UMYU Scientifica, Vol. 4 NO. 1, March 2025, Pp 137 – 149
https://doi.org/10.56919/usci.2541.014
ISSN: 2955 – 1145 (print); 2955 – 1153 (online)
A periodical of the Faculty of Natural and Applied Sciences, UMYU, Katsina

ORIGINAL RESEARCH ARTICLE

Water Resources Degradation and its Impact on the Livelihood of Komadugu Yobe Basin Communities, Yobe State, Nigeria

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ABSTRACT

This study examined water resource degradation and its effects on the livelihood of Komadugu Yobe Basin communities. The study used an interview schedule to collect data. Nguru, Bade, Bursari, and Gaidam Local Government Area were purposively selected to form the sampling frame. 5% of each household in the four selected communities formed the sample size. Data were analyzed using frequency distribution tables and bar charts. Findings show that population increase, upstream dam construction, livestock overgrazing, and intensive agricultural activities are key factors responsible for the degradation. The findings also revealed that a decline in surface water and Rainfall has resulted in declining livelihood activities due to low crop yield; hence, food insecurity at the community level, with over 75% of the households becoming food insecure due to poor harvest. The study further revealed that farmers had adopted several coping strategies, such as animal asset selling, loans, remittances, and off-farm labour, to complement family income and needs. It is recommended that the Monitoring of water should be included in the Strategic Action Plan of the basin, and educational campaigns and awareness creation should be intensified among different resource users to raise awareness of the economic implications of water resource degradation in the area. Extension workers should be deployed to sensitize and create awareness of the communities to adopt and use modern techniques for improved agriculture production. The government should provide non or low-interest credit facilities for farmers to expand their farmlands for mass food production for the teaming population; it should also provide farmers with short-season and drought resistant crops to improve crop yield for food sufficiency. The government should improve the livelihood security of the basin community through the planning of production, rural programs, and income generation; the government should also develop and provide better infrastructures for both livestock keepers and farmers within the basin wetlands area. Livelihood support and alternative employment should be created to reduce pressure on the water resources as well as to sustain economic and ecological services offered by the basin resources.

ARTICLE HISTORY

Received November 09, 2024
Accepted January 22, 2025
Published February 07, 2025

KEYWORDS

Water Resource, Degradation, Livelihood, Komadugu Yobe Basin, Communities

INTRODUCTION

"Nigeria is considered as having abundant stock of water resources" (Goldface, 2018). The country is a federation State whose management of the river basins and its water and wetland resources are under the control of Federal and State governments as well as traditional leadership. (Bdliya et al, 2016). Nigeria has been divided into eight hydrological areas/surface water provinces. The Hydrological areas are drained mainly by the River Niger and River Benue and their numerous tributaries, as well as the Lake Chad and Oguta Lake and the rivers that discharge into them (Goldface, 2018). Other important rivers form part of the hydrological surfaces of Nigeria; these include the Gongola, Hadejia, Jama'are, Yobe, Komadugu-Gana, Kaduna, and Zamfara in the north, and the Ogun, Osun, Imo, Cross and Anambra Rivers in the south. The Hadejia Jama'are Komadugu Yobe Basin (HJKYB) is within the hydrological area VIII.

The depletion of water resources poses a threat to food security for many countries in Asia, Africa, and Latin America (Kaiser, 2014). It also contributes to persistent poverty and results in decreasing ecosystem resilience and the provision of environmental services. Poor farmers tend to be associated with marginal lands and low yields (Rockstrom et al., 2013). Increased expansion of agriculture into new areas is contrary to conservation goals in many countries, and if expansion is onto even more marginal lands, it has little hope of improving livelihoods for poor rural farmers. Land degradation has

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How to cite: Boso, B. (2025). Water Resources Degradation and its Impact on the Livelihood of Komadugu Yobe Basin Communities, Yobe State, Nigeria. *UMYU Scientifica*, 4(1), 137 – 149. https://doi.org/10.56919/usci.2541.014

been estimated to affect 50% of agricultural lands over the last 50 years, with up to 70% of cultivated land in Sub-Saharan Africa now affected by some degree of degradation. Effects including salinization, erosion, nutrient depletion, carbon loss, and loss of water holding and buffering capacity have resulted in reduced productive potential and abandonment of lands (Wood et al., 2020). Water scarcity is generally agreed to be a key factor limiting food production and wealth generation for poor people, and increasing scarcity is projected (Karar, 2014). Water pollution is also an increasing concern (WRI, 2020), and there is now about 12,000 m^3 of polluted water on the planet, equal to more than the contents of the world's ten biggest river basins and equivalent to six years' worth of worldwide irrigation needs. Water quality degradation limits the range of productive uses of that water and, in particular, degrades the value of that water for environmental services.

Nigeria experienced serious water resource depletion due to the impact of dam construction. Two important larger-scale cycles are upstream and downstream transfers in watersheds and rural-urban nutrient flows. Downstream effects of upstream catchment land degradation cascade throughout watersheds. It is well recognized that intensified land use in upper catchments, largely by poor farmers increasingly forced onto marginal lands, results in increased sediment discharge and elevated nutrient loads, reducing water quality and availability downstream. It is estimated that more than 25% of the world's water storage capacity will be lost in the next 25 to 50 years in the absence of measures to control sedimentation in both large and small reservoirs" (Palmieri et al., 2001). Striking examples are found in Southeast Asia and Africa, where upper catchments are extensively exploited. This situation is similar to what is obtainable in the Komadugu Yobe Basin, Nigeria.

Komadugu Yobe Basin

The name Komadugu Yobe Basin (KYB) is derived from the principal rivers that drain the catchment from Jos in Plateau State through parts of Bauchi, Kano Jigawa, Yobe, and Borno States up to the shores of the Lake Chad, namely River Hadejia, River Jama'are, River Komadugu-Gana, and River Yobe. It covers parts of Plateau, Bauchi, Kano, Jigawa, Yobe, and Borno States (Hadejia, 2016). These are called riparian states. This catchment is what is referred to as the Komadugu Yobe Basin (KYB). The key among these institutions responsible for water resources management in the KYB is Two River Basin Development Authorities - Hadejia Jama'are River Basin Development Authority and Chad Basin Development Authority and six Ministries of Water Resources in the riparian States – Plateau, Bauchi, Kano, Jigawa, Yobe and Borno (Hadejia, 2016).

The Komadugu Yobe Basin (KYB) covers a land area of over 148,000 square kilometers. The total population of the six states stands at over 32 million people based on the 2022 Population projection. Population growth can cause a direct environmental impact on the water budget of the Komadugu Yobe Basin. Since the 1940s the Sahel has experienced a population increase at a yearly rate of 3%, which is associated with the extension of cultivated land (Sen, 2014). Over 19 million of this population directly or indirectly depend on the water resources of the basin for their livelihoods in the form of dry land agriculture, fishing, and livestock keeping for domestic supplies. The Komadugu-Yobe floodplain is a significant landmark for the economy and livelihood of the basin communities due to its high yield of grains and vegetables. In addition to the production of millet, sorghum, rice, wheat, and vegetables, the wetlands sustain fishing and livestock-rearing practices. These activities are dependent on rainfall variability and flood cycles, yet Hadejia-Nguru wetlands alone provide the livelihood of about 1.2 million people (Thompson and Polet, 2000). Historically, agriculture is the life wire of the Komadugu Yobe basin communities, a sub-set of Lake Chad, and it is driven by population growth and increased demand for food availability.

