THE ROLE OF GRAZING ON LANDSCAPE DEGRADATION IN THE SABGA-BAMUNKA AREA, CAMEROON

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Abstract: *The Sabga-Bamunka Area is a vivid example of areas in Sub-Saharan Africa where grazing has resulted in conspicuous landscape deterioration. Landscape degradation is quite visible over the globe but the manifestations of degradation on rangelands remains complex and varied from one place to another. This study is therefore carried out to assess the effects of grazing activities on the landscape of the Bamunka-Sabga Area. The methodology that has been adopted in this research is both deductive and inductive. The data used have been obtained from primary sources through field measurements, observations, photographs, and administration of questionnaire, focus group discussions and interviews. The study also made use of topographic map, satellite images, Landsat ETM of study Area. Data was then treated with the use of GIS and Computer Assisted Cartographic soft wares such as QUANTUM GIS, ArcGIS, and ADOBE illustrator. The processed data were then presented in the form of; tables, graphs, histograms and synoptic charts as well as maps. The study reveals that cattle's rearing is the main triggering force of the landscape degradation processes. This has been seen through the numerous erosional forms, reduction in vegetal cover, and recurrent/ incessant mass-movements. It was equally clearly deduced that the carrying capacity of the area is overstretched resulting in overgrazing, as a result of increasing numbers of herds that graze on the commons. The quest of the growing population to obtain a living as well as improving on the economy of the area has overtasked the environmental resources. The solutions proposed involve strategies to prevent and control landscape degradation. These solutions are sustainable and fall within the ability of the local inhabitants and the economic context of our nation. There is thus the need for concrete environmental management plans that can meet the taste of time in the short, medium and long term for present day Sabga-Bamunka area.*

Key words: cattle rearing; overgrazing; landscape degradation; famer-grazier conflict; sustainable management.

1. Introduction

Grazing land is a vital resource to mankind and cattle's rearing has become an emerging activity in recent years and this has sustained the livelihood of pastoralists in different parts of the world. Grazing lands are of great importance for the quality of life on earth, they provide various goods and services, such as food and fibre, carbon sequestration, genetic diversity, recreational areas, and heritage values. Since the domestication of major livestock species some10, 000 years ago, grazing has been the main practice for livestock feeding in most parts of the world. As opposed to modern intensive farming, where feed is presented to animals in pens or feedlots. Grazing as a practice has an enormous effect on the spatial structure (Henkin et al., 2007) and hence on ecosystem function, in terms of biodiversity, wildlife habitats (Lunt, 2005), and micro-climate (Yates et al., 2000). In recent decades, livestock production based on grazing has decreased in many regions of the world (Bouwman et al., 2005). This trend has strongly affected many of the grazing land ecosystems, causing profound changes.

In Cameroon, grazing land is important to subsistence pastoralists, foragers and farmers who are dependent on rain fed crop. Grazing land refers to expansive most unimproved land on which a significant proportion of natural vegetation is native grass, forbs and shrubs. The main effect of grazing on the landscape of Sabga-Bamunka is expressed through changes in vegetation pattern and composition. The nature and extent of these changes depend on livestock species (Rook et al., 2004), grazing history (Perevolotsky and Seligman, 1998), vegetation formation and grazing intensity (Coffin et al., 1998), as well as on a-biotic variables such as soil type and precipitation. Global processes such as climate change also play a major role in determining successional trends (Mouillot et al., 2002).

