Assessment of Forage Species on Community Rangelands, A Case Study In Tolon District, Ghana

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***Abstract*: The study was conducted in ten communities in the Tolon district of the Northern region of Ghana. The objective of this study was to identify the forage species on community rangelands and to know the trend conditions of forage species on the community rangelands. Ten communities were randomly selected from the study area for the research. The random sampling technique was applied to select ten (10) communities of which 10 people were selected in each community through the snowball sampling technique. One hundred questionnaires were administered during this study to collect the data. Quadrats of 10m ×10m were laid to identify species on rangelands in the district. The data was analyzed using Statistical Package for Social Sciences software version (16.0) and Microsoft office excel (version 2013). Male and female respondents constituted 97% and 3% respectively. Majority (78%) of the respondents were involved in sheep rearing while the least 3% were also engaged in pig farming. The study identified thirty-seven (37) forage species in which *Setaria pallide fusca* was the species that had the highest frequency whereas *Strychos spinosa, Pennisetum purpureum, Boerhavia coccinea, Eugenia subherbacea*. and *Hannoa undulate* was the forage species with the lowest frequency. Five species that are going extinct were also identified in the study. *Pterocarpus erinaceus* was the species that appeared most among the forage species which are reducing whiles *Detarium microcarpum, Securinega virosa, Hyparrhenia rufa,* and *Acacia nilotica* had the lowest frequencies. To conserve forage availability, there should be a reduction in overexploitation of the species and also to encourage the cultivation of forage species especially *Pterocarpus erinaceus, Detarium microcarpum, Securinega virosa, Hyparrhenia rufa,* and *Acacia nilotica* to sustain the forage species.**

Keywords: **Rangelands forage species, deforestation, and encroachment.**

I. INTRODUCTION

Rangelands are defined as “the land on which the potential native vegetation is predominately grasses, grass-like plants, forbs or shrubs” [1]. Rangelands provide a great variety of ecosystem services, including the provision of food and fiber, carbon sequestration, maintenance of biodiversity, and recreation [2]. Globally, rangelands occupy approximately 54% of terrestrial ecosystems and sustain 30% of the world’s population [3]. As such, rangelands are among the most interesting systems that are used to analyze the balances between supply and demand of various ecosystem services.

Soil is the most important component of rangeland ecosystems that has an inter-disciplinary nature and is associated with its biodiversity, biogeochemical cycling, hydrology, human health, and social sciences [4]. Unfortunately, rangelands have undergone and continue to undergo rapid transformations because of factors such as overgrazing, deforestation, woody-plant encroachment, and invasion by non-native woody plant species [5]. Grazing is the most important factor affecting vegetation and soil in all rangelands of the world, having critical impacts on biodiversity and species composition on [6], biological groups [6], and structure [7], [8].

A well-planned and managed pasture-based operation can maintain reasonable production, reduce input costs, and achieve a positive economic return, given a well-conceived marketing plan. High-density grazing systems also diminish weed invasion by reducing grazing selectivity. As an animal is forced to consume all the plants in a given area, no one plant is favored [9]. Overgrazing occurs when the grazing pressure exceeds the carrying capacity of the pasture. Continuous grazing allows livestock to selectively graze the most palatable plants over and over. The USDA defines prescribed grazing as “the controlled harvest of vegetation with grazing or browsing animals, managed with the intent to achieve a specified objective” [10]. According to [11], prescribed grazing improves or maintains the health and vigor of selected plants and maintains a stable and desired plant community. [12] relate that sheep spend 70% of their grazing time at ground level and only rarely make use of vegetation layers over 1 m above ground level. Goats, on the other hand, browse up to a height of 2 m and spend 60% of their grazing time between 0.7 and 1.2 m above ground level. These inter-species differences mean that their "feed spectra" usually overlap very little.

In areas where livestock production has been seriously affected by periods of drought, various groups of agriculturalists have seen their way clear to invest their agricultural surpluses in livestock, a move encouraged by a sharp rise in cereal prices and a fall in livestock prices [13]. [14] Estimates that, savannah fires account for 42% of the biomass burnt throughout the world. This would give four gigatons a year of carbon emitted into the atmosphere [15], thus about 18% of total carbon dioxide emissions each year [16].

The vegetation on rangelands has been declining and has led to some composition of the rangeland to diminish whilst others are growing vigorously. Comparative studies on the nutrition of wild and domestic herbivores sharing the same environment tend, however, to moderate this view: diet overlap is limited either because of unequal use of habitats in space and time or because of dietary adaptation connected with this proximity [17]. The problems that arise to this effect perhaps may be a result of some activities such as overgrazing on forage species, over-harvesting of plants, surface runoff leading to erosion, presence of non-native invasive species, and extinction of plants.

This study, therefore, seeks to identify and document forage species on community rangelands in tolon district and to determine the trend on forage species composition on rangeland.