The basin is an area of relatively dense population concentration in a dry land region, with a population of 19 million people critically and increasingly dependent on scarce water resources. During the 1960s to early 1980s the Komadugu Yobe basin had been one of the food baskets of Nigeria. It also harbours two of the pastoral corridors of Nigeria, the Hadejia-Nguru Wetlands and the Lake Chad basin. Many trailer loads of small and large stocks leave these areas daily to feed the major urban market of southern Nigeria.

Water is a vital resource for human survival, and its shortage has been a global challenge that has attracted milestone attention because of its importance in the lives of people all over the world. Despite its importance, data collected from different organizations and institutions recently showed that its accessibility is grossly inadequate to millions of people worldwide, with approximately 387 million individuals facing portable water shortage in 2020 alone (Singha & Eljamal 2021). Moreover, a staggering 737 million people lacked basic sanitation facilities during the same period (Soliman and Jha, 2023; Omotayo et al., 2021; Swanson et al., 2021). The severity of the situation is understood by global projections, which indicate that if measures are not taken to frontally address this deepening situation, by 2025, nearly two-thirds of the world population and ecosystem will experience a serious water crisis (WWF 2023). This is a pointer for an urgent intervention to address global water scarcity.

In Africa, water scarcity has reached an alarming proportion, and it is projected that by 2025, approximately 230 million Africans will face acute water shortages, while nearly 460 million will reside in water-stressed areas (Mbala, 2022). The water scarcity situation in Africa was

aggravated by a lack of political will, poor water governance, corruption, and polarization (Shunglu et al., 2022; Theodory, 2022). The challenges faced by African nations in addressing water scarcity call for more synergy and an integrated approach to overcome this very important issue that affects a vital resource. This can be done through concerted efforts that would bring tailored interventions to ensure water availability for all citizens, as many African populations continue to grapple with constrained access to safe water sources (Kibuika and Wanyoike 2021; Mulwa et al. 2021). Tanzania, just like Nigeria, is one of the African countries, which is facing critical challenges in water accessibility. The challenge in the country is not confined to rural areas alone but affects both rural and urban domains. The report shows that only 37% of rural communities have access to water, while 79% in urban (Rosinger and Young 2020).

In recent times, attention has been tilted toward an increasing number of water-related issues that are discernible from countries that share water resources within a single river basin. In several reported cases, water usage by the "upstream" communities, coupled with increased levels of water pollution, has had adverse effects on "downstream" communities. Whilst many of these incidents may only extend over a small geographic scale, occur for a short period of time, or implicate few water users, they invariably elicit a very strong reaction from the neighboring communities (JWL, 2004). This situation can be particularly sensitive where the states sharing a river basin make use of the available water without due consideration for each other's needs (Deborah et al., 2004). This study is similar to what is obtainable in the Komadugu Yobe Basin (KYB), where negative activities such as unregulated releases of water from the upstream dams, effluent discharge from point and non-point sources affect the downstream communities negatively in the form of flooding, proliferation of typha grass, outbreak of epidemic among other things. At the same time, desiccation in the extreme downstream communities has some consequences on the livelihood and economic activities of the basin communities.

Livelihood

The term 'livelihood' entails an ensemble of activities, capabilities, and resources needed to organize and maintain a living. Sustainable livelihood emphasizes the livelihood system of marginal groups, particularly people with low incomes, and the way in which they adapt to maintain their livelihoods under conditions of severe environmental, socio-economic, and political stress. A livelihood is therefore perceived to be sustainable 'when it can cope with and recover from shocks and stresses and maintain and enhance its capabilities and assets both now and in the future, whilst not undermining the natural resource base'. People's capacity to generate and maintain their means of living enhances their well-being and that of future generations. These capacities are contingent upon the availability and accessibility of options that are ecological, economic, and political and which are predicated on equity, ownership of resources, and participatory decision-making (Simon E Cook, et al., 2019).

Therefore, the idea of livelihood is concerned with both environmental influences on human life and human influences on the environment. It focuses on the nature and quality of the relationship between human communities and the ecosystem: how the environment provides the resource base for human existence and how the nature of exploitation of these resources by human communities enhances or undermines the natural resilience of the environment. It captures the intricate web of interaction between human communities and their environment in which people's quest for generating and maintaining their living creates both environmental and survival problems. The environmental problems capture the various instances of environmental degradation, while the survival problems are concerned with issues of struggle and conflict (ILO, 2019).

Environmental Degradation and Livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. Livelihood best expresses the idea that individuals and groups strive to make a living, attempt to meet their various consumption and economic necessities, cope with uncertainties, respond to new opportunities, and choose between different options (Lesturgez, 2004). The term livelihood gained much analytical relevance in the late 1990s when the idea of sustainable livelihood was popularized as a relatively coherent and integrated conceptual approach to reflect the environmental concern of the development efforts of international organizations.

Statement of Problem

The Komadugu Yobe basin had been one of the food baskets of Nigeria. It used to supply large quantities of grains, vegetables, fish and livestock to local and major urban markets in southern Nigeria. Over the years, the basin has faced serious water resources management challenges that have adversely affected the livelihoods of the communities. These challenges, which affected livelihoods adversely, are attributable to a number of factors, which include past upstream dam developments in the 1970s and 1990s, particularly the Tiga and Challawa dams, and their poor operational procedure. The construction of the two upstream dams has changed the entire hydrology and biodiversity of the basin. This has exerted additional demands on the water resources. Potential water resources in the area have deteriorated due to an increase in human population, declining trend of Rainfall, and anthropogenic factors. This has adversely affected livelihoods, resulting in deepening poverty. The poverty situation is manifested in the loss of grazing and farmlands, which further resulted in low food production and consequently food insecurity, unemployment, farmer-herder conflict, increasing out-migration, increase in crime rates,

increasing numbers of beggars, and threats to community safety level and security.

It is against this background that this study is intended. It aims to examine water resource degradation and its impact on the livelihood of Komadugu Yobe Basin communities, Yobe State, Nigeria. The objectives of the study are to Investigate the factors responsible for water resources degradation, Identify the various livelihood activities and Study the community livelihood strategies and related problems in the study area.

MATERIALS AND METHODS

Location of the Study Area.

The Komadugu Yobe Basin (KYB) is located between latitude 10° 13' 12.81" N and 13° 46' 48.47" N and longitude 07° 49' 17.83" E and 14° 39' 25.43" E. The Komadugu Yobe Basin covers a total area of about 148,000 km^2 in northern Nigeria (95% of the basin area) and southeast Niger (5%). Two main river sub-systems drain the basin. The first sub-system, the Yobe River, is formed by the Hadejia and Jama'are tributaries, which create the Hadejia Nguru Floodplain at their juncture. The second sub-system is the Komadugu Gana (or Misau) River. Historically, it is a tributary of the Yobe River. The hydrological boundaries of the basin traverse the states of Plateau, Bauchi, Kano, Jigawa, Yobe, and Borno States, respectively (Hadejia, 2016).

Climate

Komadugu Yobe Basin within Yobe State experiences a hot semi-arid climate condition typical of the savanna region of northern Nigeria. High temperatures throughout the year characterize the climate with an annual mean temperature of 34.7°C (94.5°F). Temperatures range from an average minimum of 23°C (73.4°F) to an average maximum of 41°C (105.8°F) across the different seasons (Etuonovbe, 2011). The area has modest Rainfall with an annual average of 620 mm. The rainy season lasts from June to September, during which Rainfall reaches a peak monthly average of about 150 mm in August (James et al., 2012). The dry season persists from October to May, with very little rainfall activity during these months.

