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ASSESSING THE IMPACT OF HUMAN ACTIVITIES ON RIPARIAN VEGETATION REGENERATION ALONG RIVER GONGOLA DADIN-KOWA GOMBE STATE, NIGERIA

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Abstract

Riparian vegetation is an important ecosystem component since it maintains huge biodiversity and provides a range of environmental services along the river courses. These remarkable repositories are experiencing increased threats from unsustainable land use activities and climate variability. This research aims to assess the impact of human activities on the regeneration capacity of riparian vegetation in river Gongola along the Dadin-Kowa area. Quantitative and qualitative data were used, the quantitative data were collected from vegetation inventory where line transects of 100mX100m were laid in the field using a systematic sampling method, and three quadrats of 30mX30m were selected in each transect for identification and enumeration of species. Species diversity was worked out using the Shannon-Weiner diversity index. The study used purposive sampling to interview farmers, herders, fishermen and fire-wood collectors, data obtained from in-depth interviews and inventory surveys were analyzed using descriptive statistics. The result revealed that the species diversity in the study area is low 2.27 H value for tree species and a 1.12 H value for seedling species. Furthermore, it has been discovered that farming activities, fire, firewood collection, herbal collection, erosion, grazing, and animal trampling are the major human activities that affect regeneration capacity. The study concluded that the regeneration capacity of tree species in the study area is very poor and human activities are the major cause of poor regeneration capacity. The study recommends that a public enlightenment campaign should be staged in local communities around the riverbank on the dangers associated with deforestation.

Keywords: Human Impact, Riparian, River, Regeneration, and Vegetation

1. Introduction

Worldwide, human activities have significantly modified river processes as well as aquatic and riparian ecosystems (Merritt, Scott, Leroy, Auble, and Lytle, 2009). In many cases, these activities have resulted in the loss of riverine ecosystems' productive capacity (Holmes, Richardson, Esler, Witkowski and Fourie, 2005). The damage is caused by a multiplicity of activities including high nutrient loading being discharged into aquatic environments from the release of surface runoff from agricultural land; the channelling and straightening of streams to use the land for other purposes such as farming and boating the construction of infrastructure such as dams and canals (Merritt *et al.*, 2009); and the encroachment of human settlements, livestock trampling and grazing as well as the planting of alien species (Holmes *et al.*, 2005).

Riparian areas constitute the interface or transition zone between terrestrial and aquatic ecosystems. Also known as shorelines or ecotones, these land/water transitional areas can exert a disproportionate influence on the productivity of aquatic ecosystems. Riparian forests have influences on this land/water transitional zone and adjacent water bodies (Nisbet, Kreutzweiser, Sibley and Scarr, 2015).

Riverbanks as a pool of essential natural resources are crucial in multiple ways for the subsistence of man. Generations past understand this and have prudently put these resources into use. The rapid population explosion of the Third World countries has put the riparian ecosystem under the stress of over-exploitation and unsustainable use. Biodiversity resources of riparian ecosystems include vegetation communities, which in most cases are hydrophilic. Conserving riparian areas is one of the most effective ways of maintaining high quality aquatic habitats (Parkyn, 2004).

The riverbank is a key place for wildlife biome, range and animal fodder sources. The removal of streamside vegetation, primarily for development purposes, has resulted in degraded water resources and diminished value for human consumption, recreation and industrial use. Riparian vegetation has been identified as a natural control of water movement, waves and tides. Roots of riparian vegetation deflect wave action and hold bank soil together (Ellen and Markelle, 2005). The vegetal community network of riparian areas is a reliable mechanism in natural flood management. This feature is unique in disaster management.

Regeneration is critical in riparian zones because it determines future species composition and stocking. When the regeneration of any species is confined to a particular range of habitat conditions, the extent of those conditions is a major determinant of that species' geographical distribution. The lack of adequate regeneration is an issue recognized by both foresters and ecologists (Mishra and Singh, 2017), hence the need for restoration and conservation (Wale, Bekele, and Dalle, 2012). Rehabilitation and ecosystem recovery also depend on regeneration capacity, which plays a direct and vital role in vegetation growth and management.