II. Methods and materials

Study Site

The District lies between latitudes 9° 15′` and 10°0 02' North and Longitudes 0° 53′and 1° 25′ West. It shares boundaries to the North with Kumbungu, North Gonja to the West, Central Gonja to the South, and Sagnarigu Districts to the East. The district is characterized by a single rainy season, which starts in late April with little rainfall, rising to its peak in July-August and declining sharply, and coming to a complete halt in October-November. The dry season starts from November to March with day temperatures ranging from 33°C to 39°C, while means night temperature range from 20°C to 26°C. The Mean annual rainfall ranges between 950mm - 1,200mm. The area experiences occasional storms, which have implications for base soil erosion depending on its frequency and intensity especially when they occur at the end of the dry season. The situation also implies staple crop farming for instance is highly restricted by the short rainfall duration. The main vegetation is grassland, interspersed with guinea savannah woodland, characterized by drought-resistant trees such as acacia, *(Acacia longifolia)*, mango (*Mangifera indica*), baobab (*Adansonia digitata Linn*), shea nut (*Vitellaria paradoxa*), dawadawa, and neem (*Azadirachta indica*). Major tree species include the shea nut, dawadawa, and mango, which are economic trees and form an integral part of the livelihood of its people. The soil is generally of the sandy loam type except in the lowlands where alluvial deposits are found. There are also deposits of gravel that are sold for economic value. The nature of the soil makes it highly vulnerable to sheet and gully erosion. This condition happens primarily because of the perennial burning of the natural vegetation, leaving the soils exposed to high weather intensity. The continuous erosion over many years has removed most of the topsoils and depleted its organic matter content. This situation does not allow the soil fauna to thrive, leading to low agricultural yields. Figure 1 shows the district map of Tolon and the ten communities of the study area.

Sampling Techniques and Data collection

A random sampling technique was used to select the ten (10) communities where the study was conducted. Names of all the communities were written on a plain sheet. The names of the communities were folded and put in a bowl. The papers in the bowls were shuffled and 10 people were asked to pick a sheet each. The sheet that was picked, gave me the names of the community to carry out the research.

Snowball sampling was used to select respondents from the communities to be interviewed. This was done by first identifying one livestock farmer. The second and the rest were identified based on the technique. This was done after interviewing the person, then being directed to another person also rearing animals. This procedure used helped in administering the questionnaire.

Questionnaires were administered to one hundred respondents in ten communities which helped in the identification of the plant species.

Data was collected using quadrat to identify the various plant species that the animals feed on in the tolon rangelands. Names of the plants that are being fed on by the animals were collected with the help of experts and pictures from books. Data was also collected on plants that have gone extinct on the rangeland by using transect to explore species richness. Data on preservation of most plant species were taken from the people in charge of the rangelands.

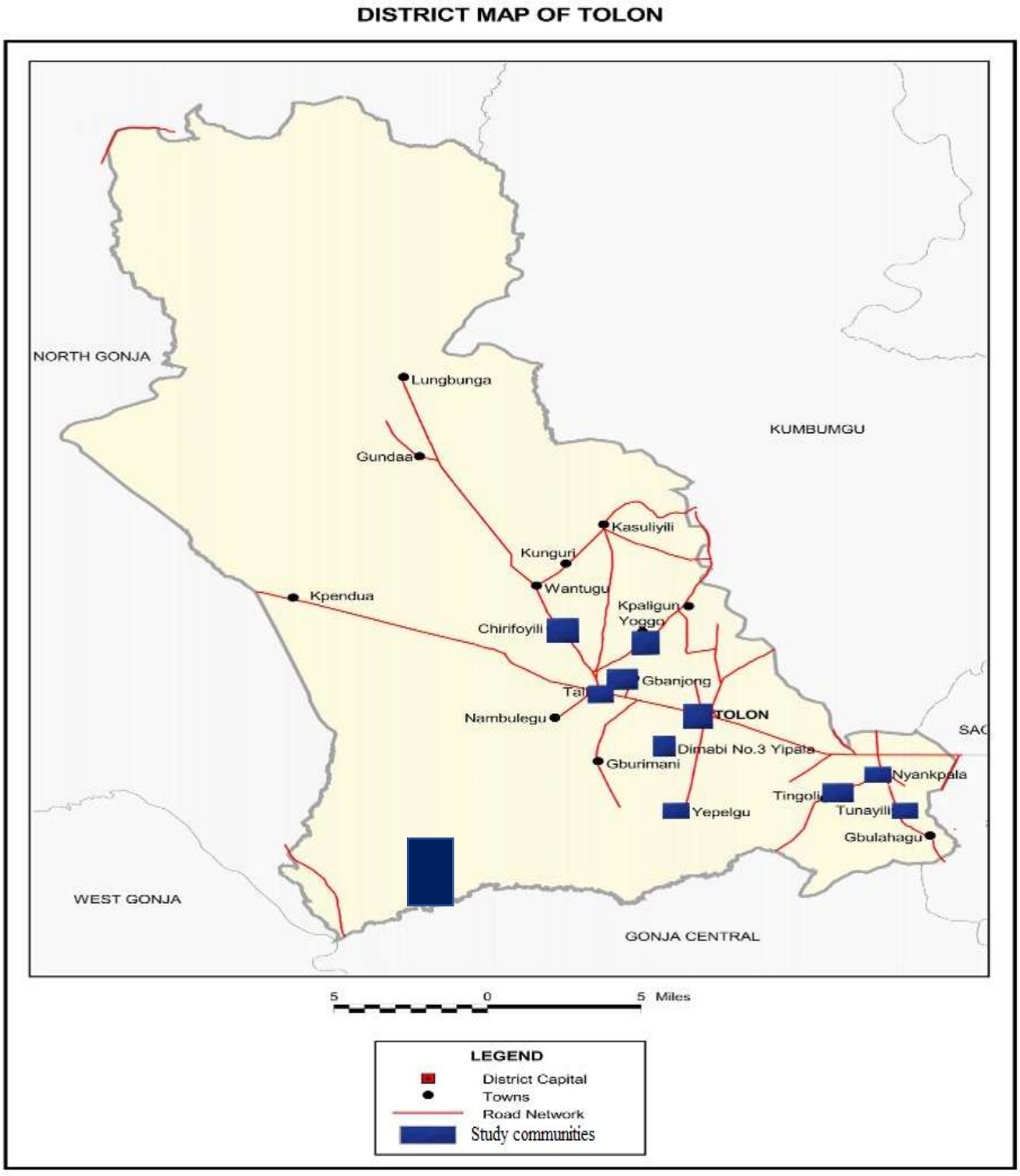

Figure 1: A map showing the location of the study. The 10 Communities where the study was conducted in Tolon district is indicated with a blue colour.