Geology and Soil

The area belongs to the Chad Formation and is drained by the Komadugu Yobe River. The predominant soil types within the basin belong to the luvisol and entisol orders (James et al., 2012). The soils are generally sandy loam to loam in texture with high organic matter content, especially around the flood plain. The arid conditions, coupled with high rates of erosion during intense rains, resulted in the accumulation of silt in the river system that gave way to flooding during the rainy season.

Relieve and Vegetation

The basin area within Yobe State lies at an average elevation of about 350 meters above sea level. The topography is characterized by flat to gently undulating land. The natural vegetation consists of open savanna woodland interspersed with shrubs and grasses. Dominant woody plant species include Acacia Senegal, Acacia seyal, Acacia nilotica, and Balanites aegytiaca (Etuonovbe, 2011). The herbaceous cover is made up of annual and perennial grasses like Andropogon gayanus, Hyperrhenia spp., and Aristida spp. Planted crops include seasonal crops of maize, sorghum, and cowpea, and vegetables such as onions, tomatoes, and pepper are grown during the dry season under irrigation.

Land Use

The predominant land use around the basin is agricultural land on the periphery. It also has clusters of settlements. Other major land use types include institutional areas comprising government administrative offices, schools, hospitals, cemeteries, places of worship, markets, recreational spaces, and light industries (Etuonovbe, 2011). Open scrublands and grasslands surround the built-up areas.

Human Activities

The major human activities revolve around the basin is agriculture. Others are commerce, trade, services, and public administration. The basin is a major livestock trading center and has a vibrant food-produce market. Numerous small-scale enterprises operate across industries, including metal works, carpentry, handicrafts, agro-processing, tailoring, transport, and electronics repair, among others.

Methodology

The research adopted a survey research design that uses descriptive statistics such as frequency distribution tables and bar charts. An interview schedule was administered to investigate the livelihood activities as they affected the livelihood and food security of the community. Data collected includes socio-economic and livelihood activities. Secondary data collected include Rainfall, temperature, and river discharge.

Sources of Data Collection

The data for this study were obtained from both secondary and primary sources. The primary data were collected through an interview schedule using a systematic random sampling technique. Data collected includes occupation, family size, educational attainment, livelihood activities, types of crops produced, size of farmlands, average harvest of crops, the benefit of dam to livelihood activities, food security condition, and coping strategies of the respondents, among others.

Secondary data, including Rainfall, temperature, and river discharge data, were collected from Nigerian Meteorological Service Agency (NiMet) field offices in Nguru and Potiskum towns Water Resources Engineering and Construction Agency (WRECA), Kano, and Hadejia, Jama'are Komadugu Yobe Basin Trust Fund (HJKYB-TF) Damaturu respectively. Data on Rainfall, temperature river discharge patterns, and trends were presented in the form of a line graph using Excel. Other secondary data were also collected through consulting relevant books; records from River Basin Development Authorities (RBDAs), line Ministries of the riparian States as well as water resources-based Non-Governmental Organizations such as Hadejia Nguru Wetlands Conservation Projects (HNWCP) Nguru, Yobe State and Komadugu Yobe Basin Wetlands Development Initiatives (KYB-WDI) Hadejia, Jigawa State.

Sampling Frame

The Yobe State part of Komadugu Yobe Basin consists of seven riparian Local Government Areas, namely, Nguru, Karasuwa, Jakusko, Bade, Bursari, Gaidam and Yunusari. Four out of the seven Local Government Areas were purposively selected because they are known to be producers of both cereals and cash crops among the seven riparian communities of the basin. It was, therefore, selected to form the sampling frame.

The formula for calculating the percentage of Local Government Areas is;

SLG= Selected Local Government- 4

TLG= Total Local Government-7

Therefore, the strata percentage (%): SLG/TLG x 100

= 4/7 x 100 = 57.1%

These strata represent 57.1% of the local government areas

Sampling Size

Two Hundred and Forty (240) interview schedules were administered across the Four Local Government Areas. The interview schedules for the community survey were administered proportionately based on their population sizes. Five (5%) percent of each selected community's population was taken as sample size for the study. The sample size was calculated based on Boyd *et al.* (1981), who recommends that a random sample should constitute at least 5% of the total population to be representative of the whole study population. The formula for determining sample size is: $n/N \geq 5\%$

Where: N = is the total households in the community n = is the number of selected households in the community.

Table 1: Number of respondents interviewed in the sampled communities

Sampled Community	Total number of households	Number of Sampled Households	Sample Size (%)
Nguru	1440	73	5
Bade	1560	79	5
Bursari	840	43	5
Gaidam	880	45	5
Total:	**4720**	**240**	**5**

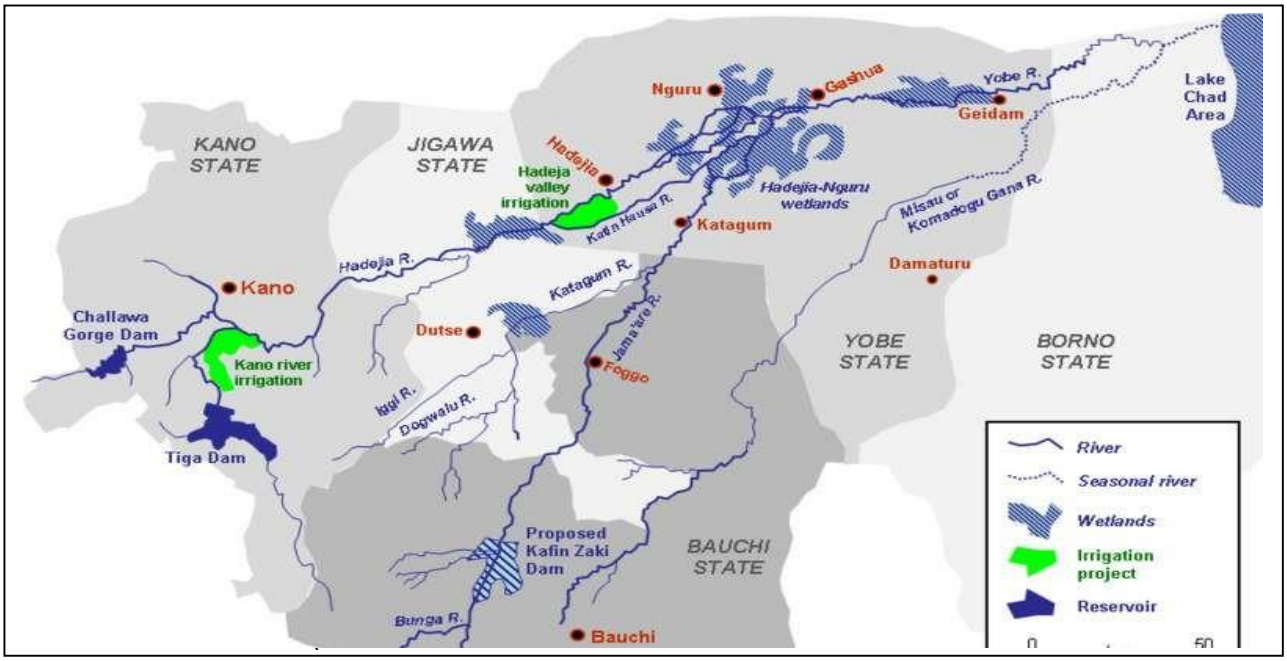

Figure 1: Map of Komadugu Yobe Basin (Source: Enhanced from Chiroma et al. 2006).