Recently, the banks of River Gongola Dadin-Kowa axis have been greatly depleted by anthropogenic activities. Man's activities along the bank have led to degradation, massive bank erosion, landslides, vegetation community changes, and wildlife distribution along the bank. Also, commercial sand dredging and intense crop cultivation occur these days in the bank. River Gongola Dadin-Kowa axis has served for many years as source of water for domestic consumption, agricultural purposes (irrigation) and fishing for the surrounding communities (Hina and Dadin-Kowa). The river sustains small hamlets, villages, settlements and different communities in the area.

Riparian vegetation in the River Gongola Dadin-Kowa axis is experiencing increased threats from unsustainable land use activities and climate variability. As an important ecosystem that provides vital services to the people, understanding regeneration capacity and the factors affecting vegetation in the area is important for ecological health and the development of scientific knowledge to enhance riparian vegetation restoration projects. Pielech, Anioł and Szczesniak (2015) noted that appropriate measures are needed to minimize changes to Riparian vegetation for their vital role in maintaining biodiversity.

The study answered the following objectives

1. Assess the current status of riparian vegetation along the Gongola Dadin-Kowa River axis in Gombe State, Nigeria.
2. Identify the specific human activities that are impacting riparian vegetation regeneration in the study area.
3. Quantify the extent of riparian vegetation loss and degradation

caused by human activities along the Gongola Dadin-Kowa River axis.

2. The Study Area

Dadin-Kowa Dam is on river Gongola a tributary of river Benue, it was constructed for the purpose of providing electricity and irrigation farming. It has enormous significance on the people living in the area, ranging from irrigation, fishing, flood control, electricity generation, recreational, grazing ground for cattle and goats. It also supplies domestic water to Gombe metropolis and its environment. Dadin-kowa dam is in Dadin-Kowa village, Yamaltu Deba local government area of Gombe State Nigeria. It lies between Latitude 10° 15' to 100 30'N and Longitude 11°15' to 110 30' E. The Dam is about 35 to 37km away from Gombe town and 5km north of Dadin-Kowa town. The Dam was constructed at the lower part of the Gongola River. Gongola River is in northern Nigeria which is the principal tributary of the Benue River (UBRBDA Dadin-kowa area office 2016).

