Nutritional characterization of major feed resources under the current climate changing conditions in Lume District of East Shoa Zone, Ethiopia

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ABSTRACT

The study was conducted in Lume district of the East Shoa Zone Oromai Region, Ethiopia, with the objective to assess the existing status of major feed resource and their chemical composition under the current climate changing and examine chemical composition. Eighteen (18) feed sample from grazing lands (protected communal (PC), protected private (PP) and unprotected communal (UnPC), and Twenty-four (24) major crop residues (CRs) were used for chemical composition analysis from different Rural kebeles. Out of 16 herbaceous species,Andropogonabysincus and Cynodondayctilon were the dominant grass species in Lume district. The mean DMY (ton ha^{-1}) of grass obtained from PPGL (2.62) and PCGL (2.9) was significantly (P<0.001) higher than that from UnPCGL (1.5) in Lume district. The mean value of CP contents of CRs in Lume district ranged 3.99±0.13 for wheat straw (WS) to 5.9±0.40 for haricot bean straw (HCB). The NDF content of CRs ranges 68.89±0.89 for HCB to 74.6±1.15 for maize stover (MS) in Lume district. The ADF contents of CRs varied from teff straw (TS) (41.8±1.63) to HCB (56.04±1.04) in Lumedistrict.Generally, the nutritive values of the evaluated feed resources were lower than the minimum and should supplement with protein and energy source.The analysis of meteorological data of 30 years of study district indicated that; as temperature increase, the annual rainfall decrease and increases the rate of crop water use. This situation of climate change affects directly or indirectly the nutritive values and yields of crop, natural pasture, and production and productivity of livestock and it will suggested that to study the effects of climate on soil and animal feed nutrients.As grazing lands are shrinking from time to time-intensive pasture or forage development strategies especially in areas where dairy and fattening activities practiced should be a crucial.Effects of season and or environmental factors on species variability and productivity of forage and nutrient composition of available feed resource should be evaluated per five year.

Keywords: *-Crop residues, grazing land, herbaceous species, natural pasture, nutritive value.*

INTRODUCTION

Ethiopia was an exceptional with a huge and wide range of natural resource and diverse agro-ecological zones. These potentials make the country well known as a reservoir area for animal genetic diversity (Hussen *et al*., 2015). The Ethiopian country livestock sector contributes about 15 to 17% of gross domestic product (GDP), 35 to 49% of agricultural GDP, and 37 to 87% of the household incomes (behnke & Metaferia, 2011). The estimate of livestock population in the country stands at about 59.5 million cattle, 30.70 million sheep, 30.20 million goats, 2.16 million horses, 8.44 million donkey, 0.41 million mule, 1.21 million camels, 56.53 million poultry and 5.92 million beehives (CSA, 2020). Despite high livestock population and the existing favorable environmental conditions, the current livestock contribution is below its potential due to various reasons (Berhanu, 2009). Seasonal feed shortage and fluctuation of rainfall, poor grazing land management, conversion of grazing lands in to croplands, inefficient utilization and poor conservation practices of feed resource as well as increased human population are the major problems affecting livestock productivity (Ulfina *et al*., 2013; Endale *et al* 2016; Gelayenew*et al.*, 2016). These problems leads to low dry matter yield (DMY), which results in to a critical shortage of animal feed, below the maintenance requirement of livestock throughout the year (Ertiro*et al*., 2013).

Crop residues are fibrous and high in lignin, and low in essential nutrient (proteins, energy, minerals, and vitamins) contents that limit the feeding value, and they generally have low digestibility and intake (Adugna, 2009). The majority of agriculture in Ethiopia was constrained by climate change (Diressa *et al*., 2008). During extended dry season and drought, very often, there is a critical decline in quantity and quality of feed and shortage of rainfall leads to decreased productivity and increased mortality of animals (McDoland *et al*., 2012). To optimize the use of low nutritive values of roughage in a sustainable manner, it is important to quantify the nutritional composition of the feedstuff (Endale*et al*., 2015). Such information is vital to adequately assess the feeding values of available forages and identify possible limiting nutrients, based on which a suitable grazing land management (Sternberg *et al*., 2000) and a feasible supplementation strategy can be implemented (Huston *et al*., 2009). To obtain good quality in animal production and productivity, an assessment on the types and sources of livestock feed, total DM production of the area and livestock feed requirement is crucial (Endale*et al*., 2015). However, there is no recently research activity undertaken in the study district regarding the pattern of utilization, biomass production, and status of grazing land under the current climate change and chemical composition of major available feed resources. In this regard, identification of feed resources and assessment of opportunities and constraints associated with livestock feed resource are preconditions for designing suitable livestock development strategies. Such studies had not been recently carryout in Lume district. Therefore, the current study were designed to assess the status of major feed resources under the current climate change and evaluate its nutritional quality during wet and dry seasons, and to assess the challenges and opportunities of livestock feed resource in relation to the current climate change.

