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Spatial and Economic Dimension of Livestock Pasturing On Rural Livelihoods and Biodiversity along the Riparian Vegetation of River Benue in Northern Nigeria

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Abstract: *The study investigated into the spatial and socio economic consequences of grazing in the riparian on the livelihood of the community along river Benue in Adamawa state Nigeria. Survey design was used and involved 232 respondents selected randomly from the communities along the riparian areas. Data were collected using the researcher made questionnaire; descriptive statistics and Pearson's correlation were used to analyze data. The findings revealed a strong negative relationship at ($r = 0.852$, $p < 0.05$), conclusively indicate negative implication on the sustainability of socio-economic activities among communities along river Benue. The study revealed economic effects of grazing as; decrease in habitat and fish productivity, decrease in wild foods and medicinal plants, cultural and recreational potentials among others. Social effects include deteriorating quality of sanitation, poor quality of life and increase in communicable diseases among others. Study further revealed variation in the socio-economic effects of grazing on the livelihoods amidst community in the upper and lower section of the riparian Findings revealed that communities along the lower section of the riparian has more severe weight of both social and economic effects compare to the upper section of the riparian. Study recommends Federal, State government agencies in alliance with traditional authorities and community base organizations; should use research institutions, and universities to push for research projects to educate the society towards having a healthy riparian. Enhance strategies and application of national ranch grazing system which will help in the rehabilitation of the upland vegetation, safeguarding the riparian for a better ecological services.*

Keywords: *Grazing, Effects, Socio-Economic, Riparian Livelihood, Community*

Introduction:

Grazing abounds across the world with differences in effects due to variation in climate and culturally conceptualization of grazing management strategies by communities. Regardless of the conceptualization of grazing management strategies, grazing still seems to be the most disastrous action where uncontrolled or unregulated practices exist. Upland vegetation grazing is as old as crop cultivation among most of the communities in Nigeria, especially among communities in the savanna region of North Eastern Nigeria, where unguided open cattle grazing have caused a serious problem of overgrazing (Adefioye, 2013). However, prior the post-independent era, grazing activities was not common along the riparian due to limited economic, technological adaptation and prevalence of tsetse fly(Adefioye,2013). Although riparian grazing seems to be a recent development however, it seems to be more disastrous and devastating across Africa countries, especially in Nigeria along the riparian of river Benue

Grazing effects is identified to be the potential influence of livestock grazing on environment in various ways such as; defoliation, trampling and browsing on plants (Zoheir,2011). Such processes lead to redistribution of nutrients, redistribution of plant seeds by passive transportation and by other propagules. Livestock management have been and still a huge source of livelihood for a large percentage of both rural and urban dwellers in Nigeria (Oyinloye,2011). Like in the pre-settlement time, grazing is mostly traditionally managed in Nigeria with variation in the practices limited to communities or regions.

The interplay between livestock grazing and sustainability of riparian vegetation has long been established as conflicting, due to their interdependence and vulnerability. These are resources of critical values to the survival of the biodiversity and the society, such resources needs to be managed harmoniously to avoid conflicting situations. Regardless of the improvements in economic, technology adaptation, however, traditional ways or methods of grazing is still in use in the north east of Nigeria among communities and the nomadic pastoralists. It is indeed a serious concern to the communities of the Savanna region of Nigeria, where livestock grazing has caused a serious problem of overgrazing (Adefioye,2013; Blench,2010).

Before the improvement in Nigeria economic, technology adaptation and population growth, riparian vegetation was well developed with stable vegetation heterogeneity which were wide stable across the country (Blench, 1999; Onoaha,2008). Also, prior post-independence the profound influence of grazing was associated with terrestrial vegetation (Aremu & Onadeko, 2010). Prior policy of breakoff of land and individual ownership of 1861 of the colonial masters, every tribe and community in Nigeria has its own customary laws safe guarding the natural resources o both terrestrial and aquatic environmental resources (Meagher and Yunusa,2012) As policies determined land ownership to the community, clan and family because, every community in Nigeria has its own customary policies used in safe guarding land and other natural resources (Meagher & Yunusa, 2012).

