Land carrying capacity for livestock production in Wa West District

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Accepted 10 March, 2017

Livestock production is an integral part of agriculture in the District. Nearly every household in the district keeps some kind of livestock along side crop production. Livestock production in the district enables individuals and families to earn income, access meat protein and serve other cultural purposes. However, the production of livestock has adverse impact on land. The paper assesses the land carrying capacity of livestock production in the Wa West District of Upper West Region of Ghana. Ten communities were purposely selected in the district for the study and it employed qualitative and quantitative approaches to the collection and analysis of data. Both approaches were supported by review of published and unpublished materials. The paper found that the land in the Wa West District has the capacity to accommodate more livestock production. Improved and innovative husbandry practices are required as a policy measure for addressing the environmental challenges associated with livestock production in the district.

Key words: Livestock, production, environment, land carrying capacity, Wa West District.

INTRODUCTION

According to FAO (2006), “the livestock sector is socially and politically very significant. It accounts for 40% of agricultural gross domestic product (GDP). It employs 1.3 billion people and creates livelihoods for one billion of the world’s poor. Livestock products provide one-third of humanity’s protein intake, and are a contributing cause of obesity and a potential remedy for undernourishment. Growing populations and incomes, along with changing food preferences, are rapidly increasing demand for livestock products, while globalization is boosting trade in livestock inputs and products.”

In Ghana, livestock production is both a social legacy and an economic enterprise generating jobs, income, animal protein and foreign exchange earnings for government and a number of people. According to NDPC (2013), the “agricultural sector’s objective of attaining food security covers access to supply of high quality meat, animal and diary products to ensure a healthy diet and adequate nutrition for the people”. The livestock sub-sector, including fisheries contributes 17.4% of the total agricultural GDP (MOFA, 2010). MOFA (2004) reports that the numerous important contributions the livestock sub-sector makes to the economy of the country include food security, provision of animal protein to enhance the nutritional adequacy in diets of the people, employment creation, income generation and livelihood enhancement, particularly, in the rural areas. Northern Ghana is the hub of livestock production in Ghana (Adam and Boateng, 2012; Blench, 2006 cited in Adzitey, 2011). In a region faced with a uni-modal rain season and a long period of dry season, livestock production not only serve as insurance against food deficit but also provides income for households to purchase inputs for crop production.

In the Upper West Region, the production of livestock as part of agriculture is one of the major social and economic activities of the people. The sale of livestock generates cash income, and hence one of the main ways in which subsistence farmers are able to acquire consumer goods and procure seeds, fertilizers and other farm inputs needed to increase crop yields. The production of livestock is also a source for District Assemblies in the region to mobilise internally generated funds (IGF). Virtually every household in the Upper West Region keeps some type of livestock (Table 1).

In view of the economic and social significance, successive governments of Ghana have been...
implementing projects aimed at boosting the production of livestock in the region to reduce poverty, improve food security, empower the livelihood of communities and reduce imports of meat into the country. From late 1990s to early 2000s, the Upper West Region benefited from the Upper West Agricultural Development Project funded by the International Fund for Agricultural Development (IFAD). A component of this project was devoted to the improvement of cross-breeding of livestock focusing on ruminants. From 2003 to 2010, the region played host to the Livestock Development Project funded by the African Development Bank (AfDB), which has its primary objectives of reducing poverty and imports of livestock and livestock products as well as improving food security. In 2014, the World Bank supported the implementation of the Guinea Fowl component of the West Africa Agricultural Productivity Project (WAAPP) in the Upper West Region.

**Theoretical and Analytical Framework**

The paper adopts the integrated conservation and development projects (ICDPs) theory of Herrold-Menzies (2008). This theory was developed in the 1980s and 1990s when governments and donors were expanding the production of livestock in large scales. The central argument of the theory is that as the scale of livestock production expands, efforts should be made to simultaneously link the expansion with sound environmental protection measures. According to Herrold-Menzies (2008), the ICDPs "were seen as a way to overcome perceived conflicts between environmental protection and economic development, creating a win-win situation where promoting development in local...
Table 2. Comparative yearly reported grievances in Wa West District 2011-2014.