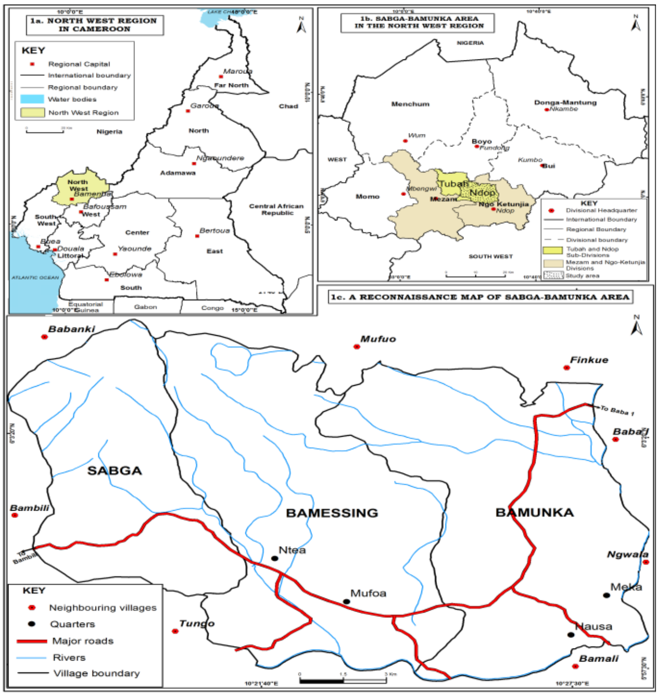
Grazing land has been a call for concern for most authors especially with reference to over grazing and grazing land degradation. In Africa, increase pressure leads to a decline in the productivity of pastures for cattle, sheep, and goat as well as wild herbivores. Authors on these opinions of degradation include Walker, (1995), Adam and Blench, (1998). They noted that heavy grazing changes the composition of the vegetation in case of persistence. Kelt, (1995), applied determinism and possibilism approach to examine the consequences of overgrazing and noted the abusive exploitation of pastures, its existence and availability to support cattle at a given pastoral territory. The recurrent expansion of cultivated land into grazing area of Sabga-Bamunka area, increased in the number of cattle has led to pasture shortage thus accelerating grazing land loss and degradation and handicapping sustainable management of grazing land. The aim of this article is to examined the role of grazing on the landscape degradation of the Sabga- Bamunka area.

2. Material and method

The Sabga-Bamunka area (figure 1) is located between latitude 6°00' and 6°6' North of the equator and between longitudes 10°18' and 10°24' East of the Greenwich meridian. This area is found in the North West Region of Cameroon. The area is bordered in the North by the Oku massif, to the west by Mbengwi, to the east by Ngoketunjia and South by Mezam. The area is inhabited by a population of about 62,000 people, and it is crossed by many streams and surrounded by hills which account for the rearing of livestock in this area.

The basic materials and method used in this study involved the interpretation of topographic sheet of Bafoussam 1:50000. Satellite images with specific reference to spot, Landsat, google earth provided much information that served as base data. This was followed by field observations and the analyses of questionnaires on such core elements. Data collected during field work was analysed using Statistical Packages for Social Sciences (SPSS), chi square. The principal software used in treating the satellite images were ERDAS IMAGINE 2014 and ARCGIS 10.2.1. The satellite images were classified using Multi Spec Version 5.01 from which, four cover classes were identified (forest, shrub/grassland, farmland and settlement). A sample size of 200 pastoralists was selected and questionnaires were administered. This was according to the spatial representation of the various grazing land areas within the study area and proportionate number of graziers. Considering the changes that occurred on grazing land, 200 respondents were determined proportionately. Two villages were covered with spectacular focus on pastoralists especially cattle owners to better assess the elements of grazing land dynamics. For instance, 200/500x100 =40

Figure 2: Location Map of Study Area



Source: Extract of Cameroon Administrative Map/ NIC 2010

3. Findings and discussion

Livestock production is the foundation of livelihood in the Sabga- Bamunka area with cattle being the most valued animal species. The possession of cattle constitutes an integral part of the social, economic and ritual life style for the people. An individual without cattle may not be qualified to fulfil the requirements of certain social standard or to execute certain social obligation (Tache & Sjaastard, 2010). The production system in this community is under increasing pressure from various stressors which include degradation and shrinking of rangeland, insecure communal land right and human population increases, changes in vegetation cover and land use, invasion of undesired species and conflicts. These are grazing land dynamics area in the Sabga-Bamunka area but not withstanding adaptation strategies has been put in place by pastoralists as well as recommendation proposed and if it is well implemented then sustainable development on grazing area or rangeland will be achieved. These grazing land dynamics includes:

3.1. Farmer – Grazier Conflict or Grazing Land Resource Use Conflict

In the Northwest Region in general and Sabga- Bamunka area in particular grazing lands are characterised by a wide range of phenomena and activities that lead to conflicts and ecological changes. Human intervention through farming and grazing naturally brings about dynamics and conflicts. Farmer-grazier conflict is a common phenomenon in the Sabga-Bamunka area. The conflict results from the rapid rate at which grazing areas are changing or degrading. Climate change and increasing in human and animal population have aggravated the pressure. Conflict is often manifested through open violent and ethnic bias because of differences in lifestyle between two communities. Such differences provoked competition over available declining natural resources for grazing, settlement, and farming (Table 1)

