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Evaluation Of The Impact Of Climate Change On Botanical Composition, Vegetation Cover And Forage Yield In Tandjilé Province Southern Chad.

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ABSTRACT
Pasture evaluation and survey study were conducted in the Tandjilé region of Chad to determine the forage production and carrying capacity of the grazing land and to examine the impact of climate change on the pastoral resources in the area. The pasture evaluation assessed the floristic composition, pastoral productivity and carrying capacity of the rangeland. The survey study involved six focal groups where herders were requested to identify palatable and unpalatable forages, those threatened with extinction and others that appeared and disappeared in the area. The pasture evaluation identified 51 plants species belonging to 19 families with a soil cover of 82.33%. The Poaceae and Fabaceae families were the dominant plant encountered on the rangeland with a specific frequency of 49.53 and 19.21% respectively. The pasture productivity was estimated at 4.58T of Dray Matter per hectare and the hectare of pasture can accommodate 1.9 TLU per dry season (07 months) in Tandjilé Province without serious deterioration. The focus group of herders revealed that 31 plants species (60.78%) were consumed by cattle, while the unpalatable ones constitute 39.22% (20 species). The plants threatened with extinction identified include Andropogon gayanus, Zornia glochidiata and Eragrostida tremula, while the Cenchrus biflorus were consideredendangered and invasive plants an around the ferrick. The grasses such as Senna obtusifolia and Hygrophila auriculata had colonized the area. Flooding, encroachment of pasture area by crop farming and bush fires set by farmers to drive away rats and voluntary burning of crop residues to prevent their access to herders were the main causes of fodder deficit in the area.

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I. INTRODUCTION

The influence of climate change, population pressure on natural resources and misunderstanding remain a risk to agropastoral production (Blanche & Camille, 2011). The effects of climate change and demographic pressure would reduce the plant resources used by livestock, which are now in a process of accelerated degradation of grazing lands linked to the reduction of grazing space in favor of new housing estates and cultures. The impact of climate and population pressure together with misunderstandings between farmers and agropastoralists have effect on the extensive livestock farming in the province of Tandjilé.

Climate, characterized by the increase in temperature, the indeterminate precipitations which greatly bring about spatio-temporal variability causing floods and demographic pressure on the lands, impact on agropastoralism in the entire province of Tandjilé. In this province, crop and livestock production are the two "udders" of the economy, but they are facing major challenge on the management of space and natural resources. Growing demographic pressures and crop production in Tandjilé province has dramatically increased, while available grazing land decreased with disappearance of certain pasture plants.

Climate change is projected to have an especially negative impact on Africa. Nearly one third of the world 1.3 billion poor people live there, and 60% of them on livestock for some part of their livelihoods (Thornton *et al.,* 2002). The great majority of these people live in smallholder, rain fed mixed and pastoral systems (Godson-Ibeji, 2022).

With increased agricultural activities, animal husbandry in the province of Tandjilé would be strongly affected because of the reduction of grazing areas. Currently, more farmers and herders use the same land, making it very difficult for herders to find suitable grazing area during the rainy season (Oyama, 2014). Challenges to livestock production in term of forage availability in term of quantity and quality are enormous (Masikati, 2010).

Livestock play a major role in rural livelihoods and the economy of developing countries. They are providers of employment and income for producers. They are crucial asset and safety net for the poor, especially women. Livestock provides an important source of revenue for billions of rural and urban households (Muhammad, 2008). The impact of the livestock systems on resource-poor people is considerable. These impacts will be influenced by both the supply-sale shifts in natural resource use as well as in market-led demand changes. A group of people likely to be affected are those who depend on cropping and animal rearing, otherwise called the agro-pastoralists (Godson-Ibeji *et al.* 2022).

Agro-pastoralists are vulnerable to predicted changes in climate since they are impoverished and heavily dependent on natural resources. This is because, they occupy less productive lands which are often poorly developed and facing severe environmental degradation, shrinking resources and reduced transhumant mobility routes (Fekadu, 2013). The main source of feed for cattle is mainly fodders Kouassi *et al.,* 2010). The production of the herds, and sometimes even their survival depends on the quantity, quality and the continuity of feed resources (Bernard, 2001).