<table>
<thead>
<tr>
<th>Frequency of reported grievances per year</th>
<th>Subject matter of grievance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marital issues</td>
</tr>
<tr>
<td>2011</td>
<td>3</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>6</td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: Field Work, 2015

Livestock producers and other actors

Livestock production

Livestock is a group of domesticated animals, which include cattle, sheep, horses, goats, and other domestic animals. Based on interviews with staff of the Upper West Regional office of MOFA, conventional livestock in Ghana include ruminants such as cattle, goats and sheep and non-ruminants like pigs and poultry (domestic fowl, guinea fowl and ducks). Adzitey (2011) reports that livestock production in Ghana is done under three main systems namely, (i) intensive system, (ii) semi-intensive system and (iii) extensive/free range system; and commercial farmers practice the intensive system while rural communities practice the extensive system (free range).

In this framework, livestock production is conceptualized as the animals, which individuals and households keep for economic, social and cultural reasons essentially under the extensive/free range system. The framework specifies the system in order to provide a context specific situation for analyzing the land carrying capacity for livestock production in the Wa District.
Land resources

In this framework, land resources are understood to mean physical and non-physical things of a given society on which livestock production takes place. The physical land resources encompass all the living and non-living things which constitute the means for livestock production. These include the vegetation on which the livestock graze, water for watering the livestock and the space for their shelter, movement and reception of sunlight and air. These resources are critical for the production of livestock.

The concept of land resources in the framework also encompasses relationship of power and control of land and its resources. As reported by Mafeje (2003), land in most parts of Africa has not been conceptualised only in terms of an economic unit, but more as a “socio-political unit held together by kinship ties and neighbourliness”. This relationship, the non-physical resource, defines the social and political dynamics between and among various actors in livestock production. It is this relationship which explains the fact that land is both a factor of production and an object that defines a constellation of social, religious and political relations between people on the one hand and between people and land on the other. It also helps in explaining the various interests in land holding i.e. “natives” (allodial interest holders) and “settlers” (usufructuary interest holders). The allodial interest the most comprehensive interest derives legitimacy, rights and authority from prior occupancy (the descendants of the founders of the community), or from conquest (Chauveau, 1998 cited in Delville, 1999).

Mechanisms

As observed by Westhoek (2010) and FAONewsroom (2006), livestock production has negative effect on land and the environment but mechanisms exist for reducing the negative effect and improving upon the quality of land resources. In this analytical framework, mechanisms for improving land resources are understood to mean set of arrangements fixed or temporal which are applied for reducing and reversing land degradation as well as improving its quality for livestock production. It depicts the efforts that ICDP theory requires of livestock producers to simultaneously put in place for sound environmental protection measures. As noted by Cleaver and Franks (2005), the construction of mechanisms is both conscious and non-conscious enterprise carried out “through the practices of their daily lives.” The design and implementation of mechanisms will yield impacts, which may determine the carrying capacity of land per period.

Impacts on land carrying capacity

This framework defines impacts as both the effect of grazing on land and the measure of the effect and influence that the mechanisms undertaken by various actors have on land for livestock production. Impacts as a measure of effect and influence may occur in different ways, from immediate availability to long-term availability. For example, as an immediate response to water shortage, livestock producers in collaboration with donor agencies and state institutions may collaborate to make water available for livestock watering or treat a particular water resource to improve quality to ensure hygiene for livestock. However, it may take the same actors years to assess and identify the underlying causes of the water shortage in order to proffer a long-term solution.

Available land resources (fodder, water and space) do not guarantee access to all livestock producers. Social structures and power relations connected to title to land essentially mediate access. While it may take moments for allodial interest holder to access land resources created through the construction of mechanisms, it may take much longer time for a usufructuary interest holder in the same community to gain access to such resources, particularly where the impacts are born out of the conscious construction of mechanisms. This therefore suggests that the design and implementation of mechanisms for impacts could be subject for negotiation. Again, impacts created from the design and implementation of mechanisms may be positive or negative for land resources.

Study area

The study was conducted in ten (10) communities in the Wa West District in the Upper West Region of Ghana. The communities are: Dabo, Dorimon, Eggu, Ga, Gurungu, Kuunchileyiri (Wuokuraa), Naaha, Nyuoli, Vieri, and Wechiau. Each of the ten communities hosts more than one cattle kraal. The Wa West District is one of the Nine (9) District Assemblies in the Upper West Region, with Wechiau as its capital. The Wa West District was initially part of the Wa District until 2004, when the Wa West District was carved out and made an autonomous district by L.I 1746 while the then Wa District was elevated to a municipality status. The District is located in the South-Western corner of the Region (Figure 2) with a total land area of 1,856 km² representing about 10% of the total landmass of the region (Wa West District Assembly, 2013).