The riparian vegetation conditions were then in good conditions and stable with efficient ecological services, which were relatively free from human activities especially grazing. The vegetation community was wide matured with standard succession level which provided to the community's efficient ranges of non-farming social and economic opportunities (Olaotswe, *et al*., 2013). Grazing drifted into the riparian areas at the post independent period due to the exhausted conditions of the terrestrial vegetation, and the demands for animal protein requirements of the teeming population.it is becoming more intensified and devastating in the riparian, which is alarming and regrettable (Adefioye, 2013). Subsequently, uncontrolled grazing has become a serious problem in the riparian, the farming and non-farming opportunities along the riparian on which most of the community's livelihood dependence are degraded and vanished (Meagher and Yunusa, 2012). The uncontrolled grazing along the riparian is a serious threat to the riparian vegetation and the livelihood of the community, due to the vanishing of the non-farming economic activities along the riparian. This study sought to investigate into the effects of unregulated grazing activities on the socio-economic livelihoods of people living along the riparian of river Benue in Adamawa state, Nigeria.

Literature Review:

Capper, (2013) focused on the importance of livestock and its wide range of undesirable direct environmental impacts upon the quality of plants, water and biodiversity. The major environmental impact of livestock on plant community, land, water and biodiversity conservation are found where production systems are not well managed. There has been much speculation around the impact of increasing livestock production on the environment, as global livestock demand increases to meet the increasing population demands.it is often seen as a potential danger to plant community (IFAD, 2013; Scholtz.et al,.2013).

Livestock is the major floristic users (Herrero et al. 2013; Nyariki et al., 2009). According to Seré (2012), livestock systems occupy 45 percent of the earth's surface. This is not surprising as 70 percent of the agricultural land in South Africa is utilized by livestock as such, most of the valley species are dominated by exotic or invasive plant that are of less value, (Meissner et al., 2013); 75 percent of land in Namibia is used for extensive livestock ranching (Lange et al, 2011); cattle production alone occupies 75 million hectares in Northern Australia (Macleod et al., 2014). However, livestock production is generally assumed to be adversely affected by land degradation, which eventually reflects on the economic performance (Macleod et al., 2014).

Poor management of livestock grazing is evident of overgrazing leading to overstocking beyond the lands' carrying capacities, which exposes pastureland and riparian loss of vegetation. Macleod et al., (2014) examined the productivity of livestock under different grazing regimes; they found that changes in plants and land conditions had both positive and negative effects on livestock production. The link between vegetation condition, livestock grazing and economic outcomes was determined using a combination of experimental data and simulating models. It was established that

as plants and land conditions deteriorate, reduction in livestock numbers was warranted Meissner. et al., (2014). Extreme cases of poor floristic and land conditions with high livestock numbers resulted in poor livestock performance, with poor market value and hence low profitability. This is mostly common with the dry season because of lack of water and grass in the highland area.

However, economic activities such as fishing, farming, weaving, hunting, transportation (navigation), among others are the common effects of overgrazing along the riparian (Adefioye,2013). The communities living along river Benue are mixed-up with reasonable number of Nomadic and Agro-pastoralists who keep large herds of cattle and some few goats and sheep, which has serious negative implications on the non-farm activities' (Meagher and Yunusa,2012).

Grazing as one of the most dominant economic activities has resulted in degradation of vegetation, land and water over the years, which impacted negatively, the non-farming and farming economic and social opportunities along the riparian (Adefioye,2013 and Blench, 2010).