MATERIALS AND METHODS

Description of the study area

Lume district is located at the altitude of 1604-2364 m.a.s.l and lies between 8^0 35’ N latitude and 39^0 10’ E longitudes. It receives an annual rainfall of 1065 mm with the minimum and maximum of 800 and 1400 mm, respectively. The average temperature varies between 18-28.7^oC with surface area of about 709.85 square kilometers and found 20 km from Adama and 75 km from Addis Ababa toward the Eastern part of the country on the main road to Djibouti. The agro-ecology of this district was classified as Moist WoinaDega (30%), WoinaDega (45%), and Kola (25%)(LDLHB, 2018).Lume district has a total land mass of 80220 ha. Of the total land mass, about 54.3% (43559.46 ha) of lands was arable or cultivable, 3% (2406.6 ha) pasture, 2% (1604.4 ha) forest, and the remaining 20% (16044 ha) is degraded or otherwise unusable in the district and vegetables are an important cash crop (LDLHB, 2018). .

Study population, sampling procedures and data collection

To select the specific study sites from Lume district, discussions were held with district livestock experts and secondary information from district and Zonal Agricultural and Rural Development offices was utilized to assist in the selection of RKs. Then, six representative rural kebeles (RKs) were selected from Lume district. Descriptive cross-sectional study was conducted in order to assess major available feed resource and quantity during wet and dry season, feeding system, and its constraints, effects of climate change on animal feeds and coping strategies.

The grazing lands were classified by grazing types as protected communal grazing (PC) which is called also enclosure area, protected private (PP), and unprotected communal (UnPC) grazing land (GL) in selected study RKs of the district. Feed samples from natural pasture were collected by using 0.25 m^2 quadrates at a distance of 10 km between the grazing sites (ILRI, 2005). From each of the grazing site, three samples were taken from different areas that are 10 m far apart from each other using 0.25 m^2 quadrates, mixed, and a composite of one sample per site (kebele) was taken. Hence, the total samples from the grazing lands were 18 from the district (that is one sample per grazing type *three grazing type per rural kebele * six rural kebele), and a total of 18 samples were taken from the district. Sampling was conducted from August 15 to October 20 when almost all the pasture plants were fully grown to over 50% of flowering stage.

Herbaceous composition and dry matter yield estimation of grazing land

Immediately after harvesting, the total fresh weight of the samples were measured using a sensitive balance and the herbaceous species composition with regard to relative proportion of the grasses, legumes, and other weeds/forbs on weight basis was determined by relating the weights of each group to the weight of the whole samples (ILCA, 1990). The dry weight rank (DWR) procedure (Tothil, 1978) that involves cutting and sorting by hand were used to measure percentage proportion of each forage type according to the following formulas.

$$\text{TDW of species} = \frac{\text{TFW of a species}}{\text{SFW of a species}} \times \text{SDW of a species} \text{---------} (1)$$

$$\text{\% proportion of species} = \frac{\text{TDW of a species}}{\text{GTDW}} \times 100 \text{----------------} (2)$$

Wher: TFW =Total fresh weight of individual species,

SFW = sub-sample fresh weight,

TDW= Total dry weight, SDW=sub-sample dry weight, and

GTDW=Grand total dry weight.

The average dry weight of the pasture samples per quadrates were calculated, which then extrapolated into dry matter yield (DMY) per hectare. The DM output from grazing land was estimated by multiplying the area of grazing land by 2.0 tons ha^{-1}, which was determined by this study as describe earlier. For the other land, use types, such as tree/shrub/wood and other forest areas were estimated by multiplying the area of land by 0.7 tons ha^{-1}(FAO, 1987; MOA, 2010).The interviewed household heads identified the pasture species present in the selected site, the abundant feed type that preferable by livestock, and the droughts tolerant species. The botanical compositions of herbaceous species (local and scientific name) were identified in the field using key pastoralist and farmers, researchers, and technical experts (range expert) being assisted by guidebooks(Ahmed &Abule, 2006).