The main economic activity in the district is subsistence farming. Farming is combined with livestock production. Food crops cultivated include millet, maize, yam, guinea corn, sorghum, cassava, rice, groundnuts and beans. Livestock (cattle, sheep, goats, and pigs) including poultry are predominant in the district. The District lies in the guinea savannah agro-ecological zone with a rolling landscape congenial for livestock production and the cultivation of crops. A very long dry season from October...
to April and a short erratic rainy season from May to September affect livestock production and crop cultivation. Other economic activities include fishing, petty trade, pito brewing and shea butter extraction. Women dominate the last three activities.

According to the 2010 Population and Housing Census, the Wa West District has a population of 81,348 with 40,227 males and 41,121 female. The population is projected to grow at a rate of 1.7% which is below the national growth rate of 2.7% implying that the District has more time to plan for the effective utilisation of land and other environmental resources. The ethnic composition in the district includes Brefor, Waala, Dagaaba pockets of Hausa, Akan and Ewe speaking people. The Waalas are allodial land title holders in the district.

**METHODOLOGY**

**Sampling procedure**

Multi-stage sampling procedure was adopted to select the ten (10) communities for the study. In the beginning, the communities were purposely selected based on the availability of cattle kraals and accessibility to conduct the survey. The communities were also selected to give some spread of coverage of the geography and traditional areas in the District. The second stage was to put respondents in each community into clusters according to livestock owners, caretakers/herders and victims of activities of livestock. The third and final stage was the use of snowballing method to identify the individuals for interviews. Within the livestock owners cluster, a ratio of 4 to 1 was used in the interview with cattle owners and owners of small ruminants.

The total sample size for the study was 250 men and women (Table 3). Given the amount of time and resources, this sample was considered large and representative enough to describe the study population of livestock farmers in the district.

**Sources and instruments for data collection**

Data were collected for a period of six months from December through to May 2015. Three instruments were used to collect the data, namely: structured questionnaires, focus-group discussions (FGD), and field observations. The semi-structured questions were directly administered to the respondents and followed up with phone calls where the need be. The information obtained from these informants includes the nature of livestock production, areas and methods of grazing, effect of livestock on land and the environment, level of environmental awareness of livestock producers and caretakers, their relations with crop farmers, challenges faced by the livestock farmers and strategies for addressing such challenges. The semi-structured interviews were complemented by participant observation, which enabled the gathering of pertinent information that may not be volunteered by informants. Follow-up interviews were conducted on telephone with
Table 3. Sample size by owners, caretakers and victims.

<table>
<thead>
<tr>
<th>Community</th>
<th>Owners</th>
<th>Caretakers</th>
<th>Victims</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dabo</td>
<td>4</td>
<td>2</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Dorimon</td>
<td>10</td>
<td>5</td>
<td>17</td>
<td>32</td>
</tr>
<tr>
<td>Eggu</td>
<td>6</td>
<td>3</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>Ga</td>
<td>5</td>
<td>4</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>Gurungu</td>
<td>11</td>
<td>5</td>
<td>15</td>
<td>31</td>
</tr>
<tr>
<td>Wuokuraa</td>
<td>8</td>
<td>4</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Naaha</td>
<td>9</td>
<td>5</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td>Nuoli</td>
<td>7</td>
<td>8</td>
<td>12</td>
<td>27</td>
</tr>
<tr>
<td>Vierri</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Wechiau</td>
<td>13</td>
<td>10</td>
<td>14</td>
<td>37</td>
</tr>
<tr>
<td><strong>Sample Size</strong></td>
<td><strong>78</strong></td>
<td><strong>49</strong></td>
<td><strong>123</strong></td>
<td><strong>250</strong></td>
</tr>
</tbody>
</table>

Source: Field Data, 2016

some of the informants to clarify and verify some pieces of information or when new issues came up.

The study gathered data from primary and secondary data. The secondary data were collected through the review of relevant literature to gain further and deeper understanding of the linkages between livestock production and the environment. The relevant documents that were reviewed included the reports of Ministry of Food and Agriculture on livestock, articles published on livestock in academic journals, books, newspaper reports and reports of the Food and Agriculture Organization (FAO). Other relevant documents, reports and publications relevant to livestock production and land carrying capacity were also reviewed. The primary data were obtained from staff of the Wa West District Assembly, Environmental Protection Agency, Ghana Immigration Services, owners of livestock in the district and selected residents in the study communities. Other individuals with experience in the destruction of crops by livestock, migrant herders in the district and staff of the Upper West Regional Office of the Ministry of Food and Agriculture were interviewed. Personal observation was also applied to gather some primary data to compliment the interviews.