II. MATERIALS AND METHODS

The study was conducted in the Tandjilé province of Chad (GPS coordinates: 9° 39' 45° 25" N latitude and 16° 43' 24° 46" E longitude). Tandjilé is the 5th province (INSEED, 2014). Two methods were used to carry out the study. The first one included interview of the agropastoralists with regard to target plants species that are consumed by livestock. It consisted of verifying the information obtained from the field survey. These were later grouped into palatable plants that are threatened with extinction and plants that disappeared and appeared due to dispersal in the province of Tandjilé. In the second study the floristic inventory of forage and herbaceous species were conducted in a plot of 5 hectares (500 m x 100 m) of pasture area. A reconnaissance survey was conducted with the local pastoralists to obtain information about the various species within the experimental sites. Transects were established at 50 m intervals along each 100 m side. Intersection between transects of 50 and 50 m was used to place the 1m² quadrat and the forage species in the quadrat assessed. The plant species present in the quadrat were coded, categorized by species and recorded. A total of 20 quadrats were placed. At the end, the forage biomass found within the quadrats was harvested at 5 cm stubble height and thereafter hand separated into various species and types. Thus, the fresh forage samples were weighed immediately in the field using a 5 kg top load balance. The samples were dried at 65°C for 72 hours (AOAC, 2016) until a constant dry weight was obtained, after which the calculation of the production per unit area was done for the different measurements. The weight obtained were used to calculate the forage productivity. The collection of the first harvest of fodder was carried out in the rainy season from June, then at the end of July, August, September and October.

De Leeuw and Tothill (1990) assumed that 50% of forage productivity is used by the animals, other 50% are not desirable. However, Boudet (1991) recommended 33.3% useful materials under range condition. For this study, conservative carrying capacity of the forage resources was projected according to the following formula of Boudet (1991) on the basis of consumable biomass.

Where:
CC: Carrying Capacity
K: Usage rate (generally estimated at 1/3).

6.25: Daily consumption of dry matter of one Tropical Livestock Unit (TLU). A TLU is an animal weighing 250kg of body weight.

Vegetation cover was estimated from each quadrat to establish the area herbage percentage. The dominant species in the plots were also assessed. Records collected on botanical composition and vegetation scores were subjected to descriptive statistical analysis using Excel software.

The study of pastures in the province of Tandjilé determined the botanical composition (herbaceous and ligneous species) and established the species and herbage productivity needed for estimating the carrying capacity. This study also enabled us to compare information from the survey and range assessment, and relate it to the impact of climate change (using 30 years' rainfall and temperature records) on botanical composition, vegetation covers, forage yield and therefore help to make a future decision.

III. RESULTS

Floristic Composition of study area

The inventory of herbaceous vegetation enhanced the compilation of the floristic list according to the vegetation unit of the study area. A total of 100 plots of $1m^2$ each were harvested five times on 5 hectares. The yield from each plot of land was weighed and dried.

Fifty one (51) species from 19 families of plants were identified on the rangeland. Of the 51 species identified, 31 were recognized by agro-pastoralists as fodder plants consumed by ruminants particularly cattle, and the other 20 are not palatable to animals. The results also indicated that highly palatable forage species represented 60.78% of the available flora as cited by the agro-pastoral populations in the study area compared 39.22% that are unpalatable. All families of Poaceae identities were eaten by livestock. The results concerned only herbaceous plants and not woody ones.

Table 1: Distribution of Plant Species and Families Identified During the Pasture Assessment