Dry matter estimation from crop residues

The quantity of available crop residues on DM basis were estimated from the total crop yields of the households, which was obtained during the interview, using the conversion factors that were developed (FAO, 1987) for Ethiopia condition. The conversion factor used for wheat, barley, and *teff* straws, and faba bean and field pea were 1.5 and 1.2, respectively (FAO, 1987). Whereas, a multiplier of 4.0 for linseed (FAO, 1987), 2.0 for maize (De Leeuw, 1990), 2.5 for sorghum (Kossila, 1988), and 0.5 for crop aftermath (FAO, 1987; MOA, 2010) were used to obtain DM yield of the feed produced from these straws. The total quantity of potentially available crop residues for animal consumption were estimated by multiplying the crop residue yield by 90% assuming that 10% was used for other purposes such as for fuel and wastage that occur during feeding. The daily dry matter requirement for maintenance of one TLU was estimated to be 2.5% of the body weight (Gryseels, 1988) that is 250 x 2.5%=6.25kg/day/animal or 2.28 ton DM per year (2281kg year^{-1} animal^{-1}). Data of livestock population in the sampled households was obtained from the interviewed household heads during the survey and from livestock and fisheries office. The number of livestock population was converted into tropical livestock units (TLU) using the conversion factors (Gryseels, 1988;Bekele, 1991).

Retrospective status of climate condition

Among the households selected for an interview, 12 individuals per district having knowledge on climate change and its effect on livestock were taken based on the suggestion of expertise and the community and in-depth information was collected using interviewing these key informants. Some of the current situation of feed resource as compared to previous years, challenges of climate change on livestock and feed resources, and existing coping mechanisms were gathered by interviewing participants' and through field observation as well as from relevant available data at the Offices of the District and Zone. The climatic (rain fall and temperature) data of (1987-2017) 30 year for Lume district were also collected from the meteorology stations of the Zone (Adama metrological station) and recorded on Microsoft office excel to show trends and compare with the perception of the respondents.

Chemical analysis of major feed resources

Representative feed samples during wet season from different grazing type were harvested at height of 0.5 cm above the ground from Lume district and major crop residues from crop cultivation were sampled purposively from crop fields. Accordingly, 42 representative feed samples, 18 from natural pastures, and 24 from major crop residues were taken from the study district. About 1/3 of the samples of the herbaceous species and about 300 g samples of major crop residues were thoroughly mixed and ground for chemical analysis. The samples were oven dried at 65^{O}C for 72 hours and ground in Willey mill to pass through 1mm sieve and allowed to equilibrate at room temperature for 24 hrs. Dry matter and ash contents of feed samples were determined by oven drying at 105^{O}C overnight and by igniting in a muffle furnace at 600^{O}C for 2 hour, respectively (AOAC, 2002) (%DM= DW/FW x 100). Nitrogen (N) content was determined by Kjeldahl method (major feed have 16% N which means 100/16=6.25N) and CP was calculated as N*6.25 (AOAC, 2002) in Batu soil laboratory Research Center, and then taken to Hawassa University of Animal Nutrition Laboratory to determine ADF, ADL, NDF and IVDMD by the modified Tilley and Terry method(Van Soest and Robertson, 1985).

Data management and statistical analysis

The data was organized and analyzed by Statistical Package for Social Sciences (SPSS, 2017). Descriptive statistics such as frequency, means, percentages, and standard error of the means were used to present the results of households' response. All data obtained from chemical analysis of the feeds including dry matter yield of each species from the grazing site were analyzed by one way analysis of variance (ANOVA) employing the General Linear Model (GLM) Procedure of SAS (2013). When significant differences between means were detected at $P<0.05$, the Tukey'sStudentized Range (TSD) test was used to separate the individual means. The major livestock and grazing land constraints were summarized by index ranking methods and Index ranking method (weighted averages) was used to obtain the major livestock production and grazing land constraints in the study area (Musa et al., 2006).

RESULTS AND DISCUSSION

Major feed resources and feeding systems

Among the feed resources crop residues, natural pasture, and aftermath were the main livestock feed resources contributing the largest feed in the study area for cattle and sheep, which was in line with the reports from other highland areas of Ethiopia (Tesfaye, 2016). Accordingly, respondents indicated that the major feed resources during dry season for cattle were crop residues (61.67%), aftermath (16.67%), concentrate (13.3%)), and hay (8.33%) and during wet season natural pasture (46.67%), crop residues (36.67%), and concentrate (16.67%), respectively. Generally, in terms of availability respondents indicated that livestock feeds in the wet season were adequate (16.67%), abundant (38.3%), and inadequate (45%), and during dry season were adequate (40%), abundant (13.3%), and inadequate (46.7%), respectively showing that the available feed resource is not adequate at any season in the study area. This result is in agreement with the other research findings reported by Elias *et al*. (2009).