Table 1: Perception on causes and reasons for persistence farmer-grazier conflict in Sabga- Bamunka area

Reasons and causes of farmer- grazier conflicts	Respondents	% of respondents
Increase of crop damage and trace passing into agricultural land	100	51%
Encroachment into grazing land and blocking of transhumance route by farmer	60	31%
Inability of the administration and traditional leader to solve farmer-grazier conflicts (corrupt practices)	36	18%
Total	**196**	**100**

Source: field work 2018

From the table above the most important causes and reasons for the persistent farmer-grazier conflicts is the continuous crop damage and trace passing into agricultural land (with 51%). This is followed by blocking of transhumance route (with 31%). Finally we have the inability to solve farmer-grazier conflicts (with 18%) and then corrupt practices. Also, the complicated nature of the conflicts such as conflict over access to water sources, bush fire related conflicts and conflict over the destruction of property were identified as minor causes of farmer-grazier conflicts during field work.

Furthermore, Farmer-grazier conflict in the area often result in open violence and manifested in different ways such as wounding and poisoning of animal by farmer, the chasing of farmers by herdsmen with knives and walking stick used in driving cattle and cutlass.

Moreover, herdsmen are often said to have destroyed fences intentionally for their cattle to feed on crop cultivated by native farmers and use money to bribe corrupt civil servants and traditional leaders to favour them against native farmers. Such violent altitudes have made the Fulani and their host native neighbours to live at logger head with each party not willing to see the other at any time in their neighbouring communities (Table 2).

Table 2: Report on Farmer- Grazier Conflict in the Sabga- Bamunka Area

Village	Nº of cases registered	Cases judge by agro-pastoral commission	Nº of cases send to court and judge	Nº pending	Cases withdrawn and solved amicable
Sabga	50	9	10	20	10
Bamunka	18	20	04	48	7
Total	68	29	14	68	17

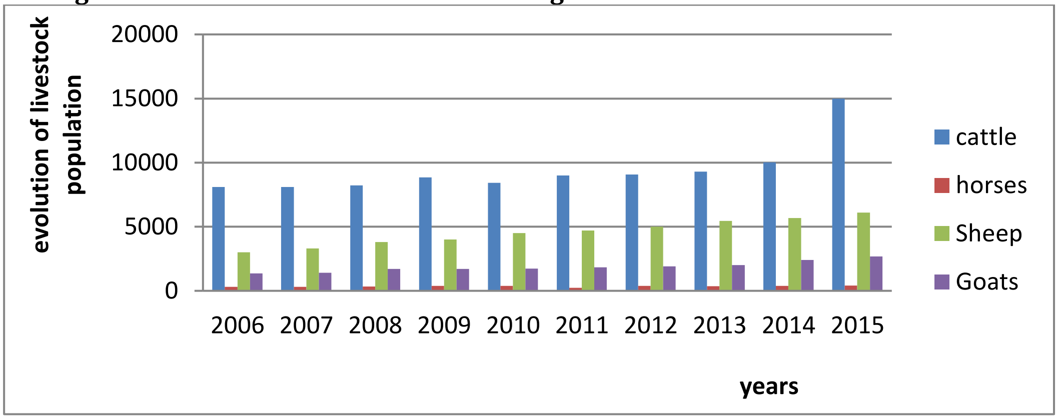
Source: Field work data, 2016 and adapted from MINEPIA in Ndop-Sabga area.

According to the result on the table, the general tendency of farmer-grazier conflict in the study area is higher (29) with varying intensity due to the number of cases solved by agro-pastoral commission. The many (68) pending cases are due to death of one party, peaceful reconciliation or some of them are discouraged and have decided to abandon the issue. In the case where both parties are discouraged, the conflict becomes more violent as a means of avenging the damage done either by the grazier or farmer through crop destruction and they always retaliate through wounding, poisoning and killing of cattle as seen in plate3 above. Farmer-grazier conflict has really contributed to poverty and misery in the study area. This is because the cost of such conflicts is often bear by both parties in the community and this cost is money that would have been used for development projects. Farmer-grazier conflict has resulted to reduction in livestock in the area since farmers killed cattle using salt because these cattle destroyed their crops. This conflict is one of the major problem in the study area.