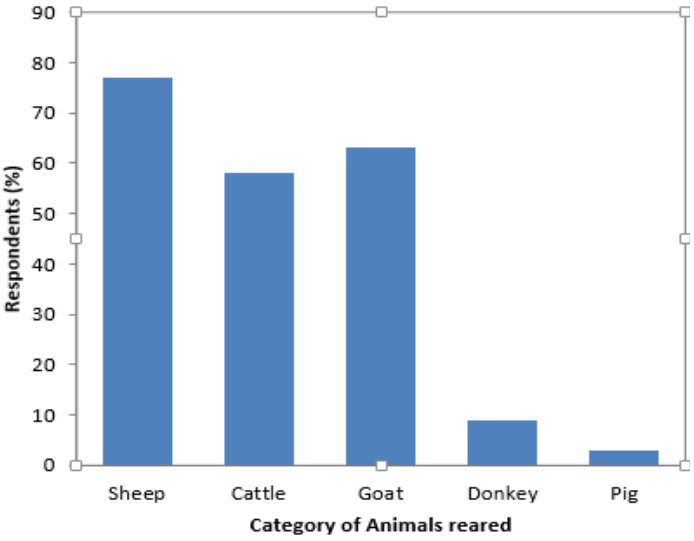

Figure 2: Animals reared by respondents in ten communities in Tolon District.

Data Analysis

The IBM SPSS (Statistical Package for Social Scientists, version 20) was used in analyzing the responses from the respondents. Responses were analyzed using descriptive statistics. Frequencies and percentages were computed on plant species identified from the data gathered and the results presented in charts and tables. The vital information pertaining to the objective of this work was taken out for analysis and conclusions made based on that.

III. RESULTS OF THE STUDY

Basic Information on Respondents

One hundred (100) respondents of which majority are farmers were interviewed during the study. Out of the 100 respondents, 97% of them were males and 3% represented females. Majority, 68 had undergone formal education. It was also noted that majority, 50% of the respondents were within the age range of 41-60 years and 22% were within the range of 61-80years. Table 1 illustrates the basic information of the respondents.

Respondents		Education		Occupation		Age		
Gender		Formal	No formal	Farmer	Non-farmers	21-40	41-60	61-80
Male	97	66	31	74	23	26	49	22
Female	3	2	1	2	1	2	1	0
Total	100	68	31	76	24	28	50	22

Table 1: Shows the information of the respondents that conducted the interview.

Categories of Livestock Reared by Respondents

The study revealed the various categories of livestock reared by the respondents in the study area. From the responses, sheep was the animal being reared by majority (78%) of the respondents, and pigs were reared by the least number of respondents. The frequency distribution of the animals is illustrated in Figure 2.

Plant Species Identified In Ten Communities in Tolon District.

Table 2: Plant species identified in ten communities in Tolon district

Common name	Scientific name	Frequency
Yihim	*Setaria pallide fusca (g)*	78
Kodo Millet	*Paspalum scrobiculatum(g)*	11
Bulasam	*Sida acuta(s)*	8
kinkang	*Ficus gnaphalacarpa(t)*	22
Kpalga	*Detarium microcarpum(t)*	29
Chima	*Pennisetum pedicellatum(g)*	71
Gampriga	*Ficus spp(t)*	13
Nee	*Pterocarpus erinaceus(t)*	8
Kinkina	*Ficus gnaphalocarpa(t)*	11
Kpagriga	*Detarium senegalense(t)*	10
Salinvogu	*Corchorus aestuans(s)*	8
Vavale	*Trianthema portulacastrum(h)*	13
Tantee	*Ellinsia guinensis(g)*	27
Kagli	*Pennisetum purpureum(g)*	32
Alepele bindi	*Tridax procumbens(h)*	11
Zalinzaa	*Indigofera spp(s)*	17
Yinyang	*Rottboelia cochinchinansis(g)*	46
Gozie	*Amaranthus spinosus(s)*	12
Banlari	*Tephrosia purpurea(s)*	16
Susugra	*Securinega virosa(g)*	8
Bulimbugu	*Annona senegalensis(t)*	21
Tinkpam	*Sesbania sesban(t)*	13
Zugubetia	*Stereospermum kunthianum(s)*	15
Zankunga	*Ximenia Americana(h)*	8
Palga	Palga(t)	37
Daziemam	*Andropogon pseudapricus(g)*	11
Dazule	*Gardenia* sp. (s)	9
Zalinzaa	*Indigo spp(t)*	26
Gbirigu	*Combretum molle(t)*	29
Prinkpang	*Imperata cylindrical(g)*	21
Prima	*Andropogon gayanus(g)*	38
Gingatia	*Strychos spinosa (s)*	7
Taane	*Vitelleria paradoxa(t)*	9
Kambana	*Hannoa undulate(s)*	7

NB: s – shrub, g - grass, t - tree, h - herb

From table 2, thirty-seven (37) forage species were identified from the survey in ten communities in Tolon district. Based on the responses, it was revealed that Setaria pallide fusca was the species with the highest frequency in ten communities in Tolon district.