Estimation of total annual feed production

In Lumedistrict about 4813.2 tons per year of total DMY from natural pasture and 1123.08 tons of feed dry matter from the total 1604.4 ha area of land covered by forest/degraded/enclosed were produced (Table 2). Generally, from different grazing and enclosure area of land a total of 5,936.28 tons DM yield per annual were produced in the district.

Table 1. Estimation of dry matter yield from grazing land managed in different ways

Land use type	Area of land (ha)	Conversion Factors	Total DMY (ton ha^{-1})
Grazing lands (protected private and communal) and unprotected communal grazing	2,406.6	2	4,813.2
Enclosure area of Shrub/tree lands and other forest	1,604.4	0.7	1,123.08
Subtotal			5,936.28

DMY=dry matter yield

The average mean dry matter yields (ton ha^{-1}) of grass, legumes, and forbs obtained from PPGL, PCGL, and UnPCGL were shown (Table2). No significance difference ($p>0.05$) on mean DMY of grass from PPGL and PCGL in the district. The DMY of grass obtained from PPGL and

PCGL was significantly (P<0.001) higher than DMY obtained from UnPCGLin the area and the average mean dry matter yield of legumes obtained from PPGL, PCGL, and UnPCGL has no significance difference. In addition, the DMY (ton ha^{-1}) of forbs 0.41, 0.49 and 0.27 tons ha^{-1} in Lume obtained from PPGL, PCGL, and UnPCGL, respectively. This result agree with the reports of Gizachew (2009) and Lelisa and Mengistu (2020) that, rapid spread of invasive species into the traditional grazing lands and become the major threat to livestock feed resource (Alemeyehu 2006). The highest proportion of grasses (66.87%) and legumes (23.66%) species were obtained from protected communal (enclosure area) and protected private grazing land in Lume district respectively. The higher share of grasses species observed in Lume district agrees with that reported by Teshome (2017) and Lelisa&Mengistu (2020). Sixty (16) herbaceous species were identified in the district. Among the identified grass species, the dominant were Andropogonabysincus and Cynodondayctilon. From legume local clovers (Trifolium species), Desmodium (Grean and Silver) species, Indigoferaspinosa, and from forb/weeds Leucasmartinicensis, Psydraxschimpefiana, Crotalaria spinosa and Hygrophillaschulli were identified.

Table 2. Mean DMY (ton ha^{-1}) and species proportion (%) from different grazing land

Grazing types	Mean DMY (tonha^{-1}) of herbaceous species			Total DMY (tonha^{-1})
	Grass	Legumes	Forbs	
PPGL	2.615^{a} (65.88%)	0.939(23.66%)	0.415^{ab} (10.46%)	3.969
PCGL	2.907^{a} (66.87%)	0.95(21.85%)	0.49^{a} (11.3%)	4.347
UnCGL	1.54^{b} (66.16%)	0.518(22.25%)	0.27^{b} (11.6%)	2.328
Overall mean	2.35	0.8046	0.39	
CV (%)	14.42	48.23	34.15	
P-value	<0.0001	0.1199	0.0347	
Sign	***	NS	*	

*PPP=protected grazing land; PCGL=protected grazing land; UnPCGL=Unprotected communal grazing land; CV=Coefficient of variation; NS=non-significant; *=significance at (P<0.05); **=significant at (P<0.001) across the column, DMY=dry matter yield*

The majority (62%) of respondents indicated that, the size of the current grazing land size was decreasing from time to time and the composition of herbaceous species were dominated with less palatable plant species, which is an indicator of declining grazing land productivity in the study areas. The major reasons for shrinking were due to the expansion of crop cultivation, increased population density, expansion of investments, and land degradation (Table 3). This current finding agrees with the reports of Amaha and Belaynesh(2004) that the grazing areas were converted into cropland due to rapid population growth. This result is similar with the reports of Yoseph (2007). According to key informants and group discussants the overall consequences of feed shortage were observed by weight loss/body condition, weakness of draft animals, low milk yield, increased mortality of young animals, retarded growth. They also indicated that to overcome feed shortage during critical season of the year, livestock producers in study district conserved crop residues as a major strategy to overcome feed shortage. This current result agree with the reports of Samuel *et al.*(2008) who found that about 94.8% of the farmers practiced feed conservation as a major strategies to overcome feed shortage.