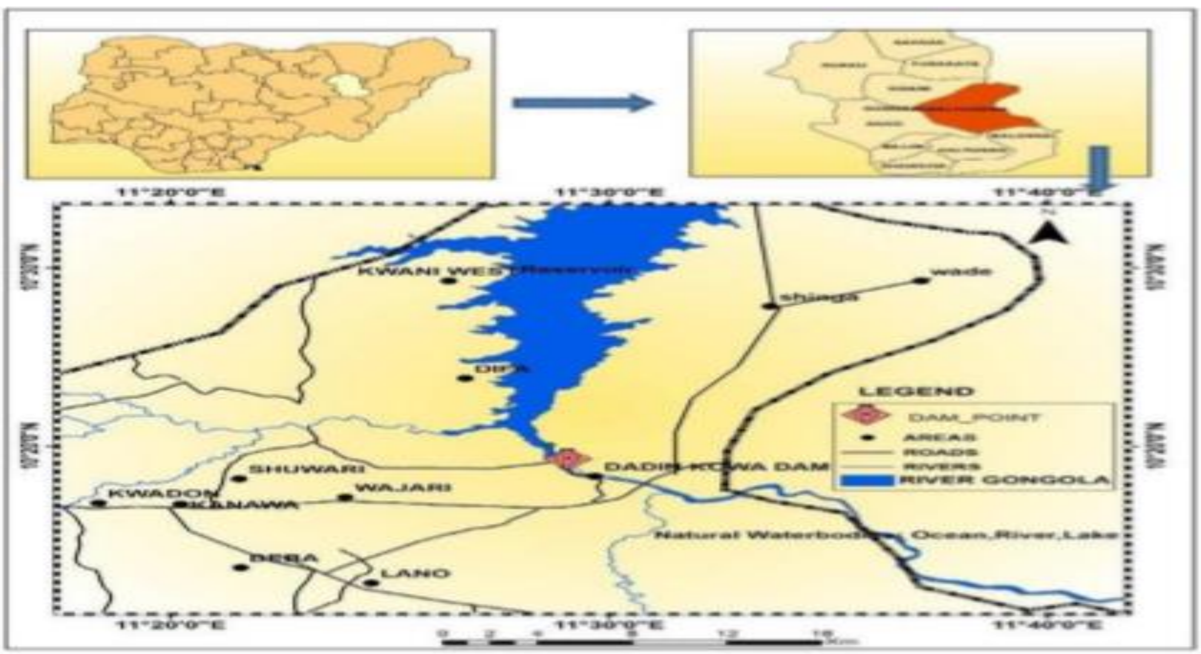

Fig. 1. Study Area. River Gongola
Source: Gombe State University GIS Lab

The climate of the area is part of the extreme tropical continental type. One of the basic characteristics of this climate zone is relatively short rainy season and a comparatively long dry season.it fluctuates from year to year. The rainfall usually begins in late April and early May and end in late October. The rainy season lasts for (5) to Six (6) months, with a maximum rain fall in the month of July and August. The mean annual rainfall of the area ranges from 800-l000mm.

The soil mostly found in Yamaltu-Deba local government is the vertisol that is dark in colour and contain measurable amount of heavy clay. The vegetation of the area is reflected by the climate of the region with scanty trees and grasses which are lush during the rainy season and dried off during the hot sunny (dry) season (Bello, 2015). The vegetation of Dadin-Kowa can be described as Sudan savannah the natural vegetation cover consists of scattered trees, shrubs and species of grasses such as; *Adansonia digitata, Annona Senegalensis, Mangifera indica, Ficus thonningii, Parkia biglobosa, Azadirachta indica, Eucalyptus* and *water lilies*, among others are found within the study area (Bello, 2015).

3. Methodology

3.1 Type and Sources of Data

Both quantitative and qualitative data were collected to address the objectives of this study. Quantitative data in the form of numerical values was sourced from vegetation inventory. Qualitative data was sourced from the In-depth Interview (IDI) with key informants in the communities around the riparian vegetation zone. Sampling units for this research was delineated in the field based on the morphology of the river channel perpendicular to the direction of flow of the river in line with Fewster, Laake and Buckland (2005) and Mendez, Hernandez and Ibarra (2014).

A systematic sampling method was used to select quadrats for data collection following the river channel from the bank of the Dadin-kowa dam down to Hinna Bridge in Dadin-kowa town, a distance of 5km. Species with a diameter at breast height (DBH) ≥ 15cm were enumerated as matured trees and species with DBH less than 2.5cm were enumerated at seedlings as adopted by Yakubu, Saka, Sa'idu, Mahmud and Yunus (2019) and Akinyemi, Ugbogu and Oguntola, (2001). The vegetation inventory was conducted along a line transect of 100m X 100m laid systematically along the river course. On each transect quadrats of 30m X 30m were established for the survey. For seedlings inventory sub-quadrats 15m X 15m within each quadrat were sampled to study the regeneration of the species.

A Purposive sampling technique was used for the identification of respondents for in-depth interview. The materials used includes Measuring tape 50m (for measurement of the distance between stations), ranging poles (for marking points), Handheld Global Positioning System (GPS) (Garmin *etrex* 10) for taking coordinates of the sampled points. Microsoft excel software was used for analysis vegetation inventory data.

Transect walk was conducted with local guides where inventory of vegetation species of the study area was conducted. Species were identified through their indigenous names; however, voucher sample of unidentified species was collected for further verification at the Federal College of horticulture Dadin-Kowa, Gombe State, Nigeria. The qualitative data generated from IDI on tape recorder was transcribed, coded and presented in thematic forms.

The vegetation inventory data of this study was analyzed using two indices to get a clear picture of the diversity and regeneration capacity of the species in the study area. Species diversity index was used to compare the biodiversity of seedlings and adult trees across land uses (Axelsson *et al*., 2012). The indices are as follows:

(1) Equation 1: Species Diversity (D)

Shannon-wiener index was employed to determine the diversity of plant species in the study area.

