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Causes and Effects of Vegetation Removal along the Riparian Areas of River MU

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Abstract: Vegetation is an important part of biodiversity whose increasing loss has become a major environmental and socio-economic problem. Vegetation removal translates directly to loss of biodiversity, its causes and effects however, vary spatially and temporally. This study assesses the causes and effects of vegetation removal along the riparian areas of the Mu River. Data for the study were obtained from people who dwell along communities bordering the riparian areas of the Mu River, using a well-structured questionnaire, field observation, and photographs. Information were obtained on socio-demographic characteristics, causes and effects of vegetation removal. Data for the study were analyzed using frequency and percentages, and were presented in tables. The study found that the leading cause of vegetation removal in the area under study is farming (32.5%), this is followed by burnt bricks production (29.5%), and charcoal production (19.6%). The study also reveals that the major effect of vegetation removal in the area is sedimentation/siltation of the watercourse which has 54.8%, erosion of river banks follows with 20.8%, and water pollution (18.1%). The study recommends that riparian area protection legislations should be initiated and strictly abided by, so as to control vegetation removal along those areas and protect them thereby reversing the trend of biodiversity loss

Keywords: Causes and Effects, Vegetation Removal, Riparian Areas.

1. INTRODUCTION

Throughout history, riparian areas have always been used by humans and have also been a main point of interest to humans. For instance, Dountchev, Dimova and Dimitrov (2017) asserted that, riparian forests have huge ecological significance, playing an important role in both nature and human populations. The proximity of riparian areas to water makes them even more important. Among their many functions are, preserving plant and animal species, preventing bank erosion, and helping to prevent flooding by retaining water.

Riparian areas are the green ribbons of trees, shrubs, and grasses that grow along water courses (Pratt, 2014). They are transition zones between aquatic (water-based) and terrestrial (land-based) systems, and usually have characteristics of both. Riparian vegetation are plant communities adjacent to, and affected by surface or ground water of perennial or ephemeral water bodies. They are areas which include flood plains and stream banks (United States Department for Agriculture, 2002). This includes vegetation that is found neighbouring rivers, streams, lakes, ponds, and drainage ways of those on floodplains. Riparian species may be reliant on the water body for part of their life cycle in order to exist (James and Barnes, 2014).

Plants in this zone protect the soil, stream banks, or water edges from excessive erosion. Riparian vegetation is significant in ecology, environmental management and civil engineering because of its role in conservation, its biodiversity, and the influence it has on fauna, and aquatic ecosystems, grassland, woodland, wetland or subsurface features such as water tables (Allsopp, 2007). Anyadike and Obeta (2012) asserted that riparian vegetation serves as a sponge filtering and recycling water quality within a drainage basin. Environmental experts consider a thriving riparian system to be the health of any river, stream or lake. Similarly, Orewole, Alaigba, and Oviasu (2015), noted that riparian vegetation moderates soil moisture conditions in stream banks and roots provide tensile strength to the matrix, enhancing bank stability. Manoel and Uieda (2017) reported that, several studies including Allan, 2004; Casatti *et al*., 2006; and Casatti *et al*., 2012 have shown the importance of riparian vegetation to the physical structure of streams, which can favor the maintenance of environmental stability and provide nutrients used through the trophic chain. Dountchev, Dimova and Dimitrov (2017) also reported that, historically, rivers have dwindled as a result of loss of riparian areas to agriculture which leads to excessive siltation/sedimentation.

Naiman *et al*., as cited in Dufour and Rodríguez-González (2019), asserted that riparian vegetation is a crucial component of fluvial systems and serves multiple socio-ecological functions. Physically, riparian vegetation in rivers alters flow conditions and therefore sedimentary processes by protecting banks, colonizing deposits, supplying large woody debris, etc. (Corenblit *et al*., 2007; Gurnell, 2014). From a morphological perspective, this influence can be strong enough to induce river metamorphosis (Tal *et al*., 2004). Chemically, riparian vegetation supports biogeochemical cycles of river systems. Because, its buffering effect improves water quality in agricultural watersheds that are affected by nonpoint- source pollution (Sabater *et al*., 2003; Mander *et al*., 2005). Biologically, (Sabo *et al*., 2005; Schnitzler-Lenoble 2007), riparian vegetation is species-rich and increases regional biodiversity. This biological role is also related to habitat and corridor functions (Seymour and Simmons; Schnitzler-Lenoble; Roshan *et al*.,; de la Fuente *et al*., in Dufour and Rodríguez-González 2019) and the influence of riparian vegetation on temperature, organic matter inputs, of aquatic ecosystems (Miura and Urabe, 2015; Ferreira *et al*., 2016; Astudillo *et al*., 2016; Wawrzyniak *et al*., 2017; Dugdale *et al*., 2018). Some of these functions are identified as playing critical roles in moderating local effects of global changes, such as thermal conditions of streams (Kristensen *et al*., 2015; Trimmel *et al*., 2018). Socially, riparian vegetation contributes to the identity of the landscape it belongs to; thus, it contributes to cultural services (e.g. recreation, spirituality, inspiration).