Table 3. Status of grazing land and reason for shrinking grazing land in the study district

Reasons	Number of respondent by rank					F-sum	Index	Rank
	1	**2**	**3**	**4**	**5**			
Expansion of crop land	24	8	4	17	7	205	0.2329	1
Reduction of livestock numbers	0	7	12	10	33	117	0.1329	5
Land degradation	5	15	12	20	8	169	0.1920	4
Increase population density	9	23	10	13	5	198	0.225	2
Expansion of investment	12	10	22	9	7	191	0.2170	3
Total						880	1.00	

A total of 256,238.47 tons of crop residues were produced from different crop types in the district (Table 4). The proportion of crop residues of the current study in the area as animal feed is higher as compared to other feed types (like natural pasture) in that district.

Table 4.Total DM production of crop residues and aftermaths from cultivated lands (Total cultivated land size in ha 43559.46)

Crop type	Total land cultivated (ha)	Total Grain yield (qt/ha)	Conversion factor (CF)	Crop residues yield in tones on DM basis
Teff	20573.68	63746.87	1.5	92581.56
Wheat	11551.68	4440	1.5	6660
Haricot bean	5230.34	1038.6	1.2	1246.32
Bean/ Pea	2177.97	4323.8	1.2	5188.56
Barley	1307.6	3892	1.5	5838
Maize	1764.8	70592	2.0	1,41184
Sorghum	177.02	1416	2.5	3540
Total crop residue produced from the grain				256238.47
Aftermath produced from all area	43559.46		0.5	21779.73
Total feed produced from crop residue and aftermath				**278018.2**

The total estimated annual available feed supply and estimated total requirement for maintenance based on livestock populations in TLU (tropical livestock unit) in district were calculated to be 283954.5 and 363952.21 tones in DM basis, respectively. Thus the total estimated annual feed supply in the district can only meet about 78.02% DM requirement for maintenance that resulted in low production and productivity.The feed deficit encountered in the area might be associated with low DMY from different available feed resources. The current study result agrees with earlier work reports of Dawit*et al*. (2013) that noted quantities of available feed resources were very low and do not supply annual dry matter required by livestock. Therefore, strategic intervention in feed production and matching of livestock number with the available feed resources required.

Chemical composition and digestibility of major feed resource

Wheat straw has the highest ash content followed by *teff* straw and this value higher than that reported by Mekuanint&Girma (2017) (9.34%) and Solomon (2004) (8.22%). The average mean ash content of maize stover recorded in the present study was far greater than the result reported by Yitaye (1999), which was 7%. The ash content of all evaluated crop residues and natural pasture were not difference ($p>0.05$) except wheat straw in Lume district had highly significant ($p<0.001$) than the other evaluated feed resources. The variations observed may be associated with environmental factors, crop management practices, and varietal difference of the crops under production, soil character, and contamination of the residues by other external factors.

The average mean value of CP of *teff* straw, maize stover, and wheat straw recorded in the current study agreed with that reports of Solomon (2004), Ahmed and Abule (2006). The current result of CP value obtained from crop residues were lower than the minimum level of nitrogen (7%) which limit feed intake (Van Soest& Robertson, 1985). The mean value of CP content of haricot bean straw obtained was significantly higher ($P< 0.001$) than that of the other crop residues in study district (Table7). This is due to the high nitrogen content of the pulse crops as they are legumes. The CP value of wheat straw was higher than the previous reports of 2.4% (Seyoum*et al*., 2001) and 2.7% (Geshaw, 1992). This may be due to varietal differences and variation in management practices as well as soil fertility of the areas.The mean value of CP contents of natural pasture harvested at blooming stage obtained from unprotected communal grazing land was significantly ($P<0.05$) lower than that from protected communal in Lume district ((Table7). The CP values from natural grasses obtained in Lume district was closer to the minimum value (7%) reported by Milford and Minson (Milkford & Minson, 1966) and Van Soest(1994) required for optimum rumen microbial function, hence, can support maintenance requirement of ruminants with slight supplementation.

The mean value of neutral detergent fiber (NDF) contents of maize stover, *teff* and wheat straw of the current study were lower than the NDF contents of maizestover (82.13%), *teff* straw (81.5%) and wheat straw (78.6%) reported by Chalchisa*et al*.(2014). The current result of NDF value of cereal crop residues agree with the reports of Alemu*et al*.(1989) who indicated that NDF contents of crop residues were greater than 70% and 72.98 to 79.4%, respectively. The NDF contents of natural pasture of the current study were lower than 74.1% in dega and 75.54% in weinadega reported in earlier studies by Dirshaet al. (2018). The higher NDF content could be a limiting factor on feed intake, since voluntary feed intake and NDF content are negatively correlated Ensmingeret al. (1990). The NDF contents of crop residues and natural pasture in this study were beyond the limit of 65% and this may be due to growth stage and temperature affecting the balance between photosynthesis and respiration and, hence could limit DM intake

(Van Soest, 1967). Therefore, there was a need of adjustment of NDF in an available feed resource in the study area.