Specie	Family	Frequency
Alicycarpus ingosus (Schum.)	*Fabaceae*	*1*
Alicycarpus ovalifolius (Schum.)	*Fabaceae*	*2*
Alysicarpus rugosus(Willd.)	*Fabaceae*	*5*
Cassia mimosoides (Lin.)	*Fabaceae*	*2*
Crotalaria retusa (L. A.)	*Fabaceae*	*1*
Senna obtusifolia (Sicklepod)	*Fabaceae*	*17*
Desmodium triflorum (L.)	*Fabaceae*	*4*
Indigofera pilosa (Poir.)	*Fabaceae*	*2*
Zornia glochidiata (Reich. Ex DC.)	*Fabaceae*	*1*
Sesbania cannabina (Retz.)	*Fabaceae*	*4*
Andropogon sp (Kunth)	*Poaceaee*	*11*
Andropogon gayanus(Kunth)	*Poaceae*	*7*
Andropogon pseudapricus (Sapf.)	*Poaceae*	*10*
Brachiaria lata (Schum.)	*Poaceae*	*2*
Brachiaria villosa (Lam.)	*Poaceae*	*3*
Bulbostylis hispidula (Vahl.)	*Poaceae*	*7*
Chloris pilosa (Hack.)	*Poaceae*	*2*
Digitaria argillacea (Hisch. Chase)	*Poaceae*	*5*
Dactyloctenium aegyptium L Willd.	*Poaceae*	*22*
Digitaria horizontalis (Willd.)	*Poaceae*	*2*
Digitaria pedicellatum (Trin.)	*Poaceae*	*03*
Digitaria sanguinalis (L.)	*Poaceae*	*1*
Eragrostida tremula (Schumach.)	*Poaceae*	*5*
Eragrostis teff (Zucc.)	*Poaceae*	*3*
Indigofera stenophylla (Guill. Perr.)	*Poaceae*	*8*
Ischaemum afrum (J. F. Gmell.)	*Poaceae*	*5*
Melinis repens (Willd.)	*Poaceae*	*1*
Penicetum pedicellatum (Trin).	*Poaceae*	*5*
Setaria pumila (Poir.)	*Poaceae*	*1*
Sida pradeepiana (Sp. Nov.)	*Poaceae*	*1*
Panicum virgatum (Swit.)	*Poaceae*	*10*
Oldenlandia corymbosa (L.)	*Rubiaceae*	*1*
Spermacoce chaetocephala (DC.)	*Rubiaceae*	*2*
Triumfetta rhomboidea (Jacq.)	*Tiliaceae*	*4*
Spermacoce radiate (L.)	*Rubiaceae*	*10*
Cyperus rotundus (L.)	*Cyperacea*	*1*
Scleria sphaerocarpa (E. A. Rob.)	*Cyperacea*	*2*
Indigofera dendroides (Guill. Perr.)	*Leguminosae*	*1*
Tephrosia bracteolate (Guill. Perr.)	*Leguminosae*	*1*
Lepidium sativum (Linn.)	*Cruciferae*	*1*
Biophytum unbraculum (K.)	*Oxalidaceae*	*1*
Bryoinia dioica (Jacq.)	*Cucurbitaceae*	*5*
Hexasepalum teres (Walter.)	*Rubiaceae*	*3*
Passiflora caerulea (Lin.)	*Passifloraceae*	*3*
Comelina nigritana (Var.)	*Commelinaceae*	*1*
Stigma hermonthica (Witch.)	*Orobanchaceae*	*1*
Tacca leontopetaloides (L.)	*Dioscoreaceae*	*1*
Arivela viscosa (L.)	*Cleomaceae*	*9*
Vitis vinifera (L.)	*Vataceae*	*3*
Walteria indica (L.)	*Malvaaceae*	*3*
Hygrophila auriculata (Schumach)	*Acanthaceae*	*19*

The frequencies indicate how many times the species was harvested from the plots.
The result of this study shows the presences of 8 families each represented by a single species.
The poaceae grass family had 21 species, and all are eaten by livestock according to the Agropastoralists.

The family of Fabaceae recorded10 species among which 6 species are eaten and 4 not eaten respectively.

Among the species identified, *Dactyloctenium aegyptium*, *Hygrophila auriculata*,*Spermacoce radiate* (L.), and *Senna obtusifolia* are the dominant ones. However, *Spermacoce radiate* and *Senna obtusifolia* are identified as unpalatable species by the agropastoralists.

In the Poaceae recorded family, a regular spatial distribution of plants was observed in 6 species, which include: *D. aegyptium A. pseudapricus*, *A. sp*., *A. gayanus*, *B. hispidula*, *I. stenophylla*.

Regarding the number of species, *Senna obtusifolia* is the most common in the study area.

Agropastoralists' Perception of the Quality of Forage Herbaceous Plants

The pastoral populations had different perceptions concerning the quality characteristics (digestibility and live weight gain) of the fodder. Based on their responses, the plants were grouped into palatable and unpalatable ones.