3.2. Over grazing, pasture degradation and variation of carrying capacity

Grazing areas are shrinking at an increasing rate and the remaining part support increasing livestock rate without pasture improvement. Overgrazing and under grazing are evident in the result of pasture degradation with changes in vegetation cover quantitatively in term of biomass and qualitatively in term of replacement of high value grass species by unpalatable species and thorny shrub. Grazing areas are changing due to increasing competitive land use. Livestock number has increased tremendously over the past (Fig5). This is because of veterinary services that treat most of the diseases affecting livestock. The competition over land is reducing grazing land. The repercussions are that the increasing numbers of cattle stocked on a reduced space will weigh on the carrying capacity. All of this, because grazing is still dependent on what nature provides and little effort is made in pasture improvement and as such pastures are deteriorated when over harvested. Overgrazing is detrimental because it reduces primary productivity, impedes growth and survival and alters species composition of the grasses.

Figure2: Evolution of livestock in the Sabga-Bamunka area from 2006 to 2015.



Source : field work data, 2018

From the figure, the result reveals that as time goes on, cattle increases more than any other livestock. The number has increased from 8102 heads in 2006 to 15000 heads in 2015. Sheep is the second with number that evolved from 3000 in 2006 to 6101 in 2015. Goats have also increased from 1370 in 2006 to 2671 in 2015. Meanwhile, horses from 300 to 400 heads in 2015.

Shrub and forbs that provide animal with food and cover heavy grazing tends to cause palatable species to decline and the subsequent dominance by other less palatable, herbaceous plants and bushes. Grazing land loss increases the stocking rate and therefore results in overgrazing. Grazing land can be used to manage grassland habitats but overgrazing that leave little vegetative cover is detrimental to biodiversity. Due to increasing pressure, domestic livestock grazing has a long term impact on native plants community. Many plant areas have experienced a shift in plant species composition due to persistent heavy grazing that leave little ability for desirable perennial plants to reproduce thus, resulting in loss of favoured plant species (Adams, 1996). During field observation, the major problem noted was the high stocking rate. Despite the loss of grazing area to other competing land use, pastoralists have stocked to their old age cattle complex.

For instance, *Hyperrhenia i*s fire climax community and *Sporobolus* is graze fire climax community. So it is seen that original climax grassland was dominated by *Hyperrhenia* due to fire. The introduction of cattle came to add on the impact of fire and permitted the proliferation of *Sporobulus*. Therefore, there is a shift from *Hyperrhenia to Sporobulus.* Hawkins and Brunt, (1965) also carried out transect measured on *Hyperrhenia and Sporobulus.* The study was undertaken firstly, on the *Hyparrheni*a where a transect was measured on an area that has not been burnt or grazed for some year, and secondly on *Sporobolus* (grazed fire climax) where a transect was taken along the Bambui-Oku road, near fences erected to protect farmland from interference by cattle, inside which transect were measured (Table 3).

Table 3: Transect measurements of grasslands

Types of grassland transect		***Hyparrhenia* species grassland below 1600m**	***Sporobolus* above1600m**
Date of transect		30.7.62	19.06.1962
Location and burning and grazing history		Lava plateau above Babanki	
Altitude (m)		1550m	2120m
Grass cover of main species as percentage of vegetal cover		*Hyparrhenia* 63.3 *Sporobulus* 5.8 mosses and liverwort 15.9 Trifolium 1.7	*Sporobolu* sp, 92.1 Digitaire sp Melinis sp} 00.7 Trifolium 02.6
Percentage ground occupied by	vegetation	36.7	34.7
	Bare earth	63.3	65.3

Source : Hawkins and Brunts, 1965.

The result from the table reveals that all the types of grassland (burnt or not) are not 100% protected by vegetal cover. Higher altitudes that are frequently affected by bush fire, the percentage of bare soil are relatively lower. This indicates that the degree of ground coverage reduces with distance downhill with *Hyparrhenia*. Considering the steep slope that characterized the higher altitude of this area, the *Hyparrhenia* grassland species is severely eroded by surface runoff water. Transect experiment of this nature were also conducted on eight other sites bringing the number up to ten on the high lava plateau. Thus, an overall average percentage of ground cover was also computed as shown on Table 4.