The ADF content for crop residues of the current result were within the range reported by Ahmed and Abule(2006) and Solomon *et al.*(2008). The mean value of ADF contents of natural pasturewere lower than that reported by Ahmed and Abule (2006), but in line with the reports of **Dirsha*et al*. (20018).**The ADF content of maize stover of the current study were greater than that reported by Chalchissa *et al*.(2014) (51.72%) and **Dirsha *et al.*(2018)** (47.6%). Whereas the ADF content of *teff* straw (46.8%) and wheat straw (58.1%) reported by Chalchissa *et al.* (2014)was higher than the results of the current study for wheat straw in Lume district. These variations in ADF contents of crop residues were associated with the differences in temperature, varietal difference, crop management, and soil type. High ADF contents in crop residues might be associated with lower digestibility since digestibility of feed and its ADF were negatively correlated with the reports of McDonald *et al*. (2012).Kellems and Church (1998) categorized roughage with less than 40% ADF as high quality and above 40% as low quality. Therefore, the ADF contents of all evaluated major feed resource were categorized under low quality with exceptional (40.42) ADF contents of natural pasture in Lume district.

The contents of Acid detergent lignin (ADL) in haricot bean straw was significantly (P<0.05) higher than in the *teff* straw and maize stover in Lume district. This indicates that, the existence of large differences in lignifications between crops residues of cereals (monocotyledons) and legumes (dicotyledons). The lignin content of haricot bean straws found in the current result in the study districts were lower than the results of 12.72% for pulse crops reported by chalchisa*et al*. (2014) and 15.42% reported by Ahmed and Abule(2006).The mean value of lignin contents in maize stover of the study area was greater than the value of 7% that limits DM intake reported by Reed *et al*.(1998). However, the lignin content of maize stover of the current study was lower than 10.59% reported by Dirsha*et al*. (2018). The mean value of ADL contents of natural pasture of the current study was lower than the critical level (7%). The mean value of ADL contents of natural pasture (6.53) in Lume district were lower than that reported by Ahmed and Abule(2006). The ADL contents of natural pasture of the current study were lower than 7.69 and 7.87% dega and weinadega agro-ecologies, respectively reported by Dirsha*et al.*(2018).

The IVDMD for maize stover in study district shown in table(7) were lower than the value reported for maize stover (58.65%) by Chalchissa*et al.*(2014). The mean value of IVDMD of the current study for wheat straw (45.55±1.94) in Lume district was higher than the value of cereal straws recorded in Gassera (41.92%) and Ginnir (42.22%) districts (Solomon, 2004), but in line with the IVDMD obtained in ATJK (41.94%). The IVDMD obtained in *teff* straw (45.64±2.07) in Lume district of the current study agree with the report of Gashu*et al*. (2017) (45.08%). The mean values of IVDMD for cereal crop residues were lower than the minimum level required for quality roughages reported by Seyoum and Fekede, (2008). The IVDMD for crop residues collected from study district were not difference ($p<0.05$) among feed types. Lower IVDMD values were observed in cereal crop residues, which are likely associated with their higher lignin content compared to the other feed resources. The lowest mean value of IVDMD was obtained from unprotected communal grazing land. This difference may be due to overgrazing, few or no palatable, legume species composition, and higher unpalatable species indicating the degradation of grazing land. With the exception of the average mean values of IVDMD of natural pasture harvested from protected communal, private grazing land, and haricot bean straw, crop residues from the other crop were poor in quality. Generally, according to the current result, the nutritive value of the major feed resources evaluated were lower than the minimum requirements and this difference may be due to variety, location, and stage of maturity, and as well as environmental factors. The current result agree with (Adugna, 2008; Lelisa&Mengistu, 2020) who reported high fiber and low crude protein contents of different feed resources could be related to varietal differences, climate, fertility of the land, stage of maturity at harvest, morphological fraction, method of harvesting and transporting, and condition of storage

Table 5.Chemical composition and digestibility of major crop residues produced in the district