Palatable Plants

Out of 51 plants species identified, 31 were (commonly consumed) palatable by ruminant animals mostly cattle representing 60.78%. Table 2 presents the species, family and their palatibilty. *Alicycarpus ovalifolius, Zornia glochidiata, Andropogon gayanus, Brachiaria lata, Dactyloctenium aegyptium L Willd, Eragrostida tremula* and *Penicetum pedicellatum* were the most palatable. The moderately palatable species were those with two ++ and the remaining (+) were considered less palatable.

Table 2: Palatable Forage Species Grazed by Ruminants in the Study Area

Specie and frequency	Family	Palatability
Alicycarpus ovalifolius	*Fabaceae*	+++
Alysicarpus rugosus	*Fabaceae*	+
Cassia mimosoides	*Fabaceae*	+
Indigofera pilosa	*Fabaceae*	++
Zornia glochidiata	*Fabaceae*	+++
Sesbania cannabina	*Fabaceae*	+
Andropogon sp	*Poaceae*	+
Andropogon gayanus	*Poaceae*	+++
Andropogon pseudapricus	*Poaceae*	++
Brachiaria lata	*Poaceae*	+++
Brachiaria villosa	*Poaceae*	+
Bulbostylis hispidula	*Poaceae*	+
Chloris pilosa	*Poaceae*	++
Digitaria argillacea	*Poaceae*	+
Digitaria horizontalis.	*Poaceae*	+
Digitaria pedicellatum	*Poaceae*	+
Dactyloctenium aegyptium L Willd.	*Poaceae*	+++
Digitaria sanguinalis	*Poaceae*	++
Eragrostida tremula	*Poaceae*	+++
Eragrostis teff	*Poaceae*	++
Indigofera stenophylla	*Fabaceae*	++
Ischaemum afrum	*Poaceae*	+
Melinis repens	*Poaceae*	+
Penicetum pedicellatum	*Poaceae*	+++
Setaria pumila	*Poaceae*	++
Sida pradeepiana	*Malvaceae*	++
Panicum virgatum	*poaceae*	+
Triumfetta rhomboidea	*Tiliaceae*	+
Cyperus rotundus	*Cyperaceae*	++
Indigofera dendroides	*Leguminosae*	++
Tephrosia bracteolate	*Leguminosae*	+

+++ Very sought after by all animals; ++ sought after by all animals; + moderating consumed

Palatable Plants Threatened with Extinction

According to the respondents, some plants are threatened with extinction such as *Andropogon gayanus, Zornia glochidiata* and *Eragrostida tremula.* The result indicated that certain plants were only eaten after the first two weeks of germination. Others, on the other hand, are not consumed at all (table 3 and 4).

Table 3: Plants not Grazed by Ruminants in the Study Area

Specie and frequency	Family	Palatability
Alicycarpus ingosus	Fabaceae	*NO*
Crotalaria retusa	Fabaceae	*NO*
Senna obtusifolia	Fabaceae	*NO*

Desmodium triflorum	Fabaceae	*NO*
Oldenlandia corymbosa	Rubiaceae	*NO*
Spermacoce chaetocephala	Rubiaceae	*NO*
Spermacoce radiate	Rubiaceae	*NO*
Scleria sphaerocarpa	Cyperacea	*NO*
Lepidium sativum	Cruciferae	*NO*
Biophytum unbraculum	Oxalidaceae	*NO*
Bryoinia dioica	Cucurbitaceae	*NO*
Hexasepalum teres	Rubiaceae	*NO*
Passiflora caerulea	Passifloraceae	*NO*
Comelina nigritana	Commelinaceae	*NO*
Stigma hermonthica	Orobanchaceae	*NO*
Tacca leontopetaloides	Dioscoreaceae	*NO*
Arivela viscosa	Cleomaceae	*NO*
Vitis vinifera	Vataceae	*NO*
Walteria indica	Malvaaceae	*NO*
Hygrophila auriculata	Acanthaceae	*NO*

Biomass Productivity in the Study Area

The biomass productivity was obtained on five transects at different periods of emergence, (June, July, August, September and October, 2021) of the forage in the study area.

Table 4: Fresh Weight Biomass of Non-Palatable Plants Harvested in Study Area.

Month	Transect	Count	Wet weight (g)
20th Jun	1	20	4019
20th July	2	20	3712
20th August	3	20	7451
20th September	4	20	6717
20th October	5	20	4527
Total	-	100	26426

Table 5: Biomass Productivity and Carrying Capacity (Palatable Plants).