Table 4: Vegetation covers of the grasslands around 1600m altitude as a percentage of ground surfaces (average)

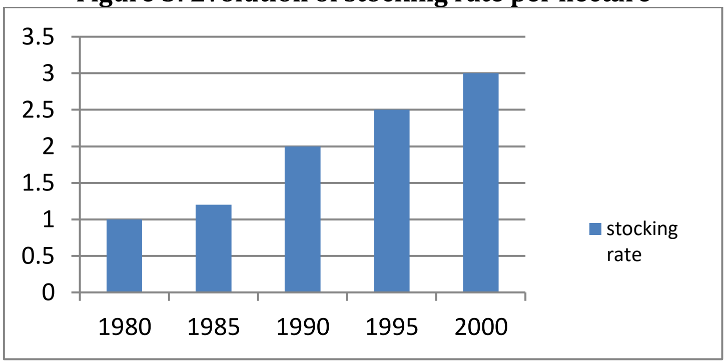
Nature of the surface	***Hyparrhenia***	***Sporobulus***
	Grassland (m)	**Grassland(m)**
Total vegetal cover grass, hedges, herbs, creepers, mosses	37.2	40.1
Bare earth	62.8	59.9
Total	100	100

Source: Hawkins and Brunts, 1965.

As indicated by the above table, the tendency already noted in preceding table 4 is reconfirmed. Thus, it is crystal clear from averages that, the grassland savanna of high lava plateau generally has vegetation covers that protect the surface at about 50%. This degree of ground cover can be classified as merely 'fair' following the classification figure and consequences by Noble, (1963). During fieldwork it was realized that even the *Sporobulus* is gradually being replaced by bracken fern, *Imperata cylindrica and Chromolaela ordorata.*

More so, over grazing has also been linked to soil erosion due to the loss of water retention and runoff reduction capacity of vegetation. Over grazing is the harvesting of biomass of animal at a rate faster than its regenerating capacity, this result in a decline in the quality and quantity of biomass. It exposes the plant roots and the ground surface to agent of erosion. Trampling animals and continuous use of the same track by animals render the area vulnerable to gully formation. Overgrazing affects the health and reproductive capacity of animals. It causes range lands ecosystem to be fragile, increases the exposure of these rangelands and reduces their resilience to climate variability and change. Over grazing have a number of causes and occurred when carrying capacity of the range is exceeded. Consequently, the soil becomes more vulnerable to soil and wind erosion. Poor pasture or bad range lower livestock growth and survival. Vegetation also helps to modify the micro-climate and its removal by grazing herbivores invites desertification which is a critical problem that threatened the existence of the local people. Grazing land is inhabited by a number of domestic animals. Man has altered so much of the natural vegetation. The nature of the natural vegetation can only be deduced. It is doubtful whether any true natural vegetation grassland exists today. Much of it is either semi natural or affected by decades of grazing and burning or cultivation. Increasing livestock population associated with loss and degradation of habitats is becoming a serious problem as grazing land is witnessing continuous stress. Over grazing by livestock is a serious issue in some areas where most of the original vegetation has gradually been eroded and/or disappeared as a result of heavy disturbance by pastoralists and livestock. In many spot, it is devoid of protective mat of grass vegetation. Grazing area has been ruined by partial removal of their top soil. The direct effect of livestock in the area is bound to be conspicuous when considering the carrying capacity of pasture as evaluated from its biomass production and nutritional requirements of animals. The grazing land has limited capabilities in vegetative production due to adverse environment today including prolonged dry season, varying degree of poor soil, soil erosion, unwanted weeds, lack of or inadequate forage and grazing management. Despite the problem of human encroachment that is responsible for dwindling nature of grazing land in the study area, one of the major constraints to grazing land improvement has been the high stocking rates (Figure 6). Furthermore, the Fulani have retained their cattle complex altitude and the entry of the Fulani natives into grazing has enormously increased the stocking rate in the study area. The implication of the reducing rangeland on the stocking rate is indicative on the deteriorating nature of grazing lands. Further complication arises from the deterioration in grazing lands due to increase in unwanted weeds and woody growth or bush encroachment. From this situation in the study, what is deduced is the fact that livestock numbers are increasing on de grading and dwindling rangelands.