Feed types	Chemical composition (%)						IVDMD
	DM	Ash	CP	NDF	ADF	ADL	
TeffStraw	90.9(±0.43)	9.83(±0.23)[b]	4.32(±0.21)[b]	69.6(±1.93)[b]	41.8(±1.63)[c]	8.51(±0.49)[b]	45.64(±2.07)
Wheat Straw	91.87(±0.61)	12.04(±0.38)[a]	3.99(±0.13)[b]	71.99(±1.01)[ab]	48.33(±3.37)[b]	11.17(±0.74)[a]	45.55(±1.94)
Haricot bean straw	90.59(±0.98)	9.43(±0.26)[b]	5.92(± 0.40)[a]	68.89(±0.89)[b]	56.04(±1.04)[a]	11.68(±0.59)[a]	49.19(±1.95)
Maize stover	92.09(±0.44)	9.34(±0.57)[b]	4.17(±0.21)[b]	74.63(±1.15)[a]	54.22(±1.28)[ab]	9.15(±0.59)[b]	48.83(±2.29)
Overall Mean	91.36	10.16	4.597	71.287	50.10	10.127	47.30
CV	1.75	9.23	13.77	4.506	10.00	14.797	10.71
LSD	1.9263	1.1296	0.7625	3.869	6.038	1.8049	6.1033
P-value	0.3164	0.0002	0.0001	0.0242	0.0003	0.0035	0.454
Significance	NS	***	***	*	***	***	NS

Means with different superscripts within a column and for similar feed type are significantly different (P<0.05), NS=Non-significance, DM=dry matter; NDF=neutral detergent fiber; ADF=acid detergent fiber; ADL=acid detergent lignin; CP=crude protein; IVDMD=In vitro dry matter digestibility; Sign. =significant; CV=Coefficient of variation

Table 6. Chemical composition and digestibility of feeds from grazing land produced during the wet season in the district

Feed types	Chemical composition (%)						IVDMD
	DM	Ash	CP	NDF	ADF	ADL	
PPGL	91.92(±0.62)	10.23(±0.58)[a]	6.81(±0.44)[a]	70.84(±2.91)	42.2(±1.35)	6.36(±0.69)	53.85(±0.48)[a]
PCGL	91.1(±0.95)	8.97(±0.27)[b]	6.8(±0.19)[a]	69.97(±1.71)	39.1(±1.15)	5.63(±0.78)	50.99(±0.92)[a]
UnPCGL	91.68(±0.55)	10.03(±0.22)[b]	5.53(±0.37)[b]	68.54(±3.17)	39.99(±2.87)	7.61(±0.46)	45.5(±1.41)[b]
Overall mean	91.57	9.74	6.38	69.78	40.42	6.53	50.12
CV (%)	1.94	9.86	13.44	9.38	11.81	24.81	4.947
LSD	2.1847	1.1828	1.0547	8.0566	5.8755	1.9939	3.0511
P-value	0.7193	0.0810	0.0300	0.8308	0.5208	0.1361	0.0001
Significance	NS	NS	*	NS	NS	NS	***

Means with different superscripts within a column and for similar feed type are significantly different (P<0.05), NS=Non-significance, PPGL=protected private grazing land; PCGL=protected communal grazing land; UnPCGL=Unprotected communal grazing land.

Perception and coping mechanisms of household on climate change

Climate change by definition is vast and difficult to see from all perspective for a given region. The majority (68.33%) of the respondents in the district indicated that frequent occurrences of drought were increasing from year to year (Figure 1) under annual rainfall and temperature trends and these results in a decreasing palatable herbaceous species and increasing forbs and those problems are the major indicators of climate change. This result was in line with the reports ofBeruk (2003) and Lelisa&Mengistu (2020 that reports effects of climate change on livestock production were measured through its effects on species composition of natural pastures, water sources, livestock diseases, and biodiversity. Similarly, few studies, which assessed farmers' perception elsewhere in Africa, have reported comparable findings [68]. National Meteorological Agency (NMA, 2017) reported that the average minimum temperature in Ethiopia has been increasing by $0.37^{O}C$ in lowland and by $0.3^{O}C$ in highlands per decade across the past 60 years in Ethiopian. To cope up the drought problems to their livestock, the respondents in the study district undertake different mechanisms. Among those use of conserved feed and tree leaves (55%), selling large ruminant and rearing small ruminant (35%), and herd diversification (10%). This is in line with the reports from the other pastoral areas of Ethiopia and the African countries (Nyanga, 2011; Lelisa, 2018; Lelisa&Mengistu, 2020).