Furthermore, due to the nomadic lifestyle and struggle for control of riparian resources conflicts have become the norm due to limited grazing areas. Lives, property and animals have been lost in these conflicts over the years and little is been done by the local, State and Federal authorities (Linus. et al., 2014)

Methodology:

The riparian areas along the river Benue starting from Lamurde and the areas below the joining of river Gongola a tributary, extending up to Fufore in the upstream in Adamawa State is the study site. The study adopted quantitative and qualitative approaches, as cross- sectional descriptive survey was used. Random simple sampling and stratified sampling were used in identifying the categories of sample population along the riparian. Study sample size was derived from five selected categories base on the nature and structure of the communities. It comprised of (1), River basin development authority (65), (2), Adamawa state environmental management agency (55), (3) Community based organizations (36), (4), Non-governmental Organisations (12), and (5) Local community members (382). Thus; a representative sample of 232 respondents from target population of 550 was attained.

The study used questionnaire to cover the objective of the research, there were questions on the social effects of grazing as well as economic effects of grazing on the livelihoods of the riparian communities along river Benue. Descriptive statistics, inferential statistics were used in consistence with research design. Statistical Package for Social Sciences (SPSS 23) and Excel were used for data analysis. Quantitative data were coded, descriptive statistics such as frequency, and percentages, Pearson's correlation was used to determine relationship. Tables, charts and figures were used in presenting the analyzed data.

Research findings:

Social effect of grazing on the communities along riparian area

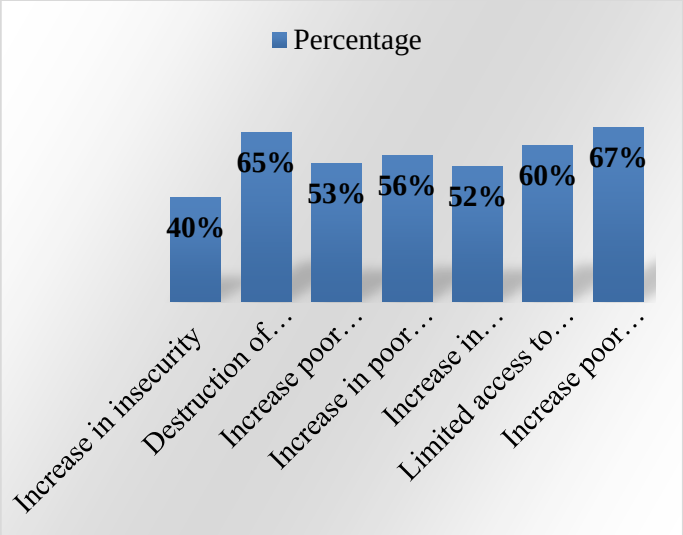

Figure 1: Social effects of grazing on the community along the riparian:

Figure 1 findings indicate that grazing affects the social functions of the communities along the riparian of the river Benue. Poor quality of life among the community was advanced by the respondents to be the most severe by 67 percent. With 65 percent, destruction of water source by the cattle constitute a major problem as advanced by the respondents. Limited access to safe and clean water was rated 60 percent by the respondents as a serious grazing effect. Poor health quality among the communities is 56 percent above average as advanced by the respondents. Others are; poor sanitation or sanitary condition among the community as advanced by the respondents to be 53 percent. The respondents also advanced that due to grazing, there is increase in communicable diseases which they rated as 53 percent and finally, insecurity was identified and advanced by the

respondents as one of the social challenges, rate 40 percent. However, it is one of the most difficult challenges.

Differences in social effects of grazing amidst the communities

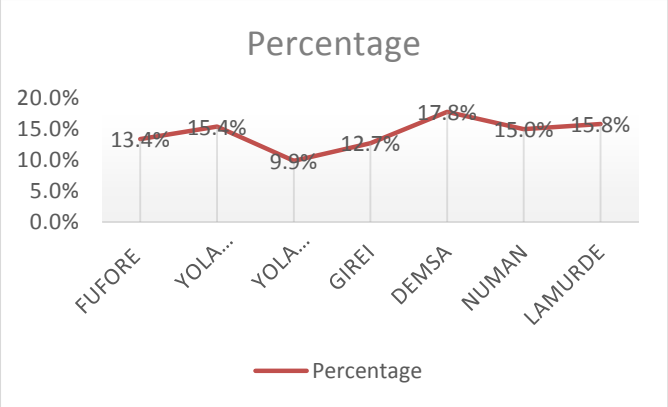

Figure 2: Differences in social effects of grazing amidst the communities:

Figure 2, findings, identified difference in the social effects of grazing amidst the communities along the riparian area. Results clearly indicate that there is a great variation in the social consequences of grazing amidst the communities. The lower section of the riparian has more severe weight of the effects compares to the upper section of the riparian. Demsa is mostly affected with 17.8 percent of asperity of all the challenges, followed by Lamurde area as 15.8 percent crabbiness of the effects and Numan areas with 15 percent tartness to the prevalence respectively. In the upper section, Yola South is most affected by 15 percent sourness of the challenges, Fufore 13.4 percent astringency of the effect on community and Girei with 12.7 percent experiences of challenges bitterness to the actuality of effects and Yola North with 9.9 percent less experiences of challenges severity.

The economic effects of grazing on community livelihood along the riparian of river Benue

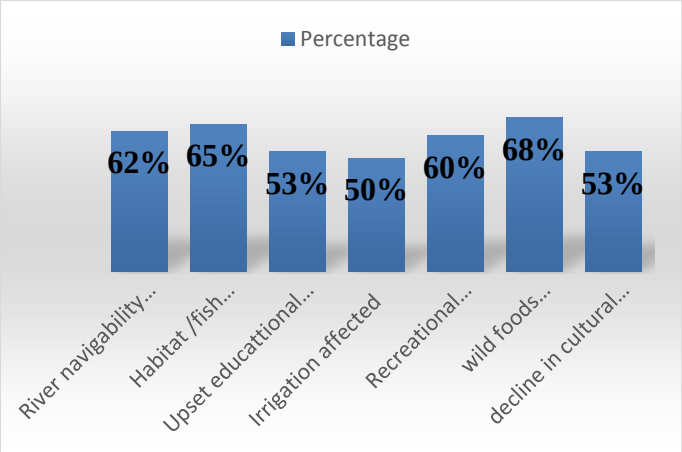

Figure 3: Economic effects of grazing on communities along riparian area:

Figure 3, findings indicate that grazing has economic backlash on the communities along the riparian area. Most common and severe of the effects that are upsetting the communities include inter Lia; decrease in wild foods (fruits/vegetable) and medicinal plants, destruction of habitat and Fishery productivity, and decrease in the navigability of riparian water for transportation and other functions. The destruction of habitat and decrease in fish productivity was advanced by the respondents to be 65 percent. Decline in wild foods (e.g. *Hack berry, Anacardium occidentale*) and medicinal plants *(Leonurus sibiricus, lactuca salinga*) is most affect by grazing as rated 68 percent by the respondents. Decrease in the navigability level of riparian water is one of the severe challenges, rated 62 percent by the respondents. Also affirmed by the respondents' is the destruction or upsetting of educational potential of the riparian resources advance to be 53 percent. Others which are not compromising are; destruction of recreational activities 60 percent, decline in irrigation 50 percent and finally the destruction of spiritual and cultural enrichment of the riparian vegetation 53 percent as advanced by the respondents respectively.

Differences in the economic effects of grazing amidst the communities along the riparian

