that it is crucial to understand physical phenomena and human-induced hazards that increase the impact of natural hazard on society, which could cause loss of human life, property damages, socio-economic disruption and environmental degradation. Since, in most cities across the country, the emphasis is always on deriving the maximum benefit from the environment without thinking about the possible impact from such activities that may harm man and his livelihood. Thus, human activities are hazardous to livelihood and are always disastrous in extreme cases when people's lives and livelihoods are destroyed. By indication, these indicate the need to identify these activities, there impact and preventive measures for minimizing the effect of natural phenomenon. Above all, this will minimize human induced potential hazard and its harmful effects on people and economic livelihood. Consequently, there is an urgent need for a systematic development and application of policies, strategies and the adoption of best practices as an indispensable pathway towards a more effective disaster risk reduction.

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