RESULTS AND DISCUSSION

Demographic features of Respondents

Gender Distributions

Table 2 below presents the gender distribution of the respondents. The study indicated that over 89% of the respondents are males, while the remaining 10.8 are females. This indicates a typical Yobe community setting where men are the heads of households and a breadwinner of the family. The proportion of males highly exceeds that of females, which may reflect the general demographic distribution in the study area as well as the cultural and religious inclination that recognizes men as heads of households. This demographic imbalance is crucial for ensuring that the findings are representative of the recognition of males as head of household in the study area.

Table 3 below shows the age distribution of respondents in the study area. The results indicated that the largest group of respondents is between the age bracket of 28-37 years, which constitutes 38.9%. The second largest group of respondents is between the age group of 38-47 years old, which represent 22.4%. While, those within the age group of 70 years and above constitute 8.8%. Those within the age group of 18-27% have the lowest percentage of 5.5%. This distribution shows a predominance of younger to middle-aged individuals, which might influence food production in the study area due to their productive capabilities.

About 45.6% of the respondents had no formal education, 30.6% of the respondents had primary education, 15.5% had secondary education, and the remaining 8.3% had tertiary education, as shown in Table 4 below. The low level of education in the study area might have led to poor agricultural practices, as education is essential for understanding the depth of knowledge and understanding of multiple issues bothering the community.

The results of the study indicate that most of the respondents in the study area, about 75.6%, are married (as indicated in Table 5) with a low level of educational attainment with

Table 6 below reveals that the majority of the respondents, about 36.1% have indicated that the average household size ranges between 5-8 members. While those households having an average of 9-12 persons constitute the least with 14.4%. Respectively.

Table 2: Gender of Respondents

Locality	**Nguru**		**Bade**		**Bursari**		**Gaidam**		**Total**	**Total**
Sex	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**		**(%)**
Male	58	79.5	77	97.5	41	95.3	38	84.4	214	89.2
Female	15	20.5	2	2.5	2	4.7	7	15.6	26	10.8
Total	**73**	**100**	**79**	**1000**	**43**	**100**	**45**	**100**	**240**	**100**

Table 3: Age of Respondents

Locality	**Nguru**		**Bade**		**Bursari**		**Gaidam**		**Total**	**Total**
Age of Respondents	Freq.	%	Freq.	%	Freq.	%	Freq.	%		**(%)**
18-27	6	8.2	8	10.1	0	-	1	2.2	15	5.5
28-37	18	24.6	56	70.9	20	46.5	6	13.3	100	38.9
38-47	23	31.5	8	10.1	7	16.4	14	31.1	52	22.4
48-57	14	19.2	5	6.4	6	13.9	14	31.1	39	17.7
58-69	4	5.5	2	2.5	4	9.3	4	9.0	14	6.7
70 and above	8	11	0	0	6	13.9	6	13.3	20	8.8
Total:	**73**	**100**	**79**	**100**	**43**	**100**	**45**	**100**	**240**	**100**

Table 4: Educational Level of Respondents

Locality	**Nguru**		**Bade**		**Bursari**		**Gaidam**		**Total**	**Total**
Educational Levels	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**		**(%)**
No formal education	31	42.5	26	32.9	22	51.2	25	55.6	104	45.6
Primary education	14	19.2	33	41.8	15	34.8	12	26.7	74	30.6
Secondary education	16	21.9	14	17.7	4	9.3	6	13.3	40	15.5
Tertiary education	12	16.4	6	7.6	2	4.7	2	4.4	22	8.3
Total:	**73**	**100**	**79**	**100**	**43**	**100**	**45**	**100**	**240**	**100**

Table 5: Marital Status of Respondents

Locality	Nguru		Bade		Bursari		Gaidam		Total	Total
Marital Status	Freq.	%	Freq.	%	Freq.	%	Freq.	%		(%)
Single	16	22.0	12	15.2	2	4.7	13	29.0	43	17.7
Married	55	75.3	62	78.5	37	86.0	28	62.2	182	75.6
Divorce	2	2.7	0	0	0	0	0	0	02	0.7
Widowed	0	0	2	2.5	4	4.4	2	4.4	08	2.8
Separated	0	0	3	3.8	0	4.4	2	4.4	05	3.2
Total:	**73**	**100**	**79**	**100**	**43**	**100**	**45**	**100**	**240**	**100**

Table 6: Household size of Respondents

Locality	Nguru		Bade		Bursari		Gaidam		Total	Total
Household Size	Freq.	%	Freq.	%	Freq.	%	Freq.	%		(%)
1-4 member	28	38.4	34	43.0	14	32.6	2	4.4	78	29.6
5-8 member	34	46.5	32	40.5	19	44.2	6	13.3	91	36.1
9-12 member	4	5.5	9	11.4	6	13.9	12	26.7	31	14.4
13 and above	7	9.6	4	5.1	4	9.3	25	55.6	40	19.9
Total:	**73**	**100**	**79**	**100**	**43**	**100**	**45**	**100**	**240**	**100**

Livelihood Activities of the Respondents

The study shows that the majority of the respondents in the Komadugu Yobe Basin communities engaged in farming activities which constitute about 64.2% of the respondents. About 17.5% of the respondents are civil servants, while 4.3% of the respondents were engaged in trading/business. 9.2% of the respondents are fishermen. Two other respondents confirmed that they are students and herders, with 3.3% and 1.3%, respectively, as in Table 7 below.

Even though there are great changes in farming livelihood activities, it still represents the dominant activities in the area.

Changes in the livelihood activities as perceived by the community compared with the past years

The result of the study indicates that, despite the decrease in surface water and rainfall amount and duration, crop production is the major livelihood activity in the area of study, with over 47.5% of the respondents indicating that they rely on crop production for their livelihood. Even though there are great changes in farming as a livelihood activity, it still represents the dominant activity in the area of study. This study is in agreement with the study conducted by the Food and Agricultural Organisation, which stated that 80 percent of smallholder farmers are already located in water-scarce regions, have little resilience to shocks, and are highly vulnerable to the impacts of climate change (FAO 2021).

Problems of livelihoods

All the respondents in the study area confirmed that, due to changes in the rainfall amount and duration as well as the change in the flow regime of the basin due to dams' constructions and other anthropogenic activities, there is a change in livelihood activities. Despite the livelihood changes by some members of the community, crop production remains the major activity of the basin community.