It is represented as: $$\mathbf{H^1 = -\sum_{i-1}^{s} p_i \ln (p_i)}$$

Where $\mathbf{H^1}$ = Shannon – wiener diversity index

S = Total number of species in the area

p_i = Proportion of S made up of the *i*th species
ln = Natural Logarithm.

(2) Equation 2: Regeneration Potential

The regeneration species was determined based on the population sizes of seedlings and adult trees, according to Shankar, (2001). The regeneration potential index (RP) was calculated using Curlis and Inrush method (1950), and adopted by Yakubu, *et al.*, (2019) as follows:

$$\mathbf{RP} = \frac{\text{Number of seedlings of species/area}}{\text{Number of parent trees/area}}$$

Where **RP**= Regeneration potential.

4. Result and Discussion

4.1 The Current Status of Riparian Vegetation along River Gongola

Result from Table 1 and 2 reveals significant variations in terms of diversities between trees and seedling species of the study area, with tree species depicting the highest 2.27 Shannon-Weiner diversity index and the lowest in seedling species (1.12 H value) respectively. This is against the work of Zakariya and Bindawa (2020) were 1.73 Shannon-Weiner diversity index was recorded in riparian vegetation along a gully erosion site at FCE (T), Gombe town.

The variations may largely be because of difference in geographical location, climatic and edaphic factors. The findings in (Table 1 and 2) also reveals that, (52) different tree species and (17) different seedling species were enumerated in the study area, with (2.27) and (1.12) Shannon-Weiner diversity indexes respectively, where the former fall within the range of low diversity and the later fall within the range of very low diversity in the biodiversity scale. The low diversity of the species in the area could be attributed to the disturbances by human activities such as irrigation farming, fishing, sand mining, and firewood collection and trampling by grazing animals which cause vegetation encroachment in the area. However, some trees are more diverse because of their ability to adapt to harsh environmental condition of the area.

Species diversity is one of the most important indices used to evaluate an ecosystem. A rich ecosystem with high species diversity has a large value (**H**) while an ecosystem with low value (**H**) will have low species diversity (Sobuj and Rahman, 2011). The diversity of tree species is a little bit higher than that of the seedling species, but both fall within the range of low and very low diversity in the biodiversity scale. The low diversity of the species in the area is due to encroachment of human activities such as construction activities, farming activities which deplete trees.

Table 1: Diversity of Trees of Different Species of the Study Area

S/N	Species	TT (N)	(DEI)-P*i*xLn(P*i*)
1	*Acacia albida*	5	0.01
2	*Acacia nilotica*	3	0.00
3	*Acacia sieberiana*	66	0.04
4	*Adansonia digitate*	11	0.03
5	*Anacardium occidentale*	196	0.21
6	*Anogeissus leiocarpus*	7	0.02
7	*Azadirachta indica*	790	0.37

8	*Balanites aegyptiaca*	15	0.03
9	*Bauhinia rufescens*	48	0.08
10	*Bombax brevicuspe*	1	0.00
11	*Calotropis procera*	11	0.03
12	*Carica papaya*	69	0.11
13	*Cassia singueana*	9	0.02
14	*Ceiba pentandra*	1	0.00
15	*Celtis integrifolia; C. spp.*	14	0.03
16	*Combretum glutinosum*	7	0.02
17	*Combretum lamprocarpum*	27	0.05
18	*Commiphora Africana*	11	0.03
19	*Crossopteryx febrifuga*	3	0.01
20	*Daniellia oliveri*	5	0.01
21	*Detarium microcarpum*	5	0.01
22	*Diospyros mespiliformis*	25	0.05
23	*Ecalyptus camaldulensis*	34	0.07
24	*Ficus platyphylla*	1	0.00
25	*Ficus thonningii*	10	0.02
26	*Gardenia aqualla*	1	0.00
27	*Guiera senegalensis*	4	0.01
28	*Hyphaene thebaica*	25	0.05
29	*Isoberlinia doka*	3	0.01
30	*Jatropha curcas L.*	16	0.03
31	*Lannea acida*	6	0.02
32	*Mangifera indica*	403	0.31
33	*Moringa oleifera*	136	0.17
34	*Musa sapientum*	11	0.03
35	*Myrianthus serratus*	27	0.05
36	*Parkia biglobosa*	1	0.00
37	*Phoenix dactylifera*	64	0.10