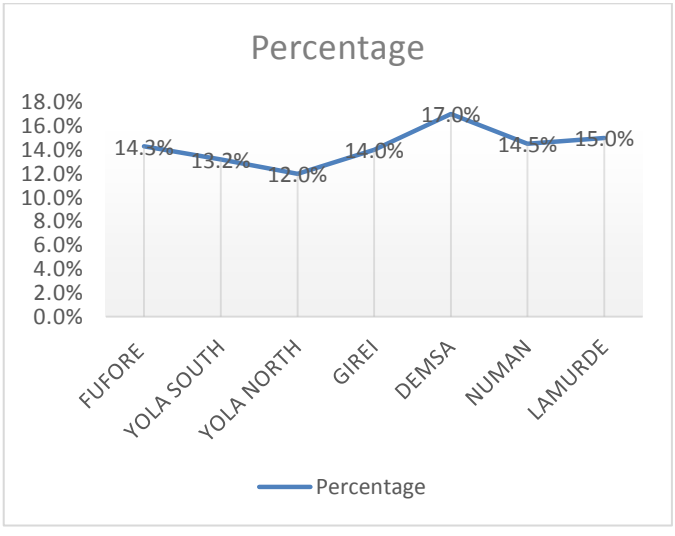

Figure 4: Differences in the economic effects of grazing amidst the communities:

Figure 4 findings indicate that there is a great difference in the economic consequences of grazing amidst the communities along river Benue, communities in the lower section of the riparian are more affected than those in the upper section.

Demsa is most affected with 17 percent astringency; followed by Lamurde 15 percent asperity and Numan 14.5 percent bitter experience. In the upper section of the riparian, Girei is most affected with 14 percent severity, while Yola North 12 percent sourness, Yola South 13.2 percent asperity and Fufore within the range of 14.3 percent of the challenges astringency respectively.

Relationship between grazing and socio economic livelihoods of the communities

Table2: Pearson correlation analysis of socio-economic effects of grazing on the communities' livelihoods:

		Social economic effects of grazing	People's Overall livelihood
Social economic effects of grazing	Pearson Correlation	1	.852*
	Sig. (2-tailed)		.000
	N	230	230
Deterioration in People's livelihood	Pearson Correlation	.852*	1
	Sig. (2-tailed)	.000	
	N	230	230

According to the analyzed result of Pearson correlation there exists a strong negative relationship at ($r=0.852^*$, $p<0.05$) between livestock grazing and the socio-economic values of riparian vegetation and the livelihoods of the community. That grazing has negative implications on the sustainability of socio-economic activities among the communities along riparian of river Benue. This signifies that the various socio economic effects of grazing like poor navigability, fishing, poor quality of life, insecurity and wild foods harvesting have a profound effect on the overall livelihood of the riparian communities. Consequently, the result indicates that, as grazing increases in the riparian, there is more deterioration of the socio-economic activities and livelihoods of the communities along the riparian area.

The most affected valuable riparian economic plant species:

Findings indicate that riparian supply variety of non-timber and bio-fuel products of significant to the riparian community livelihood economy. These products in addition to the wild foods, include handicrafts made from riparian floristic species, largely by sailors and children which support significantly source of household income.

Consequently, grazing has affected some economic plant species such as *hackberry* and *cashew apple*, produced naturally by cashew tree (*Anacardium occidentale*). Nigerian leafy vegetables such as *Wild Lettuce* locally known as (Efo Yarin –Yoruba) and *Crassocephalum rubens* locally known as the (*Yoruban* bologi Ebolo) were also affected. Some of these considerable plants include; *Vernonia amygdalina* the Edo call it oriwo*;* Hausa, *chusar doki (a horsetonic food containing the leaves), fatefate/mayemaye (a food prepared from the leaves);* Ibibio atidot; Igbo, *onugbu;* Tiv, ityuna; and Yoruba, *ewuro*. *Moringa oleifera, Garcinia kola, and Anacardium occidentale*.

One of the economic trees along the riparian is *Anacardium occidentale,* the tree is not native of the riparian plant forms but one of the several valuable trees introduced by the communities to the riparian environment due to its economic and medicinal values.

Hackberries one of the native tree found commonly on river terraces and flood plain in Lamurde, Demsa and Dong, Vunoklong, Geriyo, jobwuloyo, and Damare along the riparian. Is one of the useful economic plant used for fruits and juice by the children herding along the riparian, also picked for sale (to earn money) most especially by school age children.