Month	Transect	Count	Fresh weight (kg)	Dry weight (kg)	Average dry weight/g/m²	Dry weight Average(kg/ha)	Month TLU Charge	Season LTU charge
20th June	1	20	13,483	4,186	209,3	2093	3,68	0,53
20th July	2	20	18,597	7,065	353,25	3532.5	6,22	0,89
20th August.	3	20	19,688	7,824	391,2	3912	6,89	0,98
20th September.	4	20	30,687	13,224	661,2	6612	11,64	1,66
20th October.	5	20	33,803	13,497	674,85	6748.5	11,88	1,70
Total	-	100	116,258	45,796	2289.8	22898	-	5,76
Average /plot	-	-	1,1626	0,45796	-	-	-	-

The herbaceous cover was found to be 79.15% in June, 83.4% in July, 84.45% in August, 93.61% in September and 94.23% in October respectively on the plots. This gives an overall recovery of 82.33%.

Considering the grazing period that spans from November to May, and the basic formula of Boudet (1991), the result of this current study shows a carrying capacity of 1.9 TLU per dry season (07 months) in Tandjilé Province.

Table 6: Quality of Forage in Study Area

Score	Percentage (%)	Appreciation
Very good +++	73.80	High productivity and excellent palatability
Good ++	85.85	High productivity and average palatability
Fair +	14.85	Average productivity and low palatability
Bad -	25	Not consumed by herds

From the result in table 6, it could be inferred that Tandjilé Province is endowed with high quality forages.

Table 7: Distribution of Species According Families of Forages in the Study Area

Family	Species Number	Percentage
Poaceae	21	45,32
Fabaceae	10	19,21
Cucurbitaceae	1	2,46
Cyperaceae	2	1,48
Rubiaceae	3	7,88
Tiliaceae	1	1,97
leguminosae	2	0,99
cruciferae	1	0,49
passifloraceae	2	1,48
commelinaceae	1	0,49
orobanchaceae	1	0,49
Dioscoreaceae	*1*	0,49
Cleomaceae	*1*	4,43
Vataceae	*1*	1,48
Malvaaceae	*1*	1,48
Acanthaceae	*1*	9,36
oxalidaceae	1	0,49
Total	51	100

Endangered and invasive plants in the Study Area

Although eaten by livestock, the Poaceae species *Cenchrus biflorus* were considered invasive around this ferrick. Generally the observations were made in ferricks where sheep are dominant. In case of the leguminous plants it was noticed a large colonization of the area by *Senna obtusifolia* and *Hygrophila auriculata*.

According to the study these plants are more invasive and occupy most of the forage space in the upland area of Tandjilean savannah.

Straw Residues Production in Study Area

The total biomass obtained from cereals and legume production is 66551 T. More than 2/3 of the production was wasted in bush fire, and others... Only 1/3 of the production was consumed by herds. This means that the production of useful crop residues for animals is equal to 22183.66 T in Tandjilé-est.