Forage Species Identified in various communities In Tolon District.

Forage species were identified and documented in ten communities.

In the Tunayili community, sixteen species were found, with *Pennisetum pedicellatum* showing the highest frequency and *Pennisetum purperuem* showing the lowest frequency.

From Gbanjong community, fifteen species were found and *Pennisetum pedicellatum*, *Setaria pallide fusca* showed the highest frequency, and *Securinega virosa* showed the lowest frequency.

Fourteen species were identified, *Paspalum scrobiculatum* showed the highest and *combretum molle* showed the lowest.

In Dimabi no. 3 community, fourteen species were recorded and *Rottboelia cochinchinansis* represented the highest frequency whereas *Ficus gnaplocarpa* showed the lowest. Nyankpala community had thirteen species identified of which *Setaria Pallide fusca*, *Palga*, and *Pennisetum pedicellatum* showed the highest and *Stereospermum kunthianum* as the lowest frequency.

Fourteen species were recorded in Tali community of which *Detarium microcarpum*, *Setaria pallide fusca* showed the highest frequency, and *Pterocarpus erinaceus* and *Securinega virosa* were the lowest. Fourteen species in Yepelgu were recorded and *Pennisetum pedicellatum*, *Setaria pallide fusca* and *Annona senegalensis* showed the highest frequency while *Strychos spinosa*, *Detarium microcarpum*, and *Trianthema portulacastrum* showed the lowest frequency. In Tingoli community eighteen species were recorded and *Palga* showed the highest frequency whereas *Pterocarpus erinaceus* and *Securinega virosa* was the lowest. Chirifoyili community recorded fourteen species and *Setaria pallide fusca* showed the highest frequency and *Amaranthus spinosis* the lowest in Chirifoyili community. In Yoggo community, thirteen species were recorded, *Rottboelia cocchinchinansis*, *Pennisetum pedicellatum* showed the highest frequency whereas *Imperata cylindrica* was the lowest.

The figures below show the forage species identified in the study area:

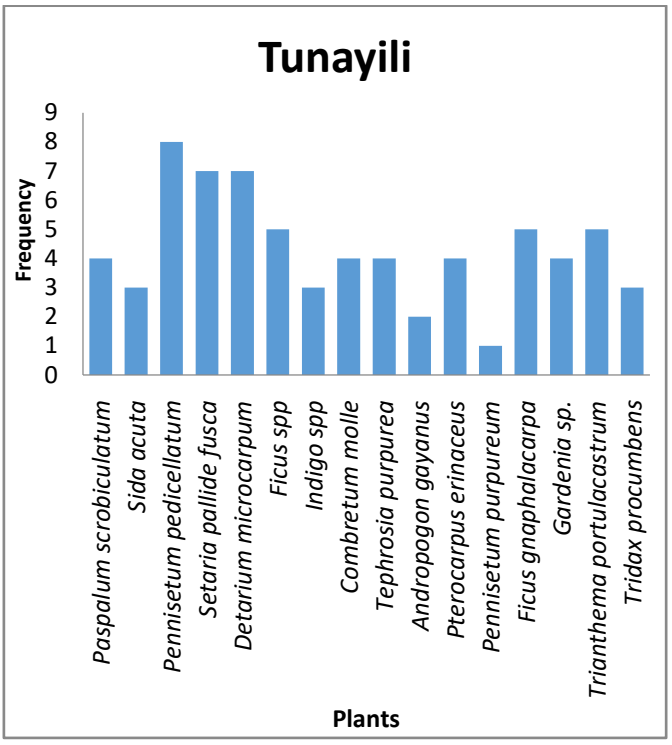

Figure 3: Frequency distribution of forage species in Tunayili community.

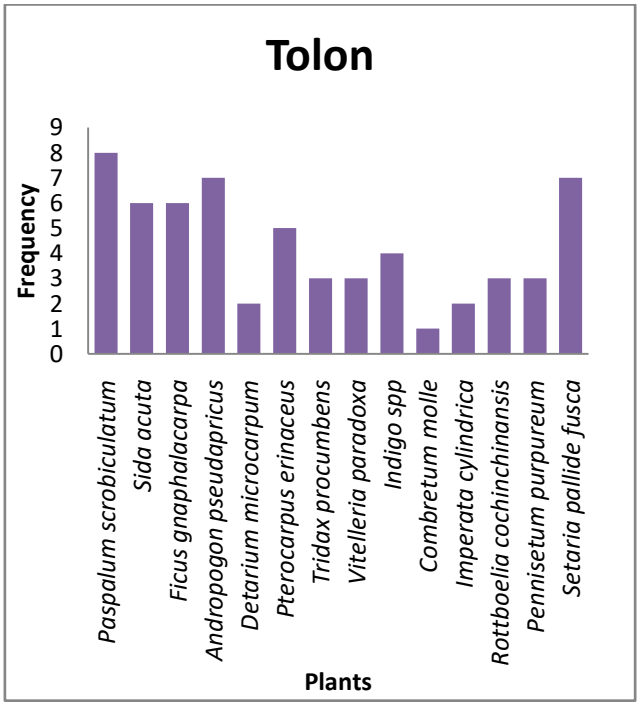

Figure 4: Frequency distribution of forage species in Tolon community.