**Analysis of data**

The data was analysed using both qualitative and quantitative approaches. Merriam (2002) argues that a qualitative inquiry is richly descriptive. The qualitative approach was used to determine the nature of impact that livestock production has on land and the environment in the Wa West District. The qualitative approach was used to enable in-depth discussions and description of the nature and impact of livestock production on land and the environment of the Wa West District. These are issues, which do not easily lend themselves to quantitative estimation. The sue of qualitative approach is enabled.

The paper applied quantitative approach to assess the land carrying capacity for livestock production in the Wa West District. The live weight measure of the Tropical Livestock Unit (TLU) was used to determine the land carrying capacity for livestock in the district. The Tropical Livestock Unit (TLU) is a livestock grazing comparison and assessment method. The TLU is expressed as a unit per hectare of land in time. Based on interviews with the Upper West Regional Office of the Ministry of Food and Agriculture, the average live body weight of a TLU animal is 250 kg. Every TLU grazes 3% of its live body weight per day. The Wa West District as already stated is located in the guinea savannah agro-ecological zone. In the savannah ecological zone, the estimated yield of natural pasture is 2,800 kg per hectare per annum. Each hectare of land provides 50% of the requirement of one TLU per annum, i.e. the allowable intake of a hectare of land per annum is 50% of the estimated yield (50% of 2800 kg). The expectation of this estimate is that the animal (TLU) will not graze and reduce the vegetation to soil, at the very least 50% of every hectare of land is available for grazing in a year.

Using the TLU estimates, the paper defines the land carrying capacity as the amount of annual intake (grazing) of a mixture of animals a given parcel of land can contain. This is expressed mathematically as:

\[
LCC = 3\% \times TLU_w \times npa.
\]

Where: \(LCC\) = land carrying capacity; \(TLU_w\) = weight of tropical livestock unit, and \(npa\) = number of days per annum.

The paper noted that different breeds of livestock graze differently and therefore the impact of their grazing on land may not be the same. Therefore, the paper converted all the livestock of different species and sizes into the TLU as one reference unit. The unit of analysis for the paper is thus the Tropical Livestock Unit (TLU).
RESULTS AND DISCUSSION

Profile of respondents

The sex composition of respondents was 198 (79.2%) males and 52 (20.8%) females. The mean age of respondents was 41.2 years. The large population of the relatively matured age (mean age of 41.2) is quite consistent with the tradition of the people inheriting livestock to older people in the family. Ethnic groups of the respondents comprised Brefo, Dagaare, Waala, and Fulani. As expected, the Brefo (Lobi) were in the majority (37.3%), followed by the Waala (36.5%), Dagaare (24.2%) and Fulani (2.0%). In terms of religion, 68.2% of the respondents were Muslims, 24.1% were Christians, and 7.7% adhered to Traditional Ghanaian Religion. Understanding the religious background was important because it has influence on keeping livestock in the district. Majority of the respondents (74.7%) did not have formal school education, 24.5% had formal school education and 0.8% had Arabic education.

Results

There are many different species of livestock. The focus of this paper is five (5) species of major livestock produced in the District: cattle, goat, sheep, pigs and donkeys estimated at the TLU. In assessing the land carrying capacity for livestock production in the district, the paper began by determining the livestock population and management practices and the impacts of the practices on land. The results showed that the TLU population in the Wa West District as at 2012 was 35,351 (MOFA, 2015). Open grazing was found to be the main method of livestock feeding and management. The open-grazing method of livestock management has negative impact on the quality of land and the environment. The District holds a pastureland, which is more than the required pasture for the TLU population. This means that the land in the Wa West District has enough capacity to carry the population of the TLU production in the District. Therefore, the observed negative impact of livestock production on land and the environment is a result of poor husbandry practices rather than the limited capacity of the land to contain livestock production.