Farm sizes of the surveyed communities in hectares

The study reveals that over 43% of the farmers in the basin community had an average farm size of between 0.25-2.5 hectares. While farmers with an average farm size of between 13 hectares and above constitute a paltry 3.25% of the respondents. This indicates that the majority of the respondents in the basin community practice a subsistence type of farming, where the produce would be used for feeding the family. This study also conforms with the study conducted by Vaughn et al., 2004, which reported that farm holdings in Nigeria could be classified as small-scale farms when a farm size is less than 10 hectares and medium-scale farms when it exceeds 10 hectares (Vaughn Sharon et al., 2014)

Types of crops grown by the surveyed communities

Farmers in the study area cultivate various types of crops, ranging from Millet, Guinea Corn, Rice, Beans, Maize, Wheat, Sesame, and Groundnut. The study reveals that, with all the crops grown in the area, Millet is the major crop grown, with an average of 19.75% of the respondents engaged in it. Others are Beans, Guinea Corn, and Rice, which constitute an average of 18.3%, 17.4%, and 16.6% of the respondents cultivating these crops. The least cultivated crop in the basin community by farmers is wheat, which constitutes an average of 2.7% of the farmers growing it. FAO and ICRASAT (2019) corroborate the findings of this study, which stated that

the Yobe state economy employs over 80% of the population engaged in small-scale farming with millet, Guinea Corn, Beans, Groundnut, and Maize as major food crops.

Table 7: Occupation of the Respondents

Locality	Nguru		Bade		Bursari		Gaidam		Total	Total
livelihoods type	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Farmer	37	50.7	50	63.3	22	51.2	45	100	154	64.2
Civil servant	20	27.4	6	7.6	16	37.2	0.0	0.0	42	17.5
Trading/business	5	6.8	3	3.8	3	6.9	0.0	0.0	11	4.5
Fishing	0.0	0.0	20	25.3	2	4.7	0.0	0.0	22	9.2
Student	08	10.9	00	0.0	0.0	0.0	0.0	0.0	8	3.3
Herders	03	4.2	0	0.0	0.0	0.0	0.0	0.0	3	1.3
Total	**73**	**100**	**79**	**100**	**43**	**100**	**45**	**100**	**240**	**100**

Source: Fieldwork, 2023

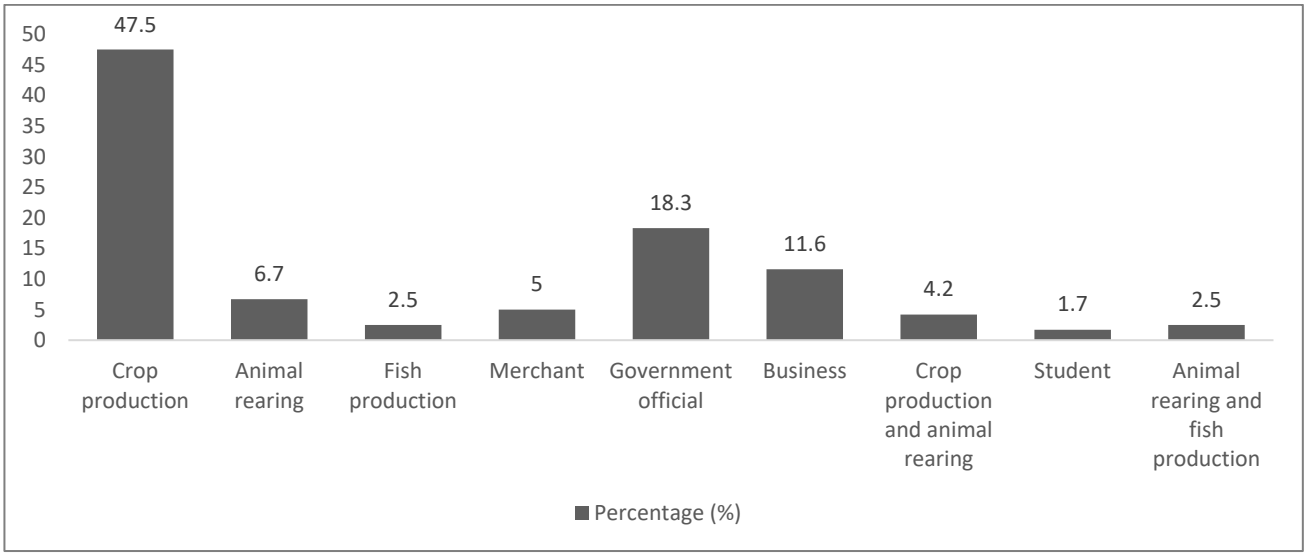

Figure 2: Livelihood changes and condition of the basin community, Source: Fieldwork, 2023

Table 8: Farm Sizes of Respondents

Locality	Nguru		Bade		Bursari		Gaidam		Total	Total
Hectares	Freq.	%	Freq.	%	Freq.	%	Freq.	%		(%)
0 .25-2.5	33	76.7	27	55.1	12	42.9	14	41.2	86	54
3.0-5.0	10	23.3	14	28.6	10	35.8	6	17.6	40	26.3
5.5-7.5	0	0	8	16.3	2	7.1	4	11.8	14	8.7
8.0-10	0	0	0	0	2	7.1	6	17.6	08	6.2
10.5-12.5	0	0	0	0	0	0	2	5.9	02	1.5
13 and above	0	0	0	0	2	7.1	2	5.9	04	3.3
Total	**43**	**100**	**49**	**100**	**28**	**100**	**34**	**100**	**154**	**100**

Source: Fieldwork, 2023

Table 9: Types of Crops Grown by Respondents

Locality	Nguru		Bade		Bursari		Gaidam		Total	Total
Crops	Freq.	%	Freq.	%	Freq.	%	Freq.	%		(%)
Millet	4	9.3	8	16.3	10	35.8	6	17.6	28	20
Guinea Corn	7	16.3	8	16.3	4	14.3	6	17.6	25	16.1
Rice	8	18.5	17	34.8	2	7.1	2	5.9	29	16.5
Beans	10	23.3	6	12.2	4	14.3	8	23.5	28	18.3
Maize	4	9.3	5	10.2	2	7.1	2	5.9	13	8.1
Wheat	2	4.7	0	-	0	-	2	5.9	04	2.6
Sesame	4	9.3	1	2.0	2	7.1	4	11.8	11	7.5
Groundnut	4	9.3	4	8.2	4	14.3	4	11.8	16	10.9
Total	**43**	**100**	**49**	**100**	**28**	**100**	**34**	**100**	**154**	**100**

Source: Fieldwork, 2023

Methods of crop production

The farmers in the basin use various methods of crop production, with the rain-fed method constituting a larger percentage of 62.9%. Those who practice both rainfed and irrigation constitute 14.3%, and irrigation methods with 13.25%. Recession cropping and irrigation and recession methods with 3.8% and 3.25%, respectively.

Problems of agriculture in the basin community include lack of capital, farm inputs such as tractors, improved seeds, and agro-chemicals. Others include runoff and drought due to anthropogenic activities such as deforestation and overgrazing, which results in rainfall variability and declining surface water resources, among other factors.

Figure 4 shows the average crop harvested by the respondents, with millet being the major crop, with 30.8% indicating that they cultivated the crop. While, wheat is the least cultivated crop with only 1.7%. Other crops grown in the area include sesame, beans, guinea corn, rice, maize, and groundnut, with 18%, 15%, 12.5%, and 6.3% each for maize and groundnut, respectively.

The respondents in the study area keep various livestock types ranging from sheep, goat, cattle, and chicken among other livestock categories. Sheep is the major livestock kept by the community, with 33.3% of the respondents owning it. Goats and cattle owned by the community constitute 28.3% and 25% of the livestock in the community. Duck and pigeon comprise 0.4% and 1.3% of the livestock owned by the respondents in the study area, respectively. This finding also conforms with the study conducted by FAO and ICRASAT, 2019, where it was reported that a significant proportion of the population in Yobe State rear livestock such as sheep, goats, cattle, and various types of poultry.