Wild lettuce, this plant species is one of the lettuce *genus* family such as;(*lactuca virosa, lactuca salinga and leonurus sibiricus)* they are native of the riparian used as food and medicinal herbs for centuries in the area. Some of these lettuce species (*e.g. lactuca virosa and lactuca salinga*) are very palatable for human and animals. There are found along the riparian but with variation in species kind influenced by soil type and nutrients, the palatable species are more in the non-grazed site of the study area.

Crassocephalum rubens (the Yoruban bologi Ebolo), is one of the *crassocephalum genus* family members include *rag leaf, thickhead* and he *bologi*. There are several in the vegetal family which are edible and consumed by many tribes across Africa. There are native of the riparian species, some like *Crassocephalum crepidiodes* and *mannii* are shrubs which are ornamental and toxic used as medicinal. Crassocephalu genus family is one of the most economic species in herbs and shrubs forms that every community value it and as such can be a source of conflicts amidst grazing herds and human beings.

Vernonia amygdalina a native plant of the riparian species a member of the *Asteraceae* family a small shrub of different class grows mostly on sandy soil of riparian stream bank it looks like the drumstick (*Moringa oleifera*). It is one of the most economic plants in the riparian use for vegetable soup and medicinal herbs like the *Moringa oleifera*. It is mostly found in the non-grazed areas as it is one of the palatable species sensitive to grazing, it is found in a scattered residual patches along the grazed site of the riparian.

Discussion:

The social and economic consequences of grazing on the livelihood of the riparian community was determine through respondents' opinion, which were analyzed using descriptive techniques simultaneously with the correlation techniques. The descriptive analysis was on both social and economic effects.

The work found that the social effects commonly cited by the respondents included; prevalence of insecurity, increased risks of contracting communicable diseases, destruction of water source for drinking. Others are increased poor health quality due to flood and open defecation by herdsmen, and limited access to safe / clean drinking water. In other words, by degrading water supplies and reducing the health of riparian habitat, livestock fragment landscape-level connections. They also damage the connection between natural and human communities, since degraded streams and plant community reduce the potential for recreational, fishing, swimming and boating in the area. Degrade riparian vegetation influence precipitation amount, provide less water for reservoirs, as well damage coastal sporting and fishing festival are some of the social implications of grazing, being experience by the communities (Linus, *et al.*, 2014).

Some of the social implications with less prevalence in the communities as affirmed by the respondents are: poor sanitation, and poor quality market, school and sports infrastructures due to the insecurity and destructions of social amenities. Effects of intensive grazing in riparian is not only on the plant community resources, but it creates conflicts between the communities and herdsmen which generate huge social implications (Meagher and Yunusa, 2012; Linus. *et al.,* 2014). There is a great variation in the social effects across the communities along the river Benue, communities along the lower section of riparian are mostly faced with severe social problem. The effect is more disastrous in Demsa which has the highest percentage, followed by Numan and Lamurde respectively. Categorically, settlements are rural in these communities with most of their social livelihood activities rely heavily on the riparian along the river.

The study found that the most common economic effects biting livelihood of the communities, accepted by the respondents included among others; destruction of fish habitat and decrease in fish productivity and wild life which is another source of protein for the community.

Destruction of recreational potentials such like pools and ponds, boating and sand mining. Others are; decline in eco-tourism activities, destruction of medicinal plants and the decline in navigability of the river which affected transport business, practices of herbal medicine and even vegetable.