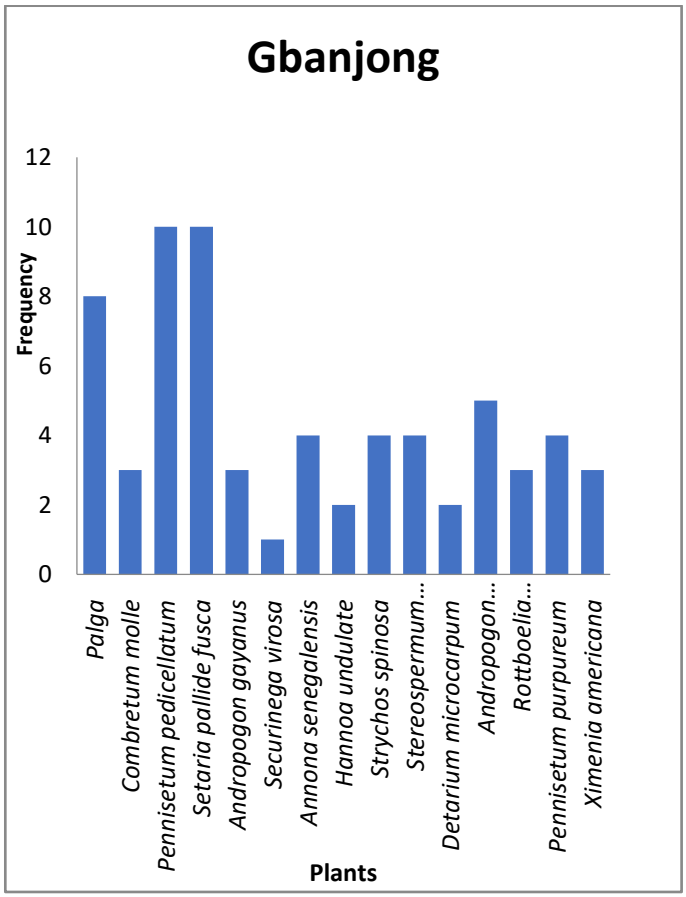

Figure 5: Frequency distribution of forage species in Gbanjong community.

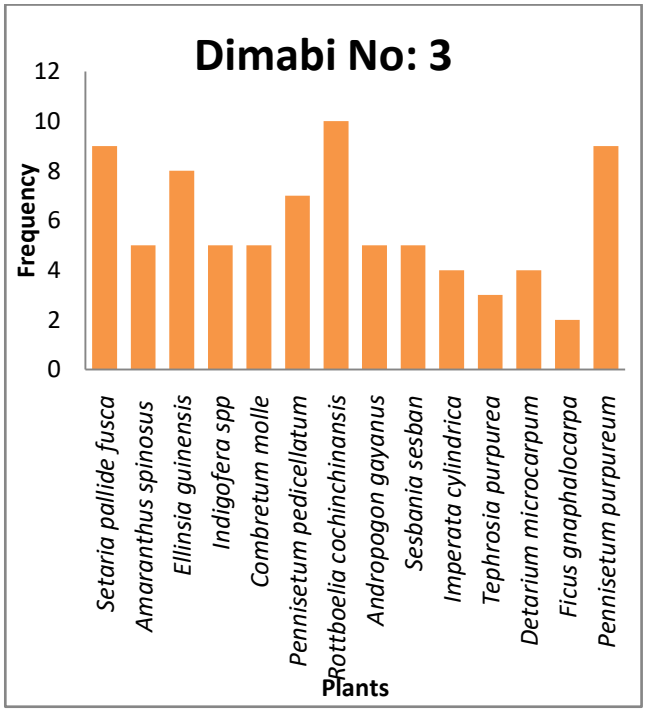

Figure 6: Distribution of forage species in Dimabi no: 3 community

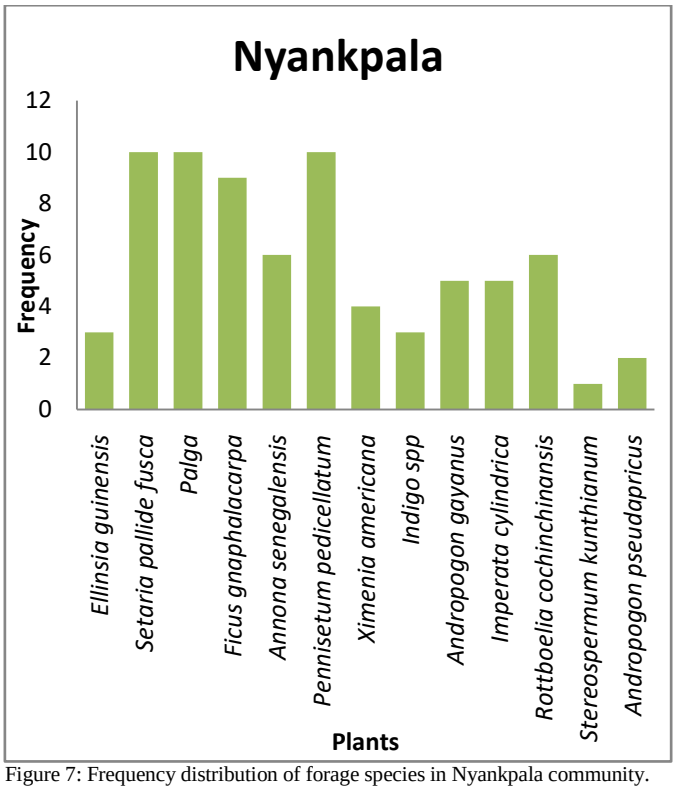

Figure 7: Frequency distribution of forage species in Nyankpala community.