Livestock production in Wa West District

The production of livestock is an important part of subsistence agriculture in the Wa West District. The estimated population of livestock in the Wa West District in 2013 is presented in Table 4. Hans (1982) summarized the motivation for livestock production into four namely: output function, input function, asset and security function, and social and cultural function. Based on field interviews and observation, all these functions were found to be present in the Wa West District. The key motivation for individuals and families in the district to produce livestock was found to be income, commercial, prestige, cultural, nutrition, and security of income and food. Variations according to ethnic groups were observed for the motivation of livestock production in the district. The Waala ethnic group scored highest for commercial motivation for livestock production while the Brefor group scored highest for cultural motivation. Steinfeld et al. (2006) pointed out that livestock production is undertaken in a variety of ways which are most frequently defined on the basis of land use by livestock, and for this purpose the distinction between land based systems and landless systems has been widely accepted. The scope of this paper is limited to the grazing system of the land based production systems. The common practice of livestock management is free and open grazing on both cultivated and uncultivated lands. The open-grazing system of livestock production has evolved over time and transferred from generation to generation. Farmers keep compound and bush farms and also combine crop cultivation with animal production. Every available pasture including compound and bush farms, school lands, parks, residential areas and forest reserves in the district are subject for grazing. Vegetation (grass, shrubs and leaves and fruits of trees), crop residues and unconsumed parts of human food constitute the feed for livestock in the district. Animal manure is important for maintaining soil fertility particularly for those that keep compound farms. During certain parts of the year, farmers allow their animals to graze on farms as a way of clearing the fields and improving fertility of the land. The period that farmers restrict animals from entering farms is generally May to October so as to avoid destruction of crops in the fields. During this period, the price for small ruminants, in particular goats and sheep are relatively low as the farmers dispose some of the ruminants to reduce the stock to a manageable level. One man reported:

“It is difficult to combine feeding a large stock of ruminants with land preparation and cropping. So if you have large stock of goats and sheep they will go and eat someone’s crops and you would be asked to pay. So we sell some and leave a few to continue breeding”

In terms of shelter, kraals are constructed for cattle and pens for goats, sheep and chickens. The kraals are made up of branches of trees usually made in the form of a circle without roof while the pens are constructed with bricks and mortar and roofed. In some cases the sheep and cattle share kraals. The small ruminants such as sheep, goats and pigs are usually allowed to graze and return to their pens in the night. Where there are no pens, the ruminants are allowed to sleep in any available space including major highways. In some cases, young males in the household usually go after the ruminants ensuring that they are brought back in the evening to the pens provided for the accommodation of the ruminants. The
study found that cattle were subject to closer supervision than the small ruminants. Young adolescent boys of school going-age or adult herders usually well experienced in herding practices were assigned to handle cattle during the farming season, in particular. In places like Naaha, Nyuoli, Ga and Wichau some cattle owners hired the services of Fulani Herders to take care of their cattle and release the young boys to attend school. The cattle owners usually come together and contribute cash or foodstuff or both which they give to the Fulani Herder as compensation for their services. The amount for compensation is often negotiated year by year between the cattle owners and the Fulani Herders.

The herders usually take the cattle out early in the morning and follow them as the cattle graze and return home when the sun is hot. The herders are particularly vigilant during the farming seasons so as to avoid stray cattle damaging crops. The herders guard the cattle to suitable pasture and fodder areas to ensure proper feeding after which the cattle may be allowed some limited free range for some hours before being guarded to the kraal. Supervision is however relaxed during the dry season. During the dry season, the cattle are allowed free move freely in search of fodder and water. This is the period in which complaints of destruction of crops are on the increase.

As part of the management strategy, Livestock Farmers Associations (LFAs) exist in many communities in the district but they were limited to cattle farmers. In the Naaha community for example, the LFA has a membership of 50 persons, consisting mainly of cattle owners. These associations rely on conventions, traditional wisdom and informal relations to guide their activities, as they do not have written guidelines. The chair for most of the associations was found to be a person with the largest herds of cattle in the particular kraal or community as the case may be. These associations engaged in various activities including the rehabilitation of communal kraals, the provision of food and income for the herdsman (where the community is keeping a care-taker herdsman), the resolution of conflict between herders and farmers, and providing liaison between livestock owners in the community and external agents (officials of government and civil society). The forum for decision-making, information sharing and the initiation of specific activities is a general meeting usually convened by the executive committee in the early part of the morning. In recent times, most of the associations in the communities in which interviews were conducted have taken upon themselves to monitor and report the influx and activities of alien Fulani herdsmen. It was observed that traditional leaders often consult the chairmen of the LFAs before settling Fulani herders in the communities.

The District Assembly and the District office of the Ministry of Food and Agriculture (MOFA) are the local and central government institutions that regulate livestock production in the District. The two institutions support communities in the acquisition of inputs for the cultivation of crops and the production of livestock. The Assembly promotes the development of livestock activities through various programmes such as the youth in agriculture and guinea fowl improvement project. The two institutions also engage in programmes to create awareness on various animal diseases and provide medicine for periodic vaccination of livestock, especially cattle. Despite the contribution, most farmers still see the Assembly and MOFA as far remote from addressing their specific concerns with respect to the production and improvement of livestock in the district.