Factors of crop yield decline

The food security condition of the basin community is related to a decline in crop yield due to several factors. Key among them are declining surface water, insufficient rainfall distribution and duration, growing population, and climate change. The result of the study indicated that there is insufficient production of food to meet household annual consumption. The food insecurity situation of the basin community is seasonal and usually occurs at the onset of the rainy season up to the harvest period. The table below shows the response to the community's insufficient annual household food production. Where 214 respondents, representing 89% of the community, indicated that, there is food insufficiency in the area of study, but the situation is becoming chronic or severe at the onset of the rainy season.

Coping strategies of the basin communities

The households in the study area adopted animal assets selling, loans from well-to-do members of the community or community cooperative, remittances from family members living outside the community, and off-farm labour. Other households' members combine one or two of the strategies to cope with food insecurity in the community.

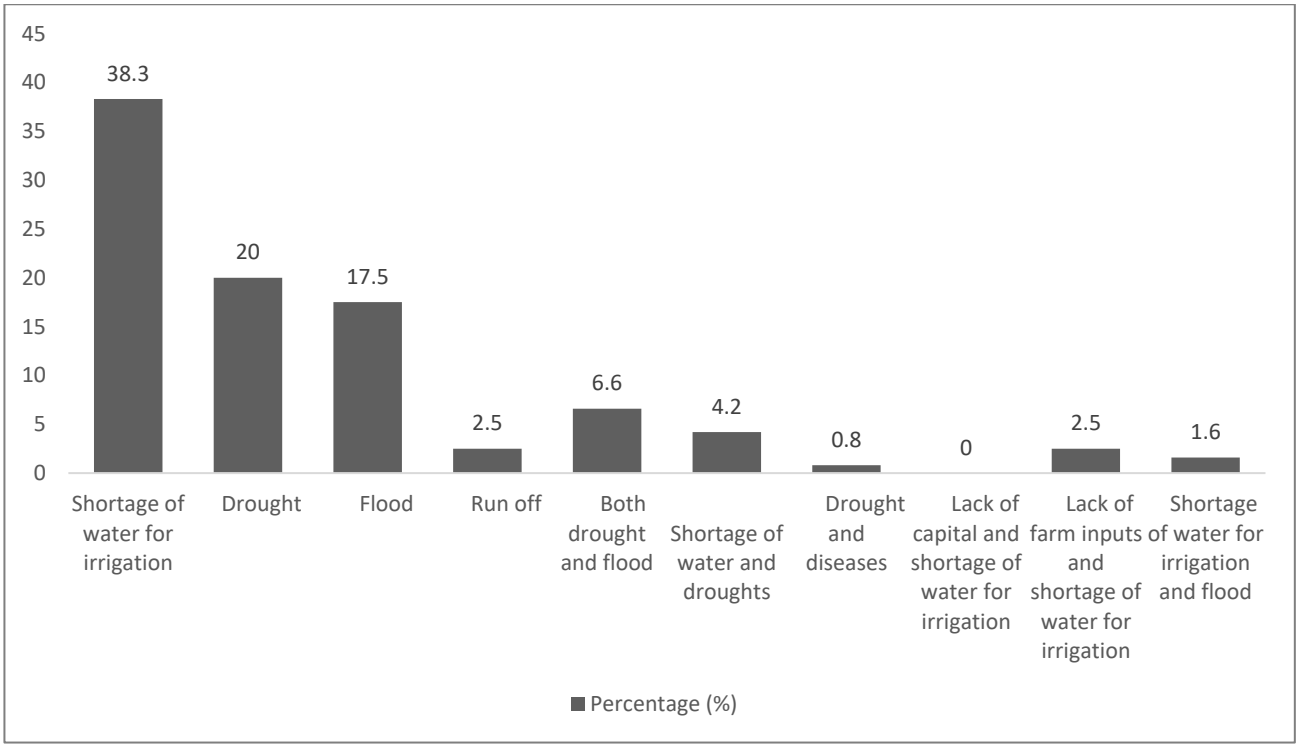

Figure 3: Problems of agriculture in the basin: Source: Fieldwork, 2023

Table 10: Methods of Crop Production as Reported by Respondents

Locality	Nguru		Bade		Bursari		Gaidam		Total	Total
Crops	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	(%)
Irrigation	10	23.3	05	10.2	3	10.7	3	8.8	21	13.3
Recession cropping	2	4.7	0	-	3	10.7	3	8.8	08	6.1
Rain-fed	19	44.2	35	71.4	15	53.6	28	82.4	97	62.9
Both rain-fed and irrigation	6	13.9	9	18.4	7	25	0	0	22	14.3
Irrigation and recession cropping	6	13.9	0	0	0	0	0	0	06	3.4
Total	**43**	**100**	**49**	**100**	**28**	**100**	**34**	**100**	**154**	**100**