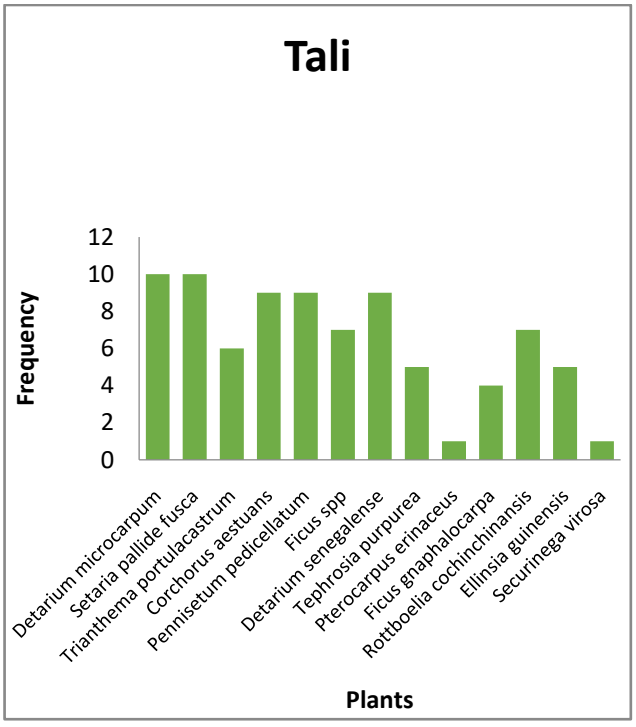

Figure 8: Frequency distribution of forage species in Tali community

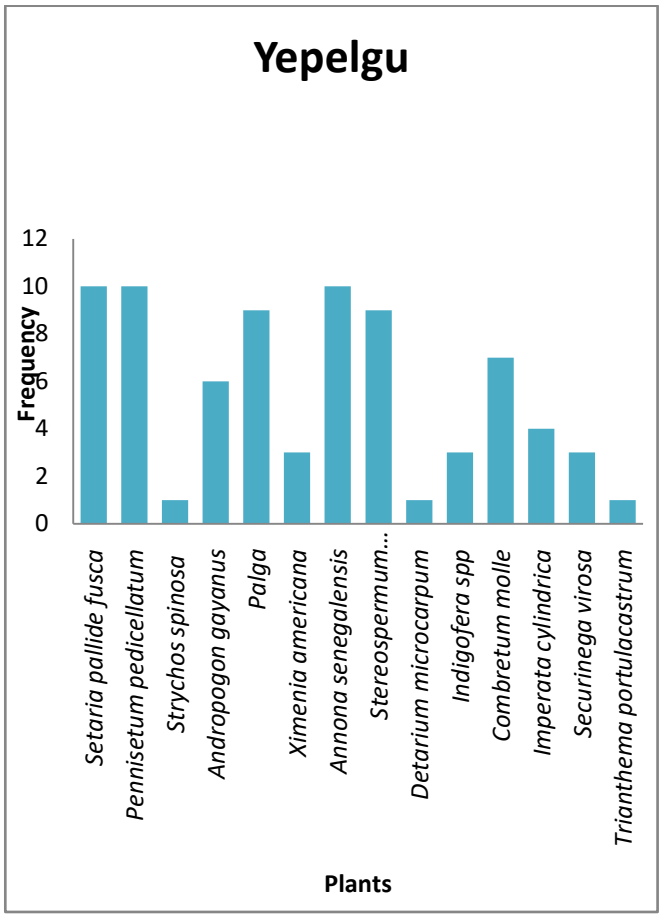

Figure 9: Frequency distribution of forage species in Yepelgu community.