Figure 3: Evolution of stocking rate per hectare



Source: Realised from annual report of MINEPIA livestock, 2015 Ndop and Sabga

It can be realised that the evolution of stocking rates has not only by passed two hectares for good management pasture but it has touched 3-4 hectares of pasture / cattle. This indicates that the critical limit in the area has been surpassed. The vegetal devastation resulting from this is quiet conspicuous. Further addition in livestock numbers in the zone can lead to reckless destruction given the fact during field observation of the study area it, was affected by range loss. Glaring examples are found in transhumance trek route to the Ndop plain and around the summits and slopes and ridges of Sabga area. These over grazing, pasture degradation, high stocking capacities resulted to a reduction in pasture on grazing land and thus making leading to instability on grazing area because cattle and graziers need to move from place to place in search of pasture.3.

4. Soil erosion

The impacts of grazing on the landscape of Sabga-Bamunka can been through soil erosion. Man is a decisive agent in erosion and its correlated effects for the past years (clearing, vegetal degradation). Human activities contribute in accelerating the rhythm of erosion within the study area to an aggressive point that man has entered into a network of research for solutions. The crisis of relief evolution by erosion corresponds to decisive changes. When the critical value is passed, we talk of limits. In effect geomorphologic application previews a scale, a variation limit, a point in time and space from which a phenomenon, spontaneously change their rhythms (slowness or rapid acceleration). This notion can be well understood with the presence of man within the area. The phenomena of erosion tend to drift from splash and sheet to rill and gully erosion

Splash erosion

Most soil material is uplifted and displaced by falling raindrops. This constitutes part of the surface wash which detaches and transports soil particles from the ground. This constitutes a mechanical process involving an expenditure of kinetic energy (Hudson, 1965). This form of erosion is the most dominant and recurrent on newly cultivated maize farmland and where there is massive vegetal destruction for the cultivation of bean and market gardening crops. It is also common around hurt where cattle assemble in the night. Splash erosion is one of the basic causes of the commencement of spectacular erosion in the area. The persistent impact of raindrops during heavy rainfall provokes the destruction of surface layer and distortion of their structure and elements. This often leads to the presence of loose fragment (clay, silt and sand) which are toasted or uplifted by raindrops at different angles of ejection. The mean splash saltation distance measured during light rain storms gave 18-28cm. Light rain however, enabled soil fragment to be found on the leaves of groundnut, beans and maize as they germinate.

The particles that are derived from splash saltation flux are transported with ease by surface runoff into small hollows. Here, small sediments concentrate to produce a layer which at times, with the aid of the high average temperature of the area may dry up. This situation is glaring around surfaces that have been trampled upon, around permanent rainy season pasture site and cattle transhumance itineraries. The battering and clogging of the soil of farm and range land of the Sabga-Bamunka area by initial raindrops obviously plays in soil permeability. This reduces the rate of infiltration and therefore increases the rate of surface retention.

Sheet Erosion

Sheet erosion, is quite noticeable on fairly flat surfaces like the flat till surface at Bamunka. It is also common in Sabga where vegetal cover of homogenous surface has been scrapped by hooves of cattle. A thin film of water accumulates on the surface, with a thickness of 2-4mm (though Moeyersons, 1989 holds < 3mm) before sweeping on the surface. The energy of the water which is derived from its velocity and consequently the capacity of the water to erode are accentuated by the slope of the land. However, the nature of this water permits it to transport only small soil particles. Sometimes, the transportation of these tiny particles even leads to the formation of micro-hydraulic steps.

Also, on farms and grazing area, sheet erosion takes various forms. This often results from the combined force of rainfall and overland flow. In this way, clay, silt and sand is found in depression just below. This is because water that flows is not capable of transporting or carrying huge rock particles or organic waste on the surface.

Rill Erosional Form

After splash and sheet erosion, the more impermeable but less resistant surface can begin to offer some micro channels. Rill of 4-10cm developed on slopes of about 8^0. These channels are obviously the result of incision of unconcentrated flow as they pave the way to the valleys. The down slope evolution of this form of erosion seem slow at the start since it contains less water and other abrasive tools. With time, as the drainage area expands, erosion also increases. This does not help to increase the volume of water but also tends to furnish more abrasive tools for rill enlargement.