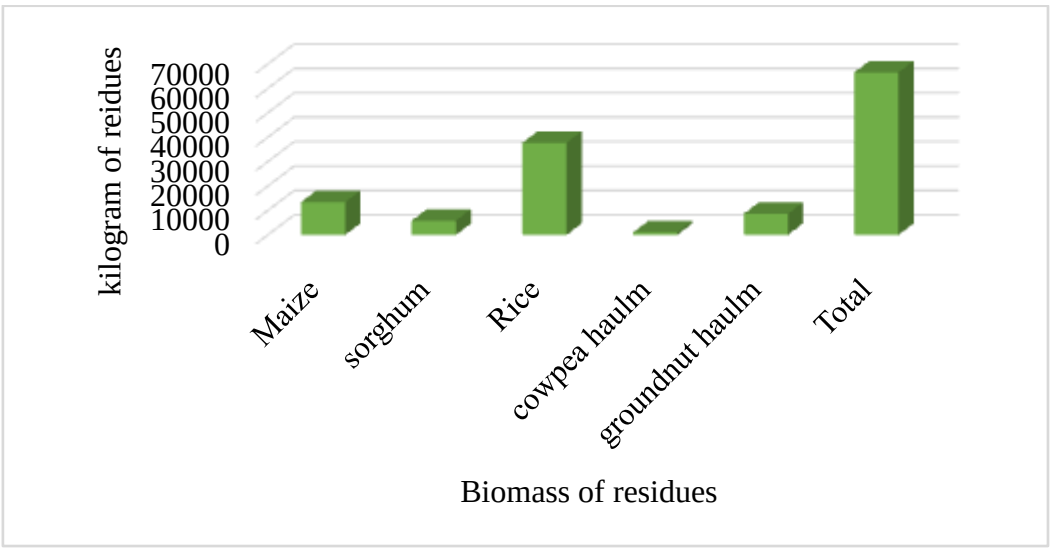

Figure 1: Straw Residues Production in 2020 (Source ANADER 2021).

Period of Forage and Straw

According to the results obtained from agropastoralists in Tandjilé province the availability of forage is variable and dependent on climate and likely human anthropogenic activity (bush fire). The critical period of unavailability of forage was observed in March, April and May. This is due to the fire bush caused in early December by herders and February by farmers for different reasons. The agro-pastoralists observed climate variability over the years in forage productivity in the study area.

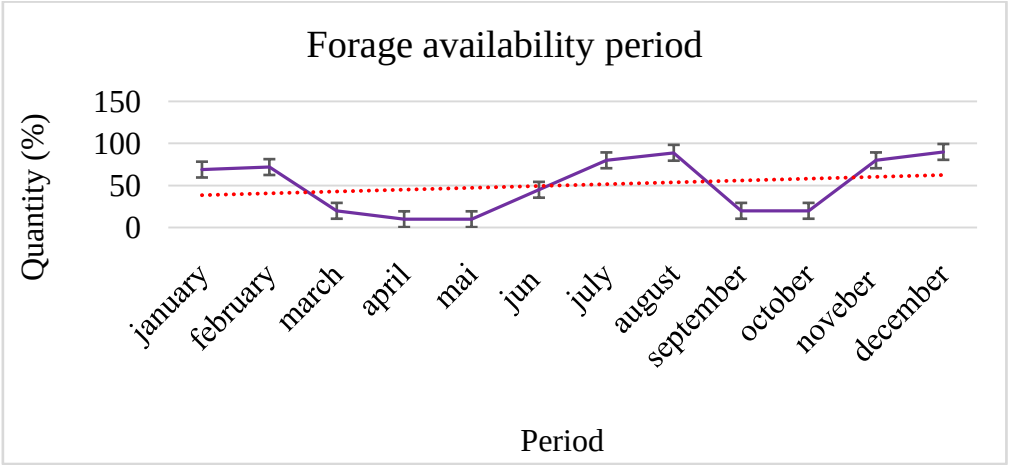

Figure 2: Seasonal Availability of Fodder in Tandjilé Province

In Tandjilé crop residues are available generally in November to February. The large quantity of rice straw is burnt by farmers and this reduces its accessibility to herder's cattle. In May to October because of rain and flood, crop residue is not available for animals hence they depend on natural forage.