Source: Fieldwork, 2023

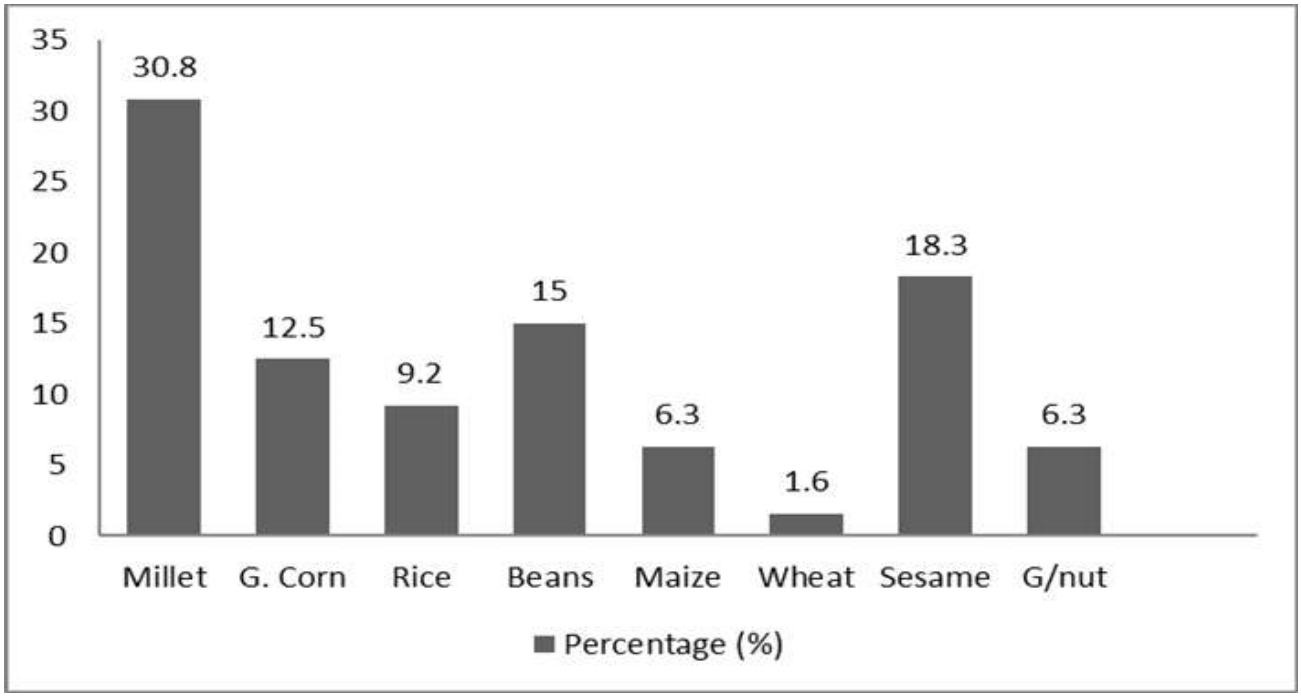

Figure 4: Average harvest of crops by household, Source: Fieldwork, 2023

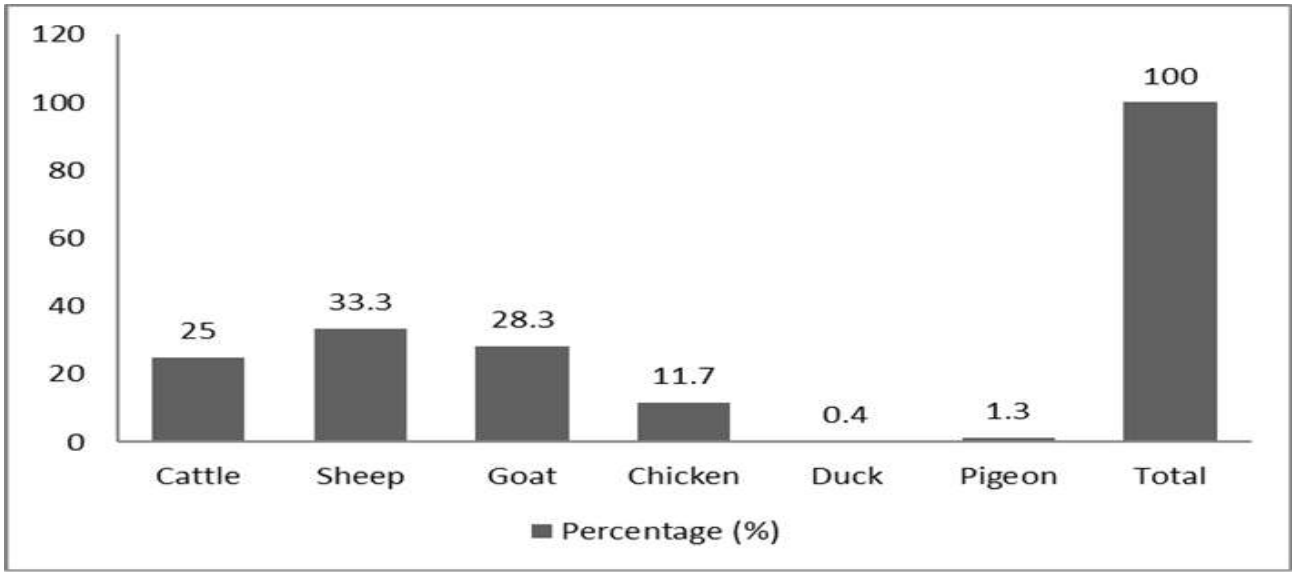

Figure 5: Livestock categories owned by households, Source: Fieldwork, 2023

Table 11: Insufficient annual household food production

Response	Frequency	Percentage (%)
Yes	214	89
No	26	11
Total	**240**	**100**

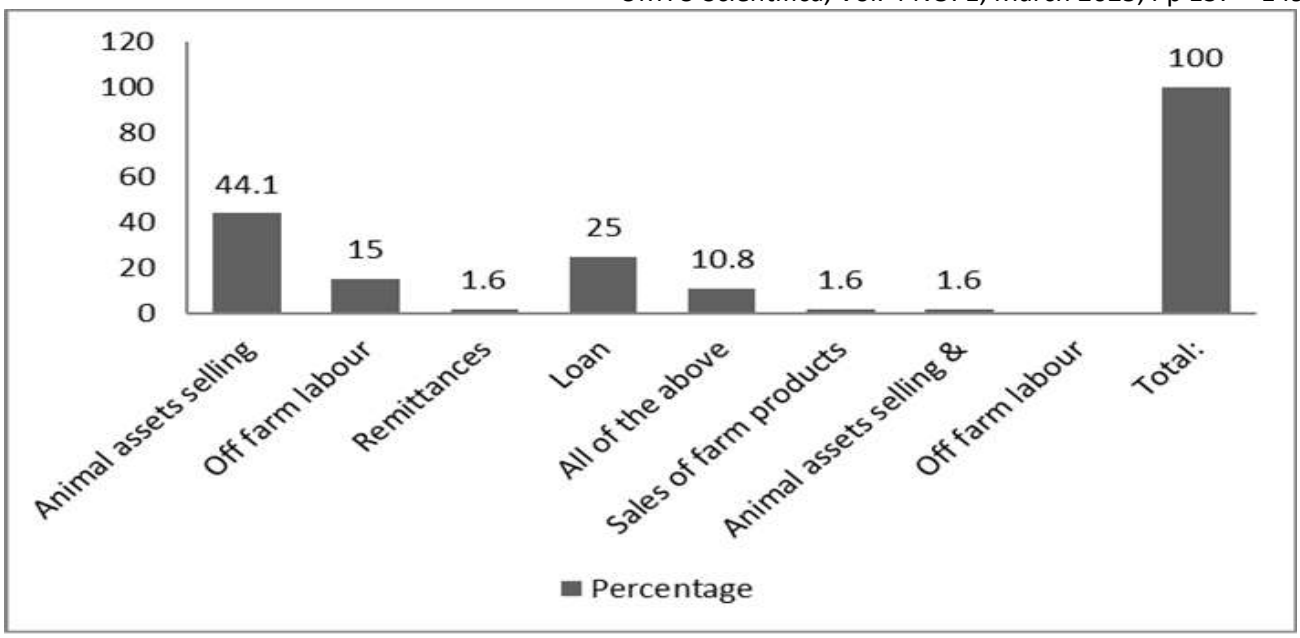

Figure 6: Coping strategies for income insufficiency by households: Source, Fieldwork, 2023

CONCLUSION AND RECOMMENDATIONS

Conclusion

The demographic features in the study area are of typical rural settings with moderate household sizes that are guided by male heads of households. The community livelihood security is mainly dependent on agriculture, based on rain-fed or irrigation farming. This livelihood security of the study area is affected negatively by many factors, which is reflected in the decline of food production. Rainfall variability and the construction of dams are the major causes of the decline in food production, where areas downstream suffer from dry conditions.

Recommendations

Based on the findings of the study, the following measures are recommended to reverse the increasing water resources degradation to ensure food security;

1. Monitoring of water should be included in the Strategic Action Plan of the basin to ensure dam regulations for water releases downstream to boost livelihood activities.

2. Educational campaigns and awareness creation should be intensified among different resource users to raise awareness of the economic implications of water resource degradation in the area. On the other hand, there is a need for establishing institutions and organizations to empower resource users in other source of income-generating activities to reduce pressure on the land and water resources of the basin.

3. Extension workers should be deployed to sensitize and create awareness of the communities to adopt and use modern techniques for improved agriculture production.

4. The government should provide non-interest or low-interest credit facilities for farmers to expand their farmlands for mass food production for the teaming population.

5. The government should provide farmers with short-season and drought-resistant crops to improve crop yield for food sufficiency.

6. The government should improve the livelihood security of the basin community through the planning of production, rural programs, and income generation.