Many of these functions are considered positive because they improve human well-being by providing many ecosystem services, such as recreation areas, raw materials (e.g. wood, energy) and water quality improvement (Kenwick *et al*., 2009; Recchia *et al*., 2010; Flores-Díaz *et al*., 2014).

Despite the numerous functions and benefits, derivable from healthy riparian areas, it is observed that most riparian areas suffer alteration, degradation, and complete de-vegetation in some extreme cases. In the era of recurring tragic floods, and diminishing biodiversity caused by climate change, the importance of riparian vegetation becomes further accentuated. It is however unfortunate, that, rather than protecting and conserving, improving and extending the available riparian areas, they are being altered and (in extreme cases) destroyed. Riparian vegetation removal threatens the health and life of the supporting water bodies. It causes severe degradation of streams' quality, mainly in headwater streams that are more linked to the terrestrial ecosystem (Pusey and Arthington, 2003; England and Rosemond, 2004). The phenomenon (Ajayi, 2015) has led to alteration, and the replacement of riparian zones by poorer vegetation especially grasses, thus impairing their recovery and decreasing their carrying capacities. In many developing countries, extensive riparian areas are undergoing land use changes due to deforestation activities, leading to conflicts in water use due to agricultural demands for irrigation. Menezes, as cited in Von (2014) observed that the expansion of agriculture and urbanization are the main factors that affect the aquatic ecosystems in many developing countries of the world, especially with respect to riparian vegetation removal, siltation and contamination by domestic and industrial sewage. The huge ecological importance of these vegetation, the damage they have already suffered, and the threats they face today call for immediate efforts for their restoration. What causes vegetation removal along riparian areas of river Mu, and the effects of its removal is the focus of this work.

2. MATERIALS AND METHODS

Study Area

River Mu is a tributary of river Benue, it is located between Latitude 7^0 45' and 8^0 00'north, and Longitude 8^0 28'east. It takes its source from the Gboko highland and flows through Gwer-east local government area in the southwestern part of Benue state and empties into river Benue in Makurdi local government area (see Figure 1, and 2). Its drainage basin covers an estimated area of about 156km^2 (Ministry of Water resources and Environment, 2010).

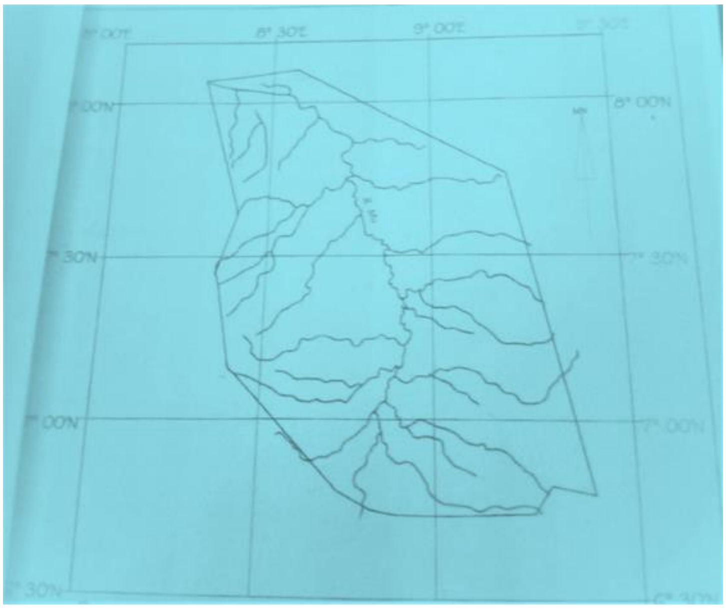

Figure 1: River Mu and its tributaries.

Source: Benue State Ministry of Land and Survey, 2010.