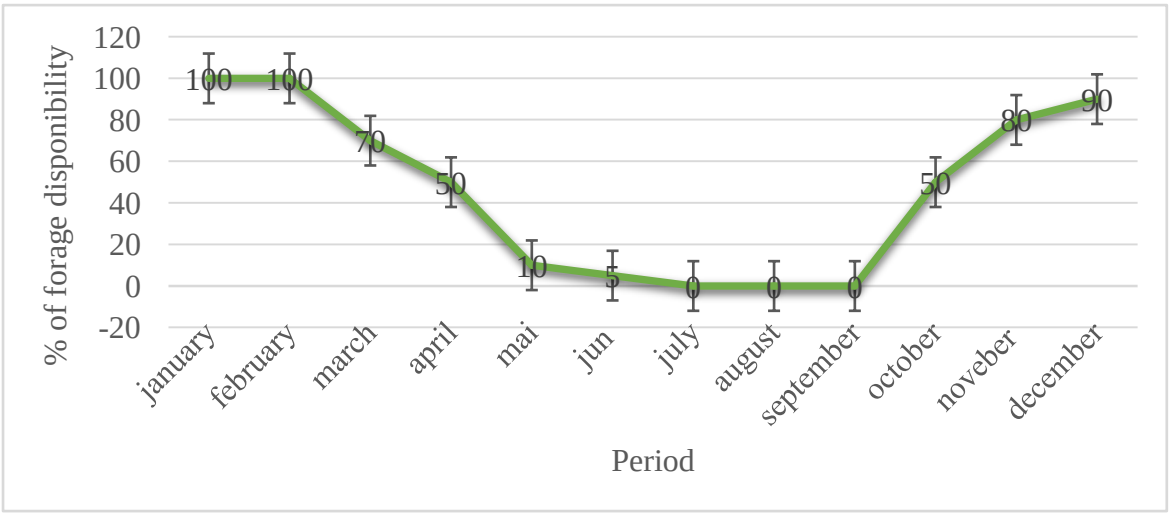

Figure 3: Availability of Rice Straw

Herbages Regrowth after Flood

After flood there is another herbaceous carpet which colonizes the plain. However the species that compose this flora are the aromatic plants that are majority not usually consumed by the animals. These species cover the ground and are heat resistant until the rainy season.

Impact of bush fire passages

Generally in the province of Tandjilé there are early bush fires between November and December. The bush fires are caused by transhumant pastoralists who arrive very early in recent years.

According to the agropastoralists interviewed bush fires facilitate the passage of cattle in the grassy savannahs that hide poisonous reptiles but also cause the regrowth of new pastoral plants.

Some of agropastoralists and farmers take crop residues home for use by animals. Others burn the residues to prevent access to the transhumant herders who are considered by farmers as destructives and confrontational.

After January, there are no more fodder plants available and the period of shortage of pasture starts in mid-February. Agropastoralists use the conserved crop residues to feed their animals and sell surplus. Transhumant herders are forced to resort to aerial pastures, i.e. woody species that are cut down in an uncontrolled manner. During this critical period, there is also a rise in heat which reduce the productivity of the animals.

According to the result of the survey of agropastoralists estimated the rate of loss of rice straw at 2/4 by destruction of fires in Tandjilé Province.

It was revealed that the fodder deficit had three causes: flooding, the encroachment of pasture areas by cropping the bush fires that farmers set to drive away rats and game and the fire set on the crop residues to prevent pastoralists having access to them.

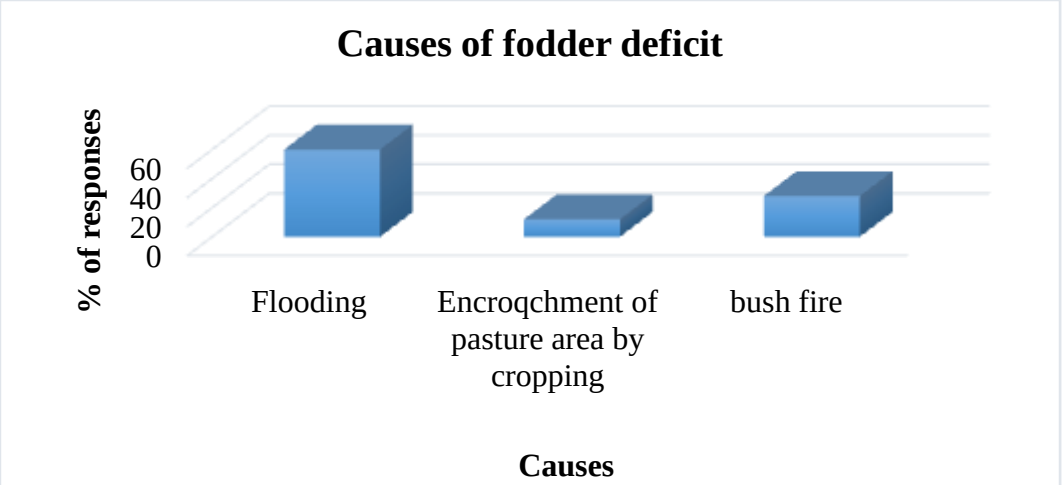

Figure 4: Causes of Fodder Deficit.

"Crop residues were abundant in the past, but presently farmers collect and burn them mainly to prevent our animals from consuming" hinted the agropastoralists during the focus group interview at Milmil.