7. Since livestock grazing and farming along the basin wetlands have been the major problems of land use in the area, leading to high degradation of water resources, the government should develop and provide better infrastructures for both livestock keepers (i.e., building ranches and rural grazing area) and farmers located within the basin wetlands area.

8. Water resource degradation has been found to have serious economic costs to the government and local communities, reflected in food insecurity, which leads to loss of income. Livelihood support and alternative employment should be created to reduce pressure on the water resources as well as to sustain economic and ecological services offered by the basin resources.

REFERENCES

Bdliya H.H., Barr, J. and Fraser, S. (2016). Institutional Failures in The Management of Critical Water Resources: The Case of the Komadugu-Yobe

Basin in Nigeria. Paper for Seminar on *Water Governance – New Perspectives and Directions*, 20th to 21st February 2016, Heaton Mount, Bradford. U.K.

Boyd, W.L., and Crowson, R.L (1981) The Changing Conception and Practice of Public School Administration.Review of Research in Education. **[Crossref]**

Chiroma, M. J, Kazaure, Y.D., Karaye, Y.B. and Gashua, A.J. (2006). Water Management Issues in the Hadejia-Jama'are-Komadugu-Yobe Basin: DFID-JWL and Stakeholders Experience in Information Sharing, Reaching Consensus and Physical Interventions. DFID-Joint Wetlands Livelihoods Project (JWL), Nigeria.

Deborah Barndt (2004). *Women working the NAFTA food chain: women, food and globalization.* Canadian Scholars' Press.

Etuonovbe, A.K. (2011). The Devastating Effect of Flooding in Nigeria: UNOCHA Report, 2011.

FAO (2021) Food and Agricultural Organisation of the United Nations agricultural series, no. 61. Rome, 2021.

FAO and ICRASAT, 2019 Climate Smart Agriculture in Yobe State of Nigeria. CSA Country Profile for Africa Series. International Centre for Tropical Agriculture (CIAT); International Crop Research Institute for the Semi-Arid Tropics (ICRISAT); Food and Agricultural Organisation of the United Nations (FAO); Rome, Italy. 22p.

Flood Investigation Group (FIG) Working Group Report Week 201 (1) 2011.

Goldface-Irokalibe, I. J. (2018). Water Management in Federal and Federal–Type Countries: Nigerian Perspectives.

Hadejia, I.A. (2016). Functional Gaps and Overlaps in the Implementation of Integrated Water Resources Management of the Hadejia Jama'are Komadugu Yobe Basin. Unpublished PhD thesis submitted to the Department of Geography, Bayero University Kano, Kano State 2016.

IWRM (2014) Global Water Partnership Technical Advisory Committee Paper no. 4

James, C., Bryman, A., and (2012) Global status of Commercialised Biotech/GM Crops. ISAAA Brief No. 44 Ithace, NY, USA.

Joint Wetlands Livelihoods (2004). Poverty Environment and Livelihoods Issues relating to common pool resources in the Hadejia Nguru wetlands. A report for Joint Wetlands Livelihoods Projects.

Kaiser, J. (2014). Wounding Earth's Fragile Skin. Science 304, 1616-1618. **[Crossref]**

Karar, E. (2014). Institutional change in river basin management and its implications for livelihood and ecosystem security in South Africa. In *SIWI/CA Seminar. Stockholm, August* (Vol. 21).

Kibuika FM, Wanyoike D (2012) Assessment of factors affecting sustainability of rural water supply schemes in Nyandarua County, Kenya: a case of Kangui water schemes. Int. J Sci. Res (IJSR) 3:578-584.

Lesturgez, G., Poss, R., Hartmann, C., Bourdon, E., Noble, A., and Ratana-Anupap S. (2004). Roots of Stylosanthes hamata create macropores in the compact layer of a sandy soil. Plant and Soil 260: 101 – 109. **[Crossref]**

Mbala K, (2022) Water-saving agriculture technologies: regional hydrology outcomes and knowledge gaps in the Eastern Gangetic Plains-a review. Water 2021 (13):636. **[Crossref]**

Mulwa f, Li Z, Fangninou FF (2021) Water scarcity in Kenya: current status, challenges and future solutions. Open Access Lib J 8:115. **[Crossref]**

Omotayo AO, Olagunju KO, Omotoso AB, Ogunniyi AI, Olekunrin OA, Daud AS (2021) Clean water, sanitation and under-five children diarrhea incidence: empirical evidence from the South Africa's General Household Survey. Environ SCI Pollut. Res 28(44): 63150-63162. **[Crossref]**

Palmieri, A., Shah, F., & Dinar, A. (2001). Economics of reservoir sedimentation and sustainable management of dams. *Journal of environmental management*, *61*(2), 149-163. **[Crossref]**

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., ... & Foley, J. A. (2013). A safe operating space for humanity. *nature*, *461*(7263), 472-475. **[Crossref]**

Rosinger AY, Young SL (2020) The toll of household water insecurity on health and human biology: current understandings and future directions. Wiley Interdiscip. Rev WATER 7(6): 1-22. **[Crossref]**

Sen, A. (2014). The Amartya Sen and Jean Drèze Omnibus:(comprising) poverty and famines; Hunger and public action; and India: Economic development and social opportunity. *OUP Catalogue*.

Shungule R, Kopke S, Kanoi L, Nissanka TS, Withanachchi CR, Gamage DU, Dissanayake HR, Kibaroglu A, Unver O, Withanachchi SS (2022) Barriers in participative water governance: a critical analysis of community development approaches. Water (Switzerland) 14:762. **[Crossref]**

Simon E. Cooka, Myles J. Fisherb, Meike S. Anderssona, Jorge Rubianoc and Mark Giordanod (2019) Water, food and livelihoods in river basins: Water International, Vol. 34, No. 1, December 2009: pp. 1–29. **[Crossref]**

Singha B, Eljamal O (2021) Exploring attitudes and household culture to encourage water conservation behavior. Proc. Int. Exch. Innov. Conf. Eng. Sci. (IEICES) 7:147-152. **[Crossref]**.

Soliman A, Jha SK (2023) Closing the access gap for water and sanitation in Eastern and Southern Africa: raising the ambition. **blogs.worldbank.org**. Accessed 27 June, 2023

Swanson M, Sample A, Bruyere B (2021) Understanding barriers and challenges for women's access to

water in Northern Rwanda. J Gend Water 8(1):102-112

Theodory TF (2022) Emerging and persistent challenges on water resources governance in rural Tanzania: the mega sub catchment of the Upper Ruvu Basin. Norsk Geografisk Tidsskrift nor J Geogr. **[Crossref]**

Thompson, J. R. and Polet, G. (2000). Maintaining the floods: Hydrological and Institutional Aspects of Managing the Komadugu-Yobe River Basin and its floodplain wetlands. PP 73-100

Water for Improve Livelihood: Decent Work in the Rural Economy. Policy Guidance Note (2019). A publication of International Labour Organisation (ILO)

Wood, S. J., Jones, D. A., & Moore, R. J. (2020). Accuracy of rainfall measurement for scales of hydrological interest. *Hydrology and Earth System Sciences*, *4*(4), 531-543. **[Crossref]**

World Wildlife Fund (WWF) (2023) Water scarcity. worldwildlife.org. Accessed 18 Dec

WRI (World Resources Institute) (2020). A Guide to World Resources 2000–2001: People and Ecosystems: The Fraying Web of Life. Washington D.C. (USA): World Resources Institute.