This form of erosion as already noted is mostly found in adjoining areas of sheet erosion on recently opened farms, Mbororo dwellings, foot and cattle tracks and some farm to market roads. In the area of rill erosion, the joint effect of the kinetic energy of water droplets, the stagnation of water and routine passage of man and animals gives birth to these micro depressions on the weathered material. Rills of similar nature are brought about by farmland cultivation and construction works on houses.

Gully Erosional Forms

The continuous evolution in the size and shape of rills (which can be attributed to increase in volume, velocity and load of the runoff and more impermeable nature of the channel) culminates in more spectacular forms of gullying. Gullies evolved and incised in the superficial deposits, regolith paved by man and animal such as farm boundaries, foot path and cattle track. These gullies are predominant on old farmland. Most gullies in this area possess depths of 50cm to 8m and widths of 10cm-30cm. It was observed during field work that most mechanical strategies to combat soil erosion cannot be a panacea in the area, owing to its hilly steeping surface.

More so, gullies on slope of farmland and rangeland of the high plateau are developed on clayey soils. Some of these gullies have steep sides showing signs of the collapse of material. The aforementioned process is enhanced by water that scraps the bank to produce 'pot holes' or 'erosional pits'. Water is concentrated inside these pits as an uncovered void or interstice carrying water and follows a whirl or making it flow out. The sides of the pits have an accumulation of plant residues and other dead organic matter. The base of these pits is made up of large pebble and gravel of either volcanic rock or basement complex. These coarse particles are at time overwhelmed by silt-clay deposits. The greatest development is during the raining season because of provision of water meanwhile the dry season is relatively a dormant period. Continuous gullying often cedes to deep pavements that have a greater dimension. This is usually after considerable vertical down cutting and lateral erosion. The water borne by this channel enlarges their base through regressive erosion. The bank of such valleys becomes susceptible to landslide and slumping. These erosional forms resulted to pasture shortages and reduced grazing land area because most of the soil nutrient is wash and carried away by these processes thus leading to low productivity of pasture and unstable nature of grazing area.

5. Recommendation

5.1. Integration of Trees into crop/ livestock production system

This entails the growing of trees, crops and pasture/animals in a system to achieve an agro-sylvo-pastoral system. Two approaches of integrating trees are to be adopted here. The first approach is the integration of trees into crop/livestock system. Pastoralists who also rear livestock should be encouraged by the government and local authorities to plant life fences that would need little or no constant repair and reinforcement. This can be realized by encouraging the pastoralists to establish multipurpose hedgerows with fast growing fodder, shrub, tree and herbaceous species. Some of such species are *Erythrina, Gmelina, Fucus, Caesalpinia, Hibiscus and sisal and Mexican sunflower also recommende by Nkwemoh (1999) .* Apart from serving as a vegetative barrier, reducing the direct impact of raindrops, facilitating infiltration and reducing runoff and soil erosion, these species serve a range of other purposes. For instance, *Erythrina* and *caesalpinia* used for live fencing even replace barbed wire or bamboo fences. *Erythrina* is also good feed for cattle and would therefore aid in alleviating the problem of shortage of pasture and overgrazing.

The second approach entails the integration of trees into pastures. This approach would be very appropriate in Sabga-Bamunka area. Pastoralists should be encouraged by the government and local authorities to plant trees. The ample space in this area can suppose a certain trilogy of landscape. This trilogy supposes that the base of the hill should be reserved under permanent vegetation composed of local trees like raffia that should be well protected from fire or other interference. The concave slope should be used for the cultivation of multi-purpose trees, crop and raising of small ruminants and birds. In this part of the slope, trees would serve as source of green manure for crop, shade and fodder.