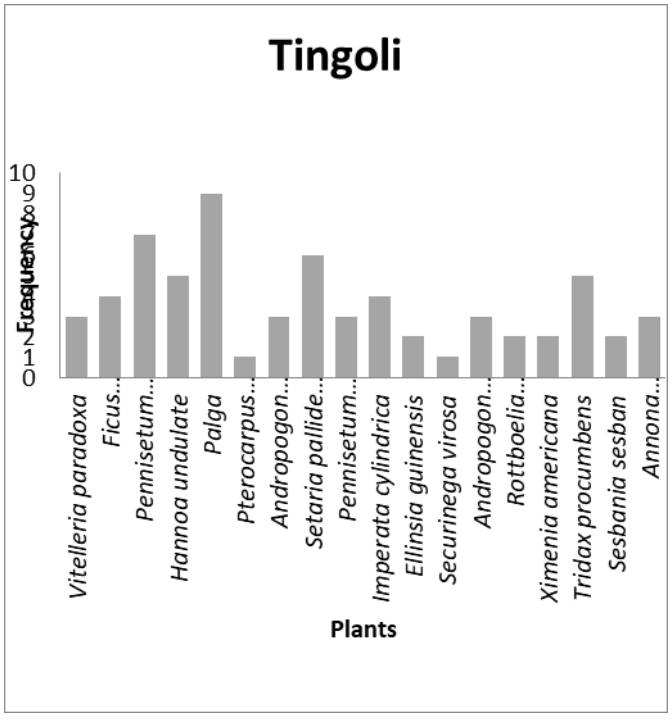

Figure 10: Frequency distribution of forage species in Tingoli community

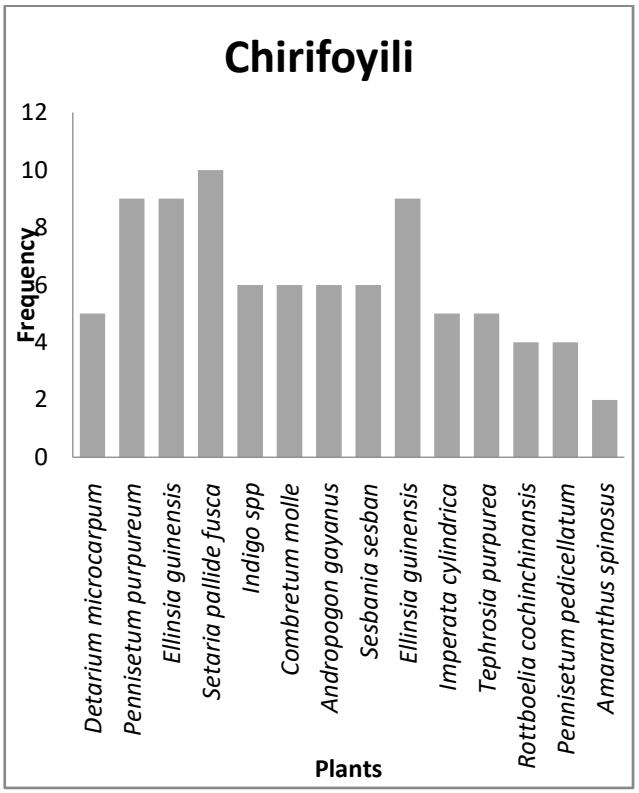

Figure 11: Frequency distribution of forage species in Chirifoyili community

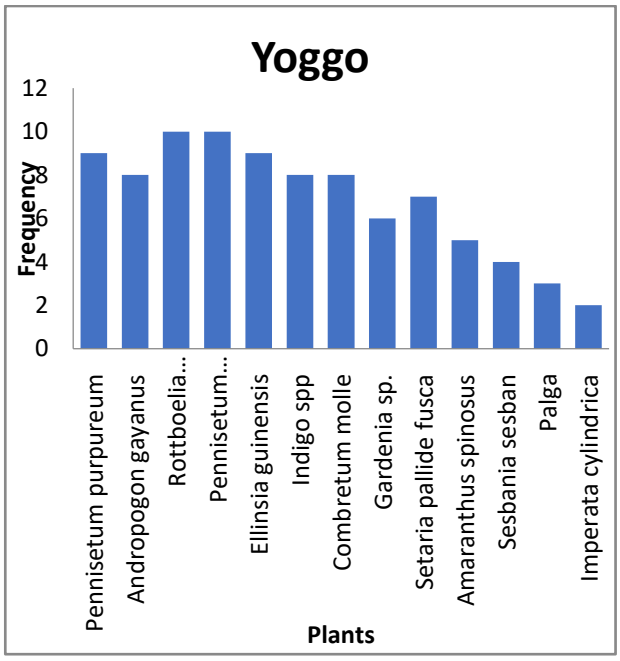

Figure 12: Frequency distribution of forage species in Yoggo community.

Forage Species Identified Using the Quadrats

Fourteen species were identified inside the quadrats in ten community rangelands. On the rangeland, *Setaria pallide fusca* shows the highest frequency and the lowest are *Pennisetum purpureum*, *Boerhavia coccinea*, and *Eugenia subherbacea*.

The figure below illustrates the forage species identified on the community rangelands.

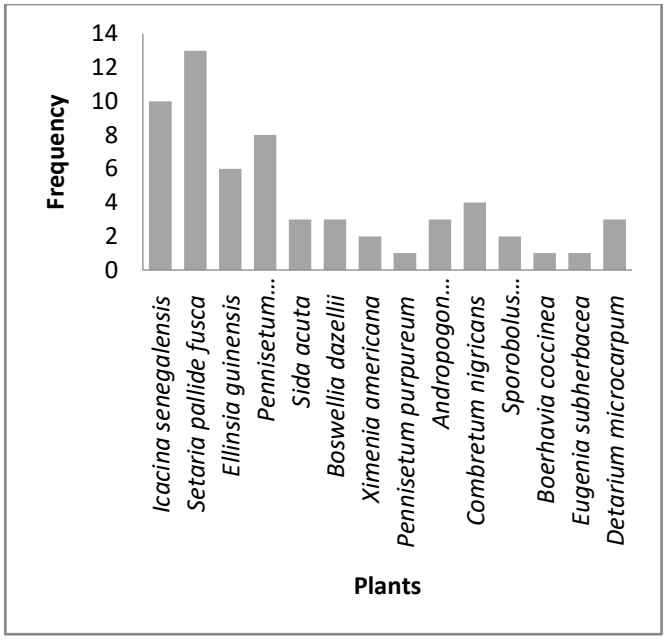

Figure 13: Forage species identified on community rangelands in Tolon District.

Forage Species Getting Extinct

From the responses five (5) forage species were identified as plants that are getting extinct in the study area. Out of these species, *Pterocarpus erinaceus* the highest frequency, and *Detarium microcarpum* showed the lowest frequency. Figure 14 illustrates the forage species which have gone extinct.