Ownership for livestock was observed to be mediated in gendered ways. Both males and females owned livestock. However, ownership of livestock for males was clearly manifested compared with females. Women were noted to prefer to confer ownership of their livestock on their sons or husband. In a discussion, one woman said:

"When I got married I gave birth to three sons and two girls. The father of the children did not have cattle. But when he or I die the children will need to kill a cow or they will need money to host visitors at the funeral. So I worked hard, made some savings and bought them a female cow. Now they have some cattle. I am happy that if I die today my children will not have problem finding an animal for my funeral".

In nearly all the ten communities where interviews were conducted, there were cases in which women actually bought cattle or goats and handed them to their sons or husbands for management. The trade in livestock was equally mediated in gendered ways. Trade in live animals and fresh meat were observed to be the exclusive preserve of males while females dominated, but not exclusively, cooked meat trade. While the females combine the sale of cooked meat with some meals like rice, fufu, kenkey and bean, their male counterparts sell the cooked meat only.

### The impact of livestock production on land

Land is an important factor for livestock production.

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**Table 4. Population Estimate of Livestock in Wa West District, 2013.**

<table>
<thead>
<tr>
<th>Livestock Type</th>
<th>Cattle</th>
<th>Goat</th>
<th>Sheep</th>
<th>Pigs</th>
<th>Donkeys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>28,789</td>
<td>12,798</td>
<td>16,963</td>
<td>14,045</td>
<td>75</td>
</tr>
</tbody>
</table>

Source: Ministry of Food and Agriculture, Wa, 2013
Livestock production requires the use of land and water for their survival and feeding. In the Wa West District, the Waala ethnic group holds alodial title to land. The alodial title holders allocate land for settlement and bush farms. While ownership is an important determinant in the use of land, it does not influence the open grazing method of livestock production in the Wa West District. The land tenure system in relation to open grazing system of livestock production is a reflection of the strand of the open access exploitation theory espoused by Brander and Taylor (1997) cited in Barbier (2005:p123). In the Wa West District, there are essentially no restrictions regarding where the livestock of a particular individual or a family in the community can graze. While settler farmers largely hold usufructuary land rights and cannot by custom allocate land to a “stranger” they have essentially equal rights to pasturelands in the community to which they belong. Settlers can graze their livestock in any part of the Community without permission, provided they do not seek permanent settlement.

In the Wa West District land and the environment is noted to be undergoing degradation. Wood and non-wood products of the Savannah are depleting in most of the communities measured by the amount of time people invest to access wood and non-wood products. Over 80% of the sample respondents reported that they spent more time than ever before to access wood and non-wood products. Large tracts of the natural vegetation and the gallery forests along the Black Volta River and its tributaries are disappearing. The Climbers and shrubs associated with the guinea Savanna agro-ecological zone have generally disappeared leaving vast areas of land with isolated trees mostly economic trees. The fallow phase of shifting cultivation has been shortened in the district for lack of fertile virgin land for agricultural production. Rivers and water resources continue to dry up. On an annual basis, more than half of the dugouts and small dams in the district dry up during the dry seasons. Majority (79%) of the respondents complained about lack of water to water their livestock during the long dry seasons. These physical and qualitative characterisation of land of the district reflect the description that UNEP (1997), Blaikie and Brookfield (1987:p.6) and Johnson and Lewis (1995:p2) give to land degradation. They all view land degradation as reduction of the potential and capacity, intrinsic qualities, or biological productivity.

Livestock production is one of the many factors contributing to land degradation in the district. Downey (2016) argues that the land “used for animal grazing, as well as the land that goes to specialized crop production for livestock animal diets, often causes mass scale deforestation: in the last 40 years, an estimated 40% of the Amazon trees were taken down with the vast majority of this land going to livestock feed production.” Downey further reports that the Food and Agricultural Organization of the United Nations (FAO) calculated that cows contribute 53% of the world’s human-related nitrous oxide and 44% of its methane. FAO (2006) reports that the livestock sector is by far the most single largest anthropogenic user of land. About 20% of the world’s pastures and rangelands, with 73% of rangelands in dry areas, have been degraded to some extent, mostly through overgrazing, compaction and erosion created by livestock action. Again, FAO (2006) further notes that livestock production accounts for 70% of all agricultural land and 30% of the land surface of the planet with the most affected areas and communities being those on dry lands or Sahel regions, as livestock are often the major source of livelihoods for the majority of households in these areas.