Meanwhile the canopies of these trees would protect the soil and control soil erosion. The summit of the hill should be reserved for permanent rearing activities and cattle should never be left to roam. A multipurpose tree that should be planted in pasture is *Leucaena. Leucaena* ia a genus of central America shrub and tree with about 10 species. *Leucaena* tiny flower form white, fluffy balls. They are usually self- pollinating, and the flower heads produce dropping clusters of thin, flat, almost straight pods. The green pods redden and harden with age, eventually splitting along both edge and ejecting the 15-30 seeds they contain. The shiny-brown flattened seeds have an impervious, wazy seed coat and must be treated to ensure quick and uniform germination. A method that gives 80% germination within 8 days involves treating the seeds with hot water for 2 to 3 minutes. Further increases can be obtained by then soaking the seed for 2 to 3days. The seed should then be sun dried and stored prior to sowing (Nkwemoh 1999). Young or mature, green dry or ensiled, the forage is relished by livestock particularly in the dry season when green feed is scarce.

5.2. Promotion of Forage Conservation

The proposed Agrostological measures aimed at improving vegetation/pasture may be complemented by the conservation of forage. Found within the tropical climatic domain, the Sabga-Bamunka area enjoys a wet season (favourable for plant growth) and a dry (not very favourable for plant growth). Forage can readily sprout and retain a high nutritive value in the wet season. The forage should be readily provided to animals to keep them satisfied without moving too far in search of forage. This would result in reducing weight loss, spread of diseases and incidence of injuries. In the dry season, forage plants become scare and even dried, lignified and even become less nutritive. This aspect obliges the Bororos to go in search of pasture in the 'Commons' of the low and more humid areas.

Transhumance is not the best management system for a degraded landscape like that of the Sabga-Bamunka area. Dry season and zero grazing habit should be adapted. For this reason, some grass and leguminous species have been recommended for their dry season feed capacity and form of conservation. Those that can be conserved through hay (dry grass having matter content of 80-85% of the original value and cut when still green) include, *Brachiaria ruziziensis* and *Hyparrhenia diplandra* which could be cut, predicted and staked when rainy season is ending. Other grasses *like Pennisetum purpureum* and *Trypsacuum laxum* are instead suitable for silage (fermented forage). Silage has a good dry matter percentage and a low cost of production that would salvage the precarious situation of the vegetation.

5.3. Promotion of Forage Conservation

The proposed Agrostological measures aimed at improving vegetation/pasture may be complemented by the conservation of forage. Found within the tropical climatic domain, the Sabga-Bamunka area enjoys a wet season (favourable for plant growth) and a dry (not very favourable for plant growth). Forage can readily sprout and retain a high nutritive value in the wet season. The forage should be readily provided to animals to keep them satisfied without moving too far in search of forage. This would result in reducing weight loss, spread of diseases and incidence of injuries. In the dry season, forage plants become scare and even dried, lignified and even become less nutritive. This aspect obliges the Bororos to go in search of pasture in the 'Commons' of the low and more humid areas.

Transhumance is not the best management system for a degraded landscape like that of the Sabga-Bamunka area. Dry season and zero grazing habit should be adapted. For this reason, some grass and leguminous species have been recommended for their dry season feed capacity and form of conservation. Those that can be conserved through hay (dry grass having matter content of 80-85% of the original value and cut when still green) include, *Brachiaria ruziziensis* and *Hyparrhenia diplandra* which could be cut, predicted and staked when rainy season is ending. Other grasses *like Pennisetum purpureum* and *Trypsacuum laxum* are instead suitable for silage (fermented forage). Silage has a good dry matter percentage and a low cost of production that would salvage the precarious situation of the vegetation.

6. Conclusion

According to Brookfield (1964), degradation is a perceptual term, and its usage in Sabga-Bamunka is a case in point. The focus of degradation debate is grazing and as a result, forage quality has been used as the major indicator of degradation, the increasing numbers of cattle and continuous grazing of pasture have not only initiated the existence of Graminae but also served as maintaining and perpetuating factors of the savanna grassland.

To add to the above, the impacts of grazing on the landscape of Sabga-Bamunka is not static, the situation has been made even more precarious by the invasion of bush and weeds with the construction of the Bamendjin Dam , erosion, mass movement and over grazing. It was also realized that pastoralist have not stayed without reactive and proactive measures such as mobility, paddocking system and pasture improvement. Since the different adaptation strategies are not panacea to the problems, the study made a number of recommendations. The proposed measures for grazing land improvement are; forage conservation, the controlled of the use of bush fire, the diseases and the adoption of a nation policy on rangeland. If these recommendations are implemented, recurrent impacts of grazing on the Sabga- Bamunka landscape can be prevented and this will lead to sustainable development and community intergradation.

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