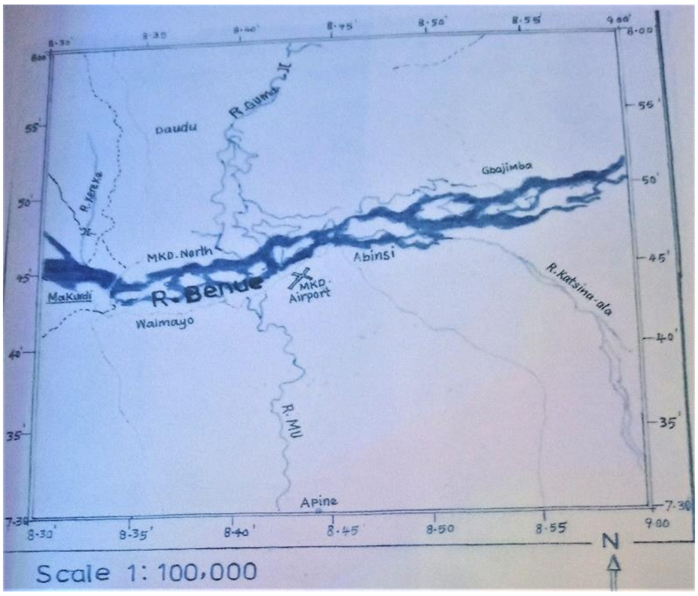

Figure 2: River Mu, and other tributaries of River Benue

Source: Benue State Ministry of Land and Survey, 2010.

The study divides river Mu into three sections; one in the upper course (near the source), another in the middle course, and the last in the lower course (close to river Benue). Similarly, three communities; one in each of the sections were studied. The communities namely Mbaker, Mbatsavkaa, and Mbasa were selected in the upper, middle and lower course(s) of the river respectively. Using the Taro Yamane (1967) sample size determination formula, a total of 338 respondents were sampled from a population of 2221 inhabitants of the three communities. The study used a four-sectioned questionnaire which was designed and administered to respondents. Using the questionnaire, data were gathered on socio-demographic status of people in the selected communities, causes of vegetation removal, and the effects of vegetation removal along the riparian areas of river Mu. From the 338 copies of the questionnaire that were administered, 332 were completed and returned valid for analysis.

3. RESULTS AND DISCUSSION

A. Socio-demographic Characteristics of Respondents

The socio-demographic characteristics of the respondents were analysed in the study. The demographic variables specifically considered include sex, age, occupation, marital status, educational level, and annual income of the respondents. Table 1 shows that, of the 332 respondents, 56.8% were male and 43.2% were female. Also, 40.1% were between the ages of 40 – 49, and 30.7% were between 19 – 29 years. The result further reveals that 87.0% of the respondents were farmers and 6.0% were artisans. The result also shows that 58.1% of the respondents were married and 26.0% were single, 9.0% and 6.9% were widows/widowers, and divorced/separated respectively. Furthermore, the result also shows that 41.0% and 32.5% of the respondents acquired primary and secondary education respectively. The study also found that 26.8% earn between ₦ 401,000 and ₦ 500,000 and 25.9% earn 301,000 – 400,000, 22.3% earn 201 – 300,000 annually (see Table 1).

Table 1: Socio-demographic Characteristics

Sex	**Frequency**	**Percentage (%)**
Male	189	56.8
Female	143	43.2
Ages	**Frequency**	**Percentage (%)**
40 – 49	133	40.1
19 – 29	102	30.7
30 – 39	78	23.5
50 and above	15	4.5
0 – 18	4	1.2
Occupation	**Frequency**	**Percentage (%)**
Farmers	289	87.0
Artisans	20	6.0
Traders	12	3.6
Civil servants	8	2.4
Students	3	0.1
Marital status	**Frequency**	**Percentage (%)**
Married	193	58.1
Single	86	26.0
Widow/widower	30	9.0
Divorced/separated	23	6.9
Educational level	**Frequency**	**Percentage (%)**
Primary education	136	41.0
Secondary education	108	32.5
Tertiary education	48	14.5
Non formal education	40	12.0
Income (₦)	**Frequency**	**Percentage (%)**
₦ 401,000 – ₦ 500,000	89	26.8
₦ 301,000 – ₦ 400,000	86	25.9
₦ 201,000 – ₦ 300,000	74	22.3
₦ 1,000 – ₦ 100,000	72	21.7
₦ 101,000 – ₦ 200,000	11	3.3

Source: Authors' Field Work, 2022.