IV. DISCUSSION

The rangelands are not generally poorly and degraded. The results obtained during the surveys and examination of the plant composition in the study area corroborate with this qualification. Very palatable forage species represent 61.22% of the available flora as cited by the agropastoral populations of the study area while 38.78% are unpalatable. The Poaceae grass family had 20 species that are eaten by livestock. The family of Fabaceae recorded 10 species among which 6 species are eaten while 4 were not palatable. According to Fournier (1991) and Cesar (1992) the condition of a pasture depends on the proportion of grasses, the most productive species and the ones consumed by livestock. According to Garde and Senn (1991) the presence of non-forage species in a range leads to a decline in its pastoral value.

All families of Poaceae identified are eaten by livestock. The values (60.78%) are slightly higher than those of Hoffmann, (1985) who got 50.5%; Kouassi et *Al.*, (2014) 50%.

Among the species identified, *Hygrophila auriculata*, *Spermacoce radiate* (L.), and *Senna obtusifolia* are the dominant ones. However, *Spermacoce radiate* and *Senna obtusifolia* identified are unpalatable according to the herders. In the Poaceae family, a most regular spatial distribution plants 6 species were identified. In terms of numbers, *Senna obtusifolia* is the most common in the field. This indicates a high rate of consumption of Poaceae families.

Indeed, the size of the sedentary herd and the transhumant animals in the area can explain the phenomenon of overgrazing.

Agropastoralists perception of feed resources in the study was good. However, in most cases, perception varies from one herder to another. Agropastoralists have a good idea of the current state of resources and its evolution over time and space. The quality of vegetation and rate of regeneration are strongly dependent on rainfall.

In recent years the rainfall has been good but has led to the destruction of the significant quantity of fodder, especially herbaceous ones. Over the last ten years, the annual rainfall has been good in the province of Tandjilé, despite its poor distribution in space and time. More flood events were experienced and this result in significant destruction plant biomass that constitute an essential livestock feed resource.

According to the respondents, some plants are threatened with extinction including *Andropogon gayanus, Zornia glochidiata* and *Eragrostida tremula.*

Although eaten by livestock, *Cenchrus biflorus* of the Poaceae family is considered an invasive species in the ferrick. This is phenomenon is common in the ferricks where sheep are dominant. Regarding leguminous plants, large colonization by *Senna obtusifolia* and *Hygrophila auriculata w*as observed in the area. Accordingly these plants are more invasive and occupy most of the forage space in the upland area of Tandjilean savannah.

The productivity of the entire study area in Tandjilé province is on average of 4.58 T DM/ ha. The result was higher to those of other researchers which various from 2.3 to 4.36 T DM/ha (Ngom *et al.*, (2012) in Senegal, Akpo (1998), and Lougbenon *et al.,* (2012) in Benin Republic.). However, the finding was within the range reported by Achard (1992) who conducted a pasture evolution study in Burkinabe savannahs and obtained a biomass production fluctuating between 2.3 and 5 T DM/ha in tropical zone. Kouassi *et al.*, (2014) found 0, 96 TLU/ha less than the result of this study. This value was less than finding of this study that showed a carrying capacity of 1.9 TLU/ha in Tandjilé Province.

In terms of specific species contribution, the result of this study identified 51 species and 19 families of plants. This is less than those of Kouassi *et al.* (2014) who reported 63 families and 190 species.

In Tandjilé province, forage availability is variable and depend on the climate and human anthropogenic activity (bush fire). The critical period of forage scarcity was observed in March, April and May. This is due to the bush fire incidence early in December by herders and February by farmers, for different reason. The agropastoralists observed climate variability over the years in forage productivity in the study area.

In Tandjilé crop residues are available generally in November to February. The large quantity of rice straw is burnt by farmers to prevent its accessibility to herder's cattle. Between May to October flood causes reduction of crop residues and fodders for livestock feeding.

V. CONCLUSION

The inventory of herbaceous vegetation was revealed by the floristic list per unit of the study area.

Pastoral populations had different perceptions of the beneficial effects of the quality of fodder available for livestock feeding. A total of 51 species were identified with 19 families within Fabaceae and Poaceae as the most predominant. These species and crop residues are the most available feed resources.

Fodder productivity represents on average one hectare of pasture for 1.9 TLU (Tropical Livestock Unit). According to the result, Tandjilé province plays an important role in cattle production. This area suitable for large-scale cattle production provided that the feed resources would be improved. The use of rangelands for arable crop production and residential purpose should be regulated by the relevant authorities.

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