The paper documented key practices of livestock production, which contribute to land and environmental degradation in the district. Livestock farmers in the district engage in practices that contribute to the degradation of land and the environment. The most serious of such practices are cutting down of trees to feed livestock and bush burning. Livestock farmers especially the herders frequently cut down trees to provide fodder, burn the bush in anticipation for early regeneration, and water their stock in dugouts and streams, which are also used for human consumption. These practices often result in retarding accelerated regeneration of the vegetation leading to soil erosion. Also, the watering of large stock of cattle in rivers, streams and dugouts especially in the dry season results in the pollution and silting of water bodies. The practice of bush burning is known to have a debilitating effect on soil fertility i.e. it destroys soil nutrients and reduces the productivity of the soil. Bush burning also slows down the pace of growth of natural vegetation. The situation is compounded by the seasonal influx of Fulani herders into the district from neighbouring ECOWAS countries. The herders take advantage of the ECOWAS Protocol and bring in herds of cattle into the district. Once in the district, they joint their counterpart livestock producers in harvesting the vegetation and water resources for their cattle. Many at times, cattle stray into crop farms causing destruction and incurring the displeasure of the farmers. This often results in conflicts between members of the communities and the pastoralists.

The seasonal migration of herders from neighbouring ECOWAS countries into Ghana has intensified competition over land and natural resources, which has become an issue of major security concern. Tonah (2006) reports that “in 2002, residents of Dromankese are reported to have attacked Fulani herds who had camped their cattle at the outskirts of the settlement. Similarly, in February 2004 the Yejihene is reported to have mobilized his subjects to attack a group of Fulani herdsmen at Kadue following disputes with the Kaduehene over the ownership of land on which the herdsmen were residing.” In a Report released by the Bureau of Democracy, Human Rights and Labour (2011),
Table 5. Total Livestock Population of Wa West District under Tropical Livestock Unit (TLU).

<table>
<thead>
<tr>
<th>Livestock Type</th>
<th>Population</th>
<th>Conversion Rate</th>
<th>TLU Population</th>
<th>Total Pasture Land Available (60% of Total Land area of Wa West District)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>28,789</td>
<td>1=1</td>
<td>28,789</td>
<td>111,360ha</td>
</tr>
<tr>
<td>Donkeys</td>
<td>75</td>
<td>1=1</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Goat</td>
<td>12,798</td>
<td>10=1</td>
<td>1,280</td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td>16,963</td>
<td>10=1</td>
<td>1,696</td>
<td></td>
</tr>
<tr>
<td>Pigs</td>
<td>14,045</td>
<td>4=1</td>
<td>3,511</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL POPULATION OF LIVESTOCK BY TLU</strong></td>
<td><strong>35,351</strong></td>
<td></td>
<td><strong>111,360ha</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Work, 2015

on January 23rd, 2010, three persons were killed in clashes between Fulani herdsmen and residents in Aboboa, a farming community in the Atebubu Amantin District of Brong Ahafo Region.” The Ghana News Agency (GNA) on November 10th 2011 reported that the Ghana Society of Animal production (GSAP) organised a press conference in Accra and called for a review of the Economic Community of West African States (ECOWAS) Protocol on Livestock and Transhumance in order to control the activities of Fulani herdsmen. The key issue for the Wa West District is whether the available land can continue to support livestock production given that land is limited in supply. This issues leads to the determination of the land carrying capacity for livestock production.

**Determining the land carrying capacity for livestock production in Wa West District**

The total land area of the Wa West District is 1,856 km² or 185,600 ha (Wa West District Assembly, 2013). This area contains different kind of activities and facilities including settlements, agriculture, forest reserves, infrastructure (roads, schools, health centres, etc.) and water resources. While open grazing is the method of livestock production in the district, the paper argues that not all the space available would be accessible to livestock grazing. The paper therefore estimates a maximum of 40% (742.4 km² or 74,240 ha) of the land to be available but not accessible for livestock grazing in the district and 60% (1,113.6 km² or 111,360 ha) is available and accessible for livestock grazing. The 60% (1,113.6 km² or 111,360 ha) area of land constitutes the total pastures available and accessible for livestock grazing as farmers generally combine crop production with livestock management in open grazing.

The total livestock population in the Wa West District estimated under the Tropical Livestock Unit (TLU) is 35,351 (Table 5). Under the TLU estimates, every ten (10) sheep or goats are equivalent to one (1) matured cow, every four (4) pigs are equivalent to one (1) matured cow and a matured donkey is equivalent to One (1) matured cow.