B. Causes of Vegetation Removal in the Riparian Areas of River Mu

Vegetation removal in riparian areas is caused by diverse factors including commercial logging, farming, burnt bricks production, and charcoal production. Due to the presence of water in riparian areas, they attract so many economic activities which are sometimes detrimental to healthy vegetation in those areas. For instance, farmers prefer riparian areas over other areas for farming where irrigation is practiced but not well-developed. Similarly, the woody nature of riparian areas attracts commercial loggers who exploit the timber available within and around those areas particularly where logging is not regulated, and riparian areas are not protected. Vegetation removal in in riparian areas is also caused by charcoal production where the trees are cut and burnt and the bye-product used as fuel. Charcoal is mostly used as fuel for domestic and sometimes industrial uses. In some cases, vegetation removal in riparian areas results from charcoal production as water is used in moulding the bricks, while trees are cut and used for burning the bricks. The availability of these two key ingredients of bricks burning within riparian areas makes them attractive to burnt bricks producers.

Table 2: Causes of Bush Burning

Causes	Frequency	Percentage
Farming	108	32.5
Burnt bricks production	98	29.5
Charcoal production	65	19.6
Commercial logging	61	18.4
Total	**332**	**100**

Source: Authors' fieldwork, 2022.

Table 2 above shows that, majority (32.5%) of the respondents identified farming as the major cause of vegetation removal, followed by burnt bricks production representing (29.5%). Also, charcoal production, and commercial logging have 19.6%, and 18.4% respectively. This result agrees with the position of Gabler, Petersen, Trapasso, and Sack (2009), who posited that slash-and-burn farming is one of the most serious challenges facing tropical vegetation. They also observed that slash-and-burn farming is common in Africa and Latin America as a result of population pressure on the available arable land. The result also agrees with the warning of UNEP (2015) that the increase in Africa's population is causing continuous migration to towns and cities thus increasing the demand for fuel. Consequently, more trees will be cut down to produce wood and charcoal to satisfy the bursting demand for energy which is mostly fed by charcoal.

C. Effects of Vegetation Removal in Riparian Areas of River Mu

The numerous benefits of riparian vegetation implies that its absence could have numerous adverse effects both on the survival of the water course, and its functions. Those effects include, siltation/sedimentation, water pollution, erosion of the river banks, and invasion of noxious weeds. For instance, the absence of vegetation along the banks of rivers allows free flow of sediments (silt) from uplands into the area and consequently, the sediments are deposited in the water channel. This process, referred to as siltation/sedimentation reduces the water-carrying-capacity of the water body. Similarly, when the riparian area is bare of vegetal cover, it allows the removal of soil particles which are hitherto held together by roots of plants. The removal and transportation of the soil particles causes erosion of the river banks through creation of rills and gullies. More so, as upland sediments are deposited into the watercourse, they introduce noxious weeds into the water system which are detrimental to the health of the river/stream. Another effect of riparian vegetation removal is pollution of the water. As the vegetation that filters substances that enter the watercourse is removed, the free flow of substances into the water pollutes the water. Such pollutants include agricultural residues, herbicides and fertilizers as well as industrial and domestic waste.

Table 3: Effects of Vegetation Removal in Riparian Areas of River Mu

Effect	Frequency	Percentage
Sedimentation/siltation	182	54.8
Erosion of the river banks	69	20.8
Water pollution	60	18.1
Invasion of noxious weeds	21	6.3
Total	**332**	**100**

Source: Authors' fieldwork, 2021.

Table 3 shows that, most (54.8%) of the respondents posited that the major effect of vegetation removal in the area is sedimentation/siltation, and 20.8% of the respondents identified erosion of river banks as the effect of vegetation removal. The result also shows that 18.1% of the respondents identified water pollution as the effect of riparian vegetation removal, and 6.3% of the respondents identified invasion of noxious weeds as the major effect of riparian vegetation removal. This result agrees with the position of Adewunmi (2013), who posited that the reduction or absence of riparian vegetation leads to siltation of river channels thus reducing its channel depth. It also agrees with the position of Dountchev, Dimova and Dimitrov (2017). According to them, rivers have dwindled as a result of loss of riparian areas to agriculture which leads to excessive siltation/sedimentation. The result also corroborates the findings of Anyadike and Obeta (2012) whose study found that the absence of riparian vegetation allows the entrance of numerous contaminants into the watercourse thereby polluting the water.

In line with the results, the story recommends the initiation of laws/bye-laws to protect riparian areas, not just in river Mu, but other streams/watercourses. Also, those laws/bye laws should be enforced to the latter. Furthermore, intensive afforestation within and around riparian areas of the Mu river should be embarked upon by individuals, groups, government and non-governmental organizations in order restore, and conserve those areas. Lastly, the riparian corridors should be demarcated from other areas, and a buffer created in order to prevent encroaching into the riparian corridors.

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