Table 1: Diversity of Trees of Different Species of the Study Area

S/N	Species	TT (N)	(DEI)-P*i*xLn(P*i*)
38	*Piliostigma reticulatum*	1	0.00
39	*Poupartia birrea*	1	0.00
40	*Prosopis Africana*	8	0.02
41	*Psidium guajava*	43	0.08
42	*Pterocarpus erinaceus*	3	0.01
43	*Sterculia setgera*	1	0.00

44	*Stereospermum kunthianum*	13	0.03
45	*Tamarindus indica*	11	0.03
46	*Terminalia macroptera*	1	0.00
47	*Vitellaria paradoxa*	6	0.01
48	*Vitex doniana*	2	0.00
49	*Ximenia Americana*	7	0.02
50	*Ziziphus abyssinica*	6	0.02
51	*Ziziphus spina-christi*	6	0.02
52	*Zornia glochidiata*	1	0.02
	Total	**2181**	**2.27**

Source: Fieldwork, 2022 **TT N**=Total Number Encountered **DEI**=Diversity

Shannon-Weiner Diversity Index **H= -∑ P*i*In (P*i*) =2.27**

Table 2: Diversity of Seedlings of Different Species of the Study Area

S/N	Species	TT (N)	(DEI)-P*i*xLn(P*i*)
1	*Acacia albida*	3	0.01
2	*Acacia sieberiana*	2	0.01
3	*Anogeissus leiocarpus*	13	0.05
4	*Azadirachta indica*	985	0.22
5	*Bauhinia rufescens*	66	0.15
6	*Cassia singueana*	3	0.01
7	*Celtis integrifolia; C. spp.*	80	0.17
8	*Detarium microcarpum*	1	0.01
9	*Diospyros mespiliformis*	8	0.03
10	*Haemotostaphis barteri*	1	0.01
11	*Hyphaene thebaica*	1	0.01
12	*Lannea acida*	2	0.01
13	*Mangifera indica*	60	0.14
14	*Myrianthus serratus*	37	0.1
15	*Psidium guajava*	7	0.03
16	*Ziziphus abyssinica*	52	0.13
17	*Ziziphus mucronata*	8	0.03
	Total	**1329**	**1.12**

Source: Fieldwork, 2022 **TT N**=Total Number Encountered **DEI**=Diversity

Shannon-weiner Diversity Index **H= -∑ P*i*In (P*i*) =1.12**

4.2 Regeneration Capacity of Trees of Different Species of the Study Area

Table 3 presents the regeneration capacity of different tree species in the area, a total of 2181 tree and 1329 seedling species were enumerated and recorded respectively. The result in (Table 3) showed poor regeneration capacity of tree species in the area. This is due to human activities such as farming and firewood collection. Another factor is that every plant species in the area required different soil, weather and climatic condition for germination and seedling growth. Low regeneration potential index therefore has a great implication on the regeneration and conservation of the various species encountered.

Findings as shown in (Table 3), recorded the regeneration status of 54 identified tree of different species out of which 6 species had good regeneration status with (1-8%), followed by 1 specie with Fair regeneration of (0.60-0.70), then 9 species with poor regeneration of (0.03-0.33%) and 37 species were non-regenerating with (0.00%). However, result from Tablet 3 also reveals that two species were new (exotics) in the area. The calculated regeneration potential index from Table 3 shows that *Ziziphus abyssinica* had the highest potentiality to regenerate with 8.67 probability of regeneration. Followed by *Celtis integrifolia; C. spp.* with, *Anogeissus leiocarpus*, *Azadirachta indica*, *Bauhinia rufescens* and *Myrianthus serratus* with 5.71, 1.86, 1.25, 1.38 and 1.37 potentialities to regenerate respectively. The next in the ranking is *Acacia albida* with 0.60 regeneration potential index.