The annual average rainfall and average annual minimum and maximum temperature trends from 1987 to 2017 of the study districts are presented in figure 1. In this study, the (annual rainfall and temperature) of 30 years in study district indicates that as temperature increase, the annual rainfall decrease (Figure 1). Therefore, the increase in temperature will increase the rate of crop water use adding to the currently frequent water stress of crops. The current study agrees with the report of Kassie(2014) who indicated that with the declining trends of seasonal rainfall, the amounts of rain in the year is also predicted to decreased. Hence, the result of the present study highlighted the possible impact of climate change on agriculture in the study area. This result agrees with the reports of other findings (De Sherbinin, 2002; Tsegaye*et al.*, 20115; Lelisa&Mengistu, 2020).

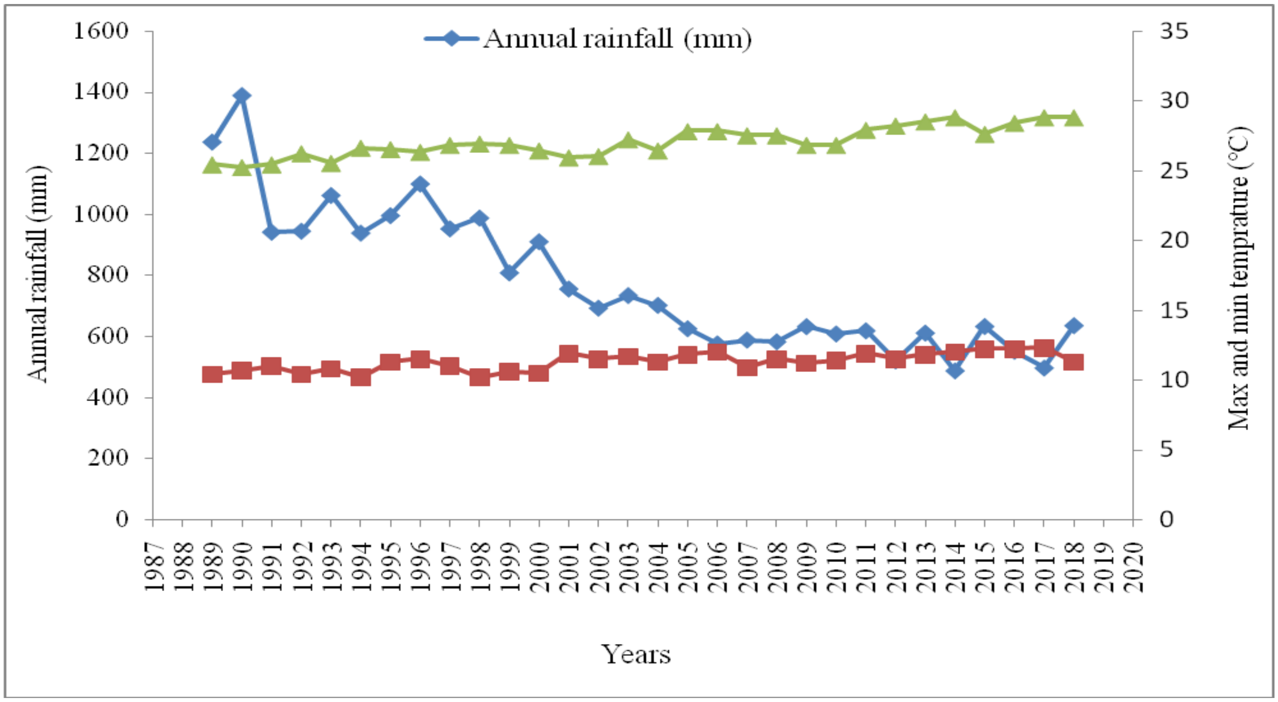

Fig. 1 Trends of annual rainfall and temperature for Lume district for 30 years (1987-2019)

CONCLUSION& RECOMMENDATION

As a conclusion, the main feed resource in the study district were crop residues and natural pasture, which are characterized with low quantity and quality, which did not match with the annual requirement of the animal and result in reduced livestock productivity and lower disease resistance. The major challenges of feed resources in the study area were inadequate to feed resource in quality and quantity, shrinkage of grazing area, drought, weed, and forbs/weeds/bush encroachment, poor soil fertility, lack of seed and planting material. The analysis of meteorological data of 30 years in Lume district indicated that as temperature increase, the annual rainfall decrease. Therefore, the increase in temperature will increase the rate of crop water use adding to the currently frequent water stress on crops and livestock showing the possible impact of climate change on the agriculture in the study area.

As grazing lands are shrinking from time to time-intensive pasture or forage development Strategies especially in areas where dairy and fattening activities practiced should be a crucial.Effects of season and or environmental factors on species variability and productivity of forage and nutrient composition of available feed resource should be evaluated per five year.

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