Livestock grazing can affect the riparian environment by changing and reducing vegetation or by actual elimination of riparian areas by channel widening, channel aggradation, or lowering of the water table through plant degradation (Macleod. *et al.,* 2014). Along the riparian the communities, the most apparent effects are on fish habitat due to vegetation degradation which reduces shade cover, and influx of food supply. Others are resultant increases in stream temperature, decline in wild fruits along stream, decrease of debris cover through plants degradation. The result complement the study of Armour. *et al.*, (2011), that stream-channel vegetation degradation has long been recognized as a major watershed-fisheries problem, not only to fisheries but it is even general to ecological services. The elimination of stream bank vegetation due to acute livestock grazing is a serious negative development to all vegetative dependent riparian components. In the grazed site of the riparian, stream banks eroded because livestock congregate along streams for shade, succulent riparian vegetation and drinking water. The collapse of overhanging banks due to livestock grazing is one of the principal factors contributing to the decline of native trout in the Western Australia (Jansen and Robertson, 2012).

Furthermore, the importance of riparian vegetation to the life support function begins in the aquatic communities of headwater streams and rivers. Studies have linked the importance of riparian plant cover to fish populations. McIntosh. *et al.,* (2013), for example, found that populations of brown trout

(*Salmo trutta*) were reduced by 27 per cent when riparian vegetation was removed by grazing cattle.

Waterholes are often favoured locations for camping, picnicking, swimming and fishing. These values can be lessened by reduced fish populations, loss of aesthetic appeal, poorer water quality, increased weeds and reduced number of shady trees and native couch grass on riverbanks. The water quality of the water holes may also exceed Nigeria health guidelines for secondary contact (e.g., swimming), especially with regard to indicators such as faecal coliforms deposits by stocks which encourages predominance of algae invasive.

The descriptive simple percentages explanation of the respondents responds and the correlation statistical analysis were simultaneously used to determine the relationship, between grazing consequences and the degrading socio-economic activities on community livelihood. The coefficient results of person correlation indicate that there was association between the grazing socio-economic effect and livelihood of the communities along the river. The high and significant Pearson correlation coefficient provides sufficient evidence for the research null hypothesis rejection. The P-value ($P = 0.00$) was significantly lower than the $\alpha = 0.05$ significance level Table 8.

The high and significant Pearson correlation coefficient analysis provides sufficient evidence for the rejection of the Null hypothesis, which states that there is no socio- economic effect of grazing in the riparian along river Benue. The p- value calculated at, (P=0.000) is significantly lower than (r=0.852) at(α=0.05) significance level, Pearson correlation state that, when P-value calculated is less than critical level of significance, Ho, should be rejected. Conclusively, the P-value (0.000) is less than α=0.05, therefore, Null hypothesis is rejected in favor of the alternative. Grazing affects the socio economic activities and the livelihoods of the communities along the riparian of river Benue.

Conclusion:

Livestock grazing has affected the riparian environment by changing and reducing vegetation of riparian areas by channel widening, channel aggradation, or lowering of the water table. Nevertheless, the adoptability and utilization of modern grazing management strategies are lacking in Adamawa State. The sustainability of the riparian areas is a serious environmental issue due to the presences of the local open and unregulated traditional grazing method. In proper grazing along the riparian has damaged the riparian vegetation which inversely damaged other vital components of the system. The degraded plant community reduce the potential for recreational, fishing and swimming among others in the area. Therefore, social and economic consequences of grazing on the livelihood of the riparian community include; non-farm and farm activities. This damaged the connection between natural resources and human communities, it also generated conflicts among herdsmen and the communities.

Recommendations:

From the findings of the study there is no attempt made on policy implementation, and other measure towards conserving the riparian vegetation. The study therefore, recommends that, Adamawa State Government Agencies in alliances with traditional and community Association, should empower public and private universities like American University of Nigeria (AUN), to push for research projects to educate the society towards: understanding that, having a healthy riparian ecology is a strong mitigation measure against climate change impingement.

Government at both Federal, State, Community leaders and Community Base Organisations should revegetate the riparian with reasonable plant species of riparian character.

Traditional rulers, Community Organizations, Institutions, individuals and government agencies should employ the use of modern grazing management practices, to help prevent or minimize the negative effects of livestock grazing in riparian.

Federal, State government and Community leaders should cooperate and provide reasonable land for establishment of ranches to control unregulated open grazing.

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