However, the result from Table 3 also indicated that, *Acacia nilotica, Adansonia digitata, Anacardium occidentale*, *Balanites aegyptiaca, Bombax brevicuspe, Calotropis procera, Carica papaya, Ceiba pentandra, Combretum glutinosum, Combretum lamprocarpum, Commiphora Africana, Daniellia oliveri, Ecalyptus camaldulensis, Ficus platyphylla, Ficus thonningii, Gardenia aqualla, Guiera senegalensis, Isoberlinia doka, Jatropha curcas L, Musa sapientum, Moringa oleifera, Parkia biglobosa, Poupartia birrea, Prosopis Africana, Pterocarpus erinaceus, Pterocarpus erinaceus, Sterculia setgera, Stereospermum kunthianum, Stereospermum kunthianum, Tamarindus indica, Terminalia macroptera, Vitellaria paradoxa, Ximenia Americana, Zornia glochidiata* and *Ziziphus spina-christi* have zero regeneration potential index in the area. This is attribute to the effect of anthropogenic activities which lead to seedlings disturbances. The seedlings were destroyed from trampling by people and livestock that are foraging around the surrounding communities (Hina and Dadin-Kowa). In line with Lorion and Kennedy (2009), the significant pervasive impact of vegetation clearance for cultivation and livestock grazing intensity on riparian ecosystems changes the composition of plant communities along riverine systems.

Table 3: Regeneration Potential Index of Different Species of the Study Area

S/N	Species	Seedlings	Trees	(RP)	Status
1	*Acacia albida*	3	5	0.60	Fair
2	*Acacia nilotica*	0	3	0.00	Not Regenerate
3	*Acacia sieberiana*	2	66	0.03	Poor
4	*Adansonia digitata*	0	11	0.00	Not Regenerate
5	*Anacardium occidentale*	0	196	0.00	Not Regenerate
6	*Anogeissus leiocarpus*	13	7	1.86	Good
7	*Azadirachta indica*	985	790	1.25	Good
8	*Balanites aegyptiaca*	0	15	0.00	Not Regenerate
9	*Bauhinia rufescens*	66	48	1.38	Good

10	*Bombax brevicuspe*	0	1	0.00	Not Regenerate
11	*Calotropis procera*	0	11	0.00	Not Regenerate
12	*Carica papaya*	0	69	0.00	Not Regenerate
13	*Cassia singueana*	3	9	0.33	Poor
14	*Ceiba pentandra*	0	1	0.00	Not Regenerate
15	*Celtis integrifolia; C. spp.*	80	14	5.71	Good
16	*Combretum glutinosum*	0	7	0.00	Not Regenerate
17	*Combretum lamprocarpum*	0	27	0.00	Not Regenerate
18	*Commiphora africana*	0	11	0.00	Not Regenerate
19	*Crossopteryx febrifuga*	0	3	0.00	Not Regenerate
20	*Daniellia oliveri*	0	5	0.00	Not Regenerate
21	*Detarium microcarpum*	1	5	0.20	Poor
22	*Diospyros mespiliformis*	8	25	0.32	Poor
23	*Ecalyptus camaldulensis*	0	34	0.00	Not Regenerate
24	*Ficus platyphylla*	0	1	0.00	Not Regenerate
25	*Ficus thonningii*	0	10	0.00	Not Regenerate
26	*Gardenia aqualla*	0	1	0.00	Not Regenerate
27	*Guiera senegalensis*	0	4	0.00	Not Regenerate
28	*Haemotostaphis barteri*	1	0	-	New
29	*Hyphaene thebaica*	1	25	0.04	Poor
30	*Isoberlinia doka*	0	3	0.00	Not Regenerate
31	*Jatropha curcas L.*	0	16	0.00	Not Regenerate
32	*Lannea acida*	2	6	0.33	Poor
33	*Mangifera indica*	60	403	0.15	Poor
34	*Moringa oleifera*	0	136	0.00	Not Regenerate
35	*Musa sapientum*	0	11	0.00	Not Regenerate
36	*Myrianthus serratus*	37	27	1.37	Good
37	*Parkia biglobosa*	0	1	0.00	Not Regenerate