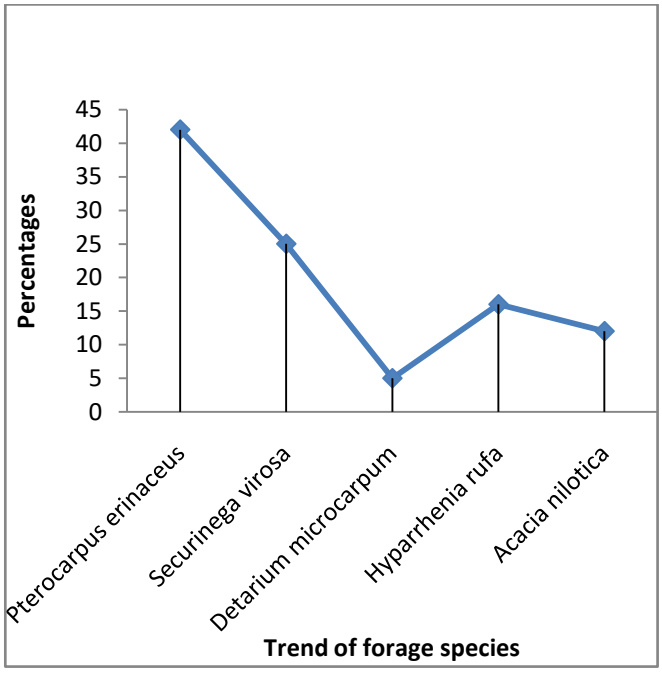

Figure 14: Percentages of forage species going extinct

IV. DISCUSSION

Basic Information on Respondents

The study revealed that the inhabitants of the study area were predominantly farmers and among the farmers, males were more involved than the females. The high number of males involved in farming could be because males are more engaged in farming activities as compared to their female counterparts. Due to the farming activities, they are engaged in, they have more knowledge about the forage species in the area. From the findings, sheep were found to be animals that are being reared by most of the respondents while pigs were found to be the least animals being reared in the study area. Sheep are reared more because they are being used for cultural or religious activities like naming ceremonies, festivals, funerals, and other cultural practices as compared to the pig which was rarely reared. This might stand to reason that the area where the study was conducted is dominated by Muslims. Also, pork is not a delicacy consumed by Muslims, hence the reason for recording a lesser number.

Identification of Forage Species

The study identified thirty-seven forage species in the study area through one hundred questionnaires administered. Out of these species, *Setaria pallide fusca* showed the highest frequency whiles *Strychos spinosa Pennisetum purpureum*, *Boerhavia coccinea*, *Eugenia subherbacea*, and *Hannoa undulate* had the lowest frequency. This could mean that *Setaria pallide fusca* is highly viable and can withstand adverse weather conditions. From observation, these species grow along roads, walkways, farms, riverbanks, and many areas. [18] their study on germination of *Setaria pallide fusca* in Nigeria indicated that the species has a viable seed and is widely distributed in Nigeria and known to be part of some serious weeds in Senegal, Sudan, Zambia, Fiji, Kenya, and India. *Strychos spinosa Pennisetum purpureum*, *Boerhavia coccinea*, *Eugenia subherbacea* and *Hannoa undulate* are the species with lower frequencies and this could be attributed to their high demand for water and nutrient and they cannot be found everywhere on the rangelands. This is in line with [19] who reported that *Pennisetum purpureum* is generally weak and particularly demands much water, N, P, and K for germinating. For example, the available P levels in a substrate must be maintained above 8 ppm for *P. purpureum*.

Trend of Forage Species

The results of the study revealed that five species were identified as getting extinct which include *Pterocarpus erinaceus*, *Detarium microcarpum*, *Securinega virosa*, *Hyparrhenia rufa*, *and Acacia nilotica*. From the findings, there has been a reduction in the trend of some of the forage species. These species are getting extinct because they are highly beneficial to both mankind and livestock. *Pterocarpus erinaceus and securinega virosa* were the forage species that proved high in reduction representing 42% and 25% respectively. This might have happened due to over-harvesting,

overexploitation, and overgrazing. *Pterocarpus erinaceus* has a lot of multipurpose uses and is being harvested much by people. They serve as a source of food for animals and as harvested as a source of fuel. *Pterocarpus erinaceus* represents a very common and widely grown tree native to the Sahelian region of West Africa, which is known to possess a range of potential medical uses [20].

In the case of *Securinega virosa* and *Detarium microcarpum*, they are highly used in the District to fence their gardens and farmlands which might have caused the decline in the species. This observation is in concordance with [21] who noted that *Securinega virosa* and *Detarium microcarpum* are commonly used in the West African sub-region which serves a lot of medicinal purposes of which the root is used in many parts of Africa in the treatment of fever, body pain, stomachache, rheumatism, diarrhea, pneumonia, and epilepsy.

According to the respondents, *Hyparrhenia rufa* is being harvested in the District for fodder and roofing of buildings which might have caused the reduction in the species. This agrees with [22] who reported that the species is commonly cultivated throughout the tropics for cattle fodder. [23] also noted that *Hyparrhenia rufa* is not cultivated in Northern of West Africa which has attributed to the decline in the species.

V. CONCLUSIONS AND RECOMMENDATIONS

The study identified thirty-seven (37) forage species in Tolon district in which *Setaria pallide fusca* appeared in all the area where the study was conducted and had the highest frequency. From the study, *Pterocarpus erinaceus*, *Detarium microcarpum*, *Securinega virosa*, *Hyparrhenia rufa*, and *Acacia nilotica* were noted to decline in the study area due to overexploitation.

Based on these conclusions, there should be moderate exploitation of forage species especially, *Pterocarpus erinaceus* and *securinega virosa*. There is a need to encourage the cultivation of forage species especially *Pterocarpus erinaceus*, *Detarium microcarpum*, *Securinega virosa*, *Hyparrhenia rufa*, and *Acacia nilotica* to sustain the forage species.

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