In arriving at the land carrying capacity for livestock production, the paper applied the mathematical model \((LCC=3\% \times TLUw \times npa)\) to determine the daily and annual intake of TLU as follows:

(i) \(LCC=3\% \times 250 \text{ kg} \times 365 \text{ days}\)
(ii) \(LCC=7.5 \text{ kg} \times 365 \text{ days}\)
(iii) \(LCC=2,737.5\)

This means that 2737.5 kg of feed is required for a TLU in a year. This amount is less than the quantity of feed that 2 ha of pastureland can yield in a year in the savannah agro-ecological zone. In other words, less than 2 ha of a parcel of pastureland in the district can feed one TLU in a year without pressure on the land and the environment.

Given the LCC per a TLU at 2,737.5 kg, the total number of pastureland required a year to feed the total TLU population in the District without pressure on the land and the environment is 35,351 TLU x 2,737.5 kg, which is 96,773,362.5 kg. However, the total estimated yield of the pastureland (stocking capacity) per year in the District is 311,808,000 kg (2,800 kg x 111,360 ha) half of this amount 155,904,000 kg (50% of 2,800 kg x 111,360 ha) is required as adequate feed for livestock. The 155,904,000 kg amount of feed is lower than the actual feed of 96,773,362.5 kg required by the current population of TLU in a year in the district.

Therefore, there is enough capacity of the land to carry more TLU than the current TLU population. By the TLU estimates, the Wa West District requires a total TLU population of 155,904,000 (50% of 2,800 kg x 111,360 ha) to reach full carrying capacity of land in the district.

**Conclusion and Recommendations**

The study found that Wa West District is conducive and holds great potential for livestock production. The District holds a pastureland, which is more than the required pasture for the TLU population. While the livestock production is important for the social, economic and political organisation of the people, the activity also results in negative impact on land and the environment of the district. Open grazing was found to be the main
method of livestock feeding and management. The paper concludes that the negative impact of livestock production on land and the environment is a result of poor husbandry practices rather than the limited capacity of the land to contain livestock production.

Based on this conclusion, the paper makes the following policy recommendations. The Ministry of Food and Agriculture may need to intensify public awareness of the complex relations between livestock production and the environment and the overall effect for food security. The renewed emphasis on awareness should focus smallholder farmers, as they constitute the majority in the rural district like Wa West. The intensification of awareness at the local level requires that state policy must continue to prioritise decentralization and extension services as key levers for participatory development and service delivery.

Emphasis must also shift from the application of technology as inputs to agricultural productivity towards indigenous knowledge-based and development technologies. The history of the industrial revolution has provided enough evidence and pointers that technology developed out of production is not only relevant but also far more speedily accepted because such technologies evolved out of need rather than a sympathetic response to the plight of producers.

The paper also recommends further studies on the sociological and anthropological production of livestock with the possibility for a return to the community paddock systems. Any return to the community paddock system should be preceded with intensive and sustained public awareness and campaigns paying attention to land tenure and livestock ownership mechanisms.

In view of the deteriorating quality of the environment, the Wa West District Assembly should take advantage of its being a new Assembly to plan and enforce land use. This policy action would not only distinguish the District as a star but also supportive to improved livestock systems. Further, a proper and effective execution of land use plan would facilitate and enhance the availability and accessibility of land and land related data in the district.

The Wa West District Assembly should consider fixing an environmental levy on livestock producers and other individuals and organisations whose commercial activities have direct impact on the environment. This should be decided and enforced only when an elaborate incentive schemes have been developed and applied to farmers in the District. Rather than introducing an entirely new levy, the existing rate on cattle could be adjusted upward by a small margin and tagged as environmental resources fee. This amount could be isolated and put into an Environment Restoration Fund for exclusive environmental restoration activities including surveillance on alien invasion species, establishment of fodder banks, preservation of crop residues, as well as roughage and browse development.

The Wa West District Assembly should initiate and lead an advocacy for negotiations between Ghana and its neighbouring countries under the ECOWAS protocol to agree on terms under which alien herders could enter into Ghana on annual basis. The terms of the agreement which should spell out among others are the total number of herds per period of time, approved routes and period of entry, areas for settlement, appropriate charges and distribution formular, modalities for transfer of livestock of entry, areas for settlement, appropriate charges and period of herds per period of time, approved routes and period.

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Ministry of Food and Agriculture-MOFA (2015). Interview with the Upper West Regional Office, May 2015, WA.