Table 2: Regeneration Potential Index of Different Species of the Study Area

S/N	Species	Seedlings	Trees	(RP)	Status
38	*Phoenix dactylifera*	0	64	0.00	Not Regenerate
39	*Piliostigma reticulatum*	0	1	0.00	Not Regenerate
40	*Poupartia birrea*	0	1	0.00	Not Regenerate
41	*Prosopis africana*	0	8	0.00	Not Regenerate
42	*Psidium guajava*	7	43	0.16	Poor
43	*Pterocarpus erinaceus*	0	3	0.00	Not Regenerate
44	*Sterculia setgera*	0	1	0.00	Not Regenerate
45	*Stereospermum kunthianum*	0	13	0.00	Not Regenerate

46	*Tamarindus indica*	0	11	0.00	Not Regenerate
47	*Terminalia macroptera*	0	1	0.00	Not Regenerate
48	*Vitellaria paradoxa*	0	6	0.00	Not Regenerate
49	*Vitex doniana*	0	2	0.00	Not Regenerate
50	*Ximenia Americana*	0	7	0.00	Not Regenerate
51	*Ziziphus abyssinica*	52	6	8.67	Good
52	*Ziziphus mucronata*	8	0	-	New
53	*Ziziphus spina-christi*	0	6	0.00	Not Regenerate
54	*Zornia glochidata*	0	1	0.00	Not Regenerate
	Total	**1329**	**2181**	**22.4**	

Source: Fieldwork, 2022 **RP** = Regeneration Potential

4.3 Effect of Human Activities on Riparian Vegetation

According to Mallam Muhammad, the riparian corridor in Dadin-kowa axis had significantly faltered by human intervention. The riparian zone is reduced to isolated patches of dispersed trees and shrubs leaving large open areas with buildings and other land-uses respectively. He also revealed that there is decrease in the density and diversity of the vegetation of the area,

> "20 years back the riparian zone is densely vegetated and compose of variety of both trees and shrubs, rural dwellers cannot gain access to the riverbank easily because of the density of the vegetation, but nowadays the density has reduced drastically".

Jauro Mu'azu reveals that, riparian vegetation is disturbed because of the increase in population of Hina and Dadin-kowa communities which put much pressure to the vegetation. He further elaborates that the exploitation of the riparian vegetation increases due to massive need for energy firewood and charcoal in particular, recurrent needs for medicine by traditional herbalist, needs for constructional material use for building houses, income generation through the sale of firewood and fruit collection by people in the area among others compounded the situation. Most of the families, especially women and children in the communities around the area depended heavily on the gathering and sales of the products derived from riparian zone for their livelihood. The income realized from the sales of the products takes care of their financial needs in the area.

According to the participants, the introduction of exotic species leads to the loss of some native species in the area, some of them have going into extinction like: *Kele-kele*, *Machara*, *Burugu*, *Dorawa*, *Kizni*, *Maje* and *Rawaya*. Cushman and Gaffney, (2010) reported similar instances along river Niger where they found that, *Arundo* and *Vinca* have strongly negative effects on riparian plant community diversity and advocated effective control and restoration efforts. Subsequently most of the participants believe that farming activities is the major course of vegetation encroachment in the area. It has been observed that most of the areas that were formerly vegetated are now cleared and converted to farmlands.

Plate 1: Plantation (Orchard) on the Banks of River Gongola Dadin-Kowa Dam Area
Source: Field work, 2022

Plate 2: Fire Ignited by Farmers in River Gongola Dadin-Kowa Dam Area
Source: Fieldwork, 2022

4.4 Drivers of Riparian Vegetation Encroachment in the Study Area

According to the participants, land use, fire (Plate 2), fishing activities, erosion, firewood collection, herbal collection and grazing and trampling by animals are the major human activities which cause riparian vegetation encroachment in the area. The finding reveals that, increase in human population has caused many changes to riparian vegetation along River Gongola area. The Riverbank was most intensively farmed for commercial Mango, Guava and Cashew plantations (Plate 1). The human impacts resulting from farming, firewood collection, sand mining and fishing activities in the area gradually alter riparian vegetation conditions by reducing the population of native species plants, through promoting non-native species (exotics) thereby reducing natural regeneration of vegetation in the area. The participant also reveals that, rural dwellers in the area rely heavily on vegetation resources for livelihood because they use the fruits for food, part of plants for medicine, animal fodder, construction materials and other uses. Similar findings were reported by Madebwe and Madebwe, (2005) in Surunghui District, Zimbabwe, that growth in population, high drought incidence rates, national and economic developmental challenges resulted in many farms and economic activities being established on riverbanks. The crops growing in the study area fall in to two categories namely cereals crops and legumes which include: Maize, Millet, Beans, Groundnut, Cassava, Guinea corn, Rice, Spinach, Okro, Lettuce, Cavage, Pepper, Tomatoes and Garden egg.

Finding also reveals that, aquaculture used ponds of different size to rear fish in the area. This necessitated the cutting down of trees and shrubs to paves way for construction of artificial ponds. According to the participants, fishing activities take place in the morning and evening times daily, most of the fisher men keep their fishing equipment's at the Riverbank and smoke their fishes for storage and conveyance to nearby market. Gathering of wood logs for the purpose of smoking the fish contributed to the degradation of vegetation of the area. Furthermore, People used the riparian zone as event center for marriage ceremonies like picnic and other ceremonial occasions which contribute to damages the vegetation of the area.

According to the participants, fire ignited by farmers and hunters in the study area also contribute to damages the riparian vegetation rapidly (Plate 2), irrigation and rainfed farmers ignite fire to burn hay and cleared their farms for cultivation which course a lot of damages to the riparian ecosystem in the area. The finding reveals that, local dwellers used to wash Clothes, Motorcycle, Automobile and Bathing their body in the area, which is a great threat to the riparian ecosystem. This may arise from the deposits of detergents and oilmen on the soils which hinders free flow of air in the soil these retardate plants grow.

According to a participant Jauro mu'azu, the two riverbanks (North and South) of the study area are seriously eroded. Signs of water erosion can be seen throughout the length of the riverbanks. He further stated that tree roots are good source of holding the soil particles together and reducing the water speed at the banks, however the removal of vegetation is equivalent to loss of this vital function. Human uses of the riverbanks which are not in tandem with environmental standard practices are the principal factors that encouraging soil erosion. Sand mining is another anthropogenic disturbance that contributes to the reduction of riparian vegetation in the area.

Heavy browsing from animals in the area which includes cattle, donkeys, sheep and goats reduce the vegetal cover of the area. These disturbances reduce seedlings survival rates in the area. Similarly, Fischer and Fischenich (2000) opined that, riparian corridor is essential for routine animal movement, migratory species and location of birds of different species. According to the participants, most of the herders are cutting part of the trees as food for their animals this include *Marke*, *Taura* and *Baure* which is of a great threat to the riparian ecosystem.

5. Conclusion

In the River Gongola riparian zone particularly along Dadin-kowa Dam, the nearly natural landscape and the human influence landscape shared a substantial proportion of vegetation layers species, but human activities are changing the species composition nowadays. These human activities are affecting biodiversity in various forms and have led to decreased in species diversity, especially at the Riverbank sides. The vegetation community are highly structured by the hydrological process. Furthermore, human activities have altered the natural species distribution and diversity

The study concluded that cutting of tree species for farming activities, firewood/medical collection, animal grazing and trampling, fire (ignited by farmers and hunters) and sand mining are the major human activities which are affecting regeneration of tree species and course vegetation encroachment.

6. Recommendations

has been discovered that fishermen and local communities depend on vegetation along the riverbank for energy, hence the need for the government to provide them with alternative sources of energy like solar cooking stoves, modern charcoal cooking stoves, and Liquefied cooking gas at affordable prices this will reduce pressure on natural vegetation around the area.

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