STATUS AND CHALLENGES OF AVAILABLE FEED RESOURCES AND IT’S QUALITY UNDER THE CHANGING CLIMATE IN ADAMI TULU DISTRICTS OF EAST SHOA ZONE, ETHIOPIA

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ABSTRACT

The study was conducted in Adami Tulu Jido Kombolcha (ATJK) district of the East Shoa Zone Oromai Region, Ethiopia, with the objectives to assess the existing status of feed resource under climate change and examine chemical composition. Feed sample from grazing lands (protected communal (PC), protected private (PP) and unprotected communal (UnPC) and crop residues were used for chemical composition analysis (23 from the natural pasture (NP) and 48 from crop residues (CRs). Out of 23 herbaceous species identified in ATJK district, Cynodon dactilon in ATJK district was the dominant grass species. The average mean DMY (ton ha-1) of grass obtained from PPGL (2.43) and PCGL (2.36) was significantly (P<0.01) higher than that from UnPCGL(1.18) in ATJK . The mean value of CP contents of CRs in ATJK district were 3.5±0.17 for maize stover (MS) to 6.5±0.93 for Haricot bean (HCB) straw. The NDF contents of CRs were between 63.5±1.83 for HCB to 79.74±1.24 for maize stover (MS). The ADF contents of CRs varied from WS (49.12±2.82) to HC (52.63±1.16) in ATJK district. 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 ATJK 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 the crop, natural pasture, and production and productivity of livestock and it will be suggested that to study the effects of climate on soil and animal feed nutrients.

Keywords: Crop residues, Grazing land, herbaceous species, Natural pasture, Nutritive value.

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1. INTRODUCTION

Demand for animal products in Sub-Saharan Africa and generally in the developing countries is likely to rise significantly because of population growth, urbanization, and rising income [66]. Livestock production in Africa accounts for about 30% of the gross value of Agricultural production, with 92% of this is coming from the production of beef cattle, dairy cattle, goats, sheep, and chickens [96]. Ethiopia was gifted with a huge and wide range of natural resource and diverse agro-ecological zones. These potentials make the country to be well known as a reservoir area for animal genetic diversity [92]. The 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 income [35].

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 [53]. Despite high livestock population and the existing favorable environmental conditions, the current livestock contribution is below its potential due to various reasons associated with a number of complex and inter-related factors such as feed shortage, disease, and drought [40].

There were less effort made in introducing appropriate package of improved livestock technologies, improved feed management practices, and adequate health care services that could enhance the current livestock production and productivity [84].

According to Gelayenew et al. [79] seasonal feed shortage and inefficient utilization are the major problems affecting livestock productivity. The productivity of the natural pasture in most parts of Ethiopia is extremely low [165, 3] due to seasonal fluctuation of rainfall, poor grazing land management, conversion of grazing lands in to crop lands, and increased human population [68]. This 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 [71, 68]. 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 [14].

Agriculture in Ethiopia is mostly affected by climate change whereby decreasing in precipitation and increases in temperature are both destructive factors [61]. Several studies showed that there is a declining trend of livestock numbers per household and species [103, 26]. According to Negassa and Jabbarr [126], the size of livestock holdings at the household level is very small and does not support stable and sufficient commercial off-take even though there is apparently large livestock population in Ethiopia. This is due to the changes associated with temperature itself, relative humidity, rainfall distribution in time and space, altered disease distribution, changes in the ecosystem, encroachment of grazing land by undesirable plant species [136]. Thus, 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 was needed [69].

In the present study area, factors contributing to the declining trends of livestock numbers per household as well as annual availability of feed production with animal requirements per TLU are not estimated. So far, different research activities regarding assessment of livestock production practices in relation to available feed resource and major factors affecting livestock production were conducted in part of East Shoa Zone [30, 54]. 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 carried out in ATJK district. Therefore, the current study was designed to generate base-line information with the objective to assess the status of major grazing ruminant feed resources under the current climate change and 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.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

Geographically Adami Tulu-Jido Kombolcha (ATJK) district is located between 38°25'E and 38° 55'E latitude and 7°35'N and 8°05'N longitudes, bordering in the West by Southern Nations, Nationalities, and Peoples' National Regional State and Arsi Negele district, in North West by Dugda-Bora woreda, in East-South by Arsi Zone [109]. It is located at a distance of about 168 km from Addis Ababa. The district has semi-arid and arid agro-climatic Zones and lies between 1500-2000 m a.s.l., with exception of areas located around Mount Aluto. This district is characterized by mixed crop-livestock farming system, semi-arid, and sub-humid in which 90% of the area is lowland while the remaining 10% is intermediate. The average annual temperature ranges from 22°C to 28°C. The area receives average annual rainfall of 760 to 1000 mm, in which the distribution is uneven and erratic in nature [121, 100], and characterized by very short and unreliable rain during the months of April-May. While most of the rain in the district occurs during three months (June-August) and sometimes up to September [102, 4, 5]. About 72352 ha of the land in ATJK was allocated for cultivation while the rest 14601.75 ha were allocated for private grazing land, communal grazing, homestead land, and 4968 ha were allocated for enclosed plantation/wood land and forest, respectively [1].

2.2 Study Population and Sampling Procedures

To select the specific study sites from the two districts, 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, 6 representative rural kebeles (RKs) were selected from ATJK 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.

2.3 Data Collection and Sampling Procedures

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 m² quadrates at a distance of 10 km between the grazing sites [95]. From each of the grazing site, 3 samples were taken from different areas that are 10 m far apart from each other using 0.25 m² 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 *3 grazing type per rural kebele * 6 rural kebele), and a total of 18 samples from 18 quadrates were taken from the district. Sampling was conducted from August 15 to September 20 when almost all the pasture plants were fully grown to over 50% of flowering stage.

2.4 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 [94]. The dry weight rank (DWR)
procedure described by Tothill et al. [162] that involves cutting and sorting by hand were used to measure percentage proportion of each forage type according to the following formulas.

\[
\text{TDW of species} = \frac{\text{TFW of a species} \times \text{SDW of a species}}{\text{SFW of a species}} \quad (1)
\]

\[
\% \text{ proportion of species} = \frac{\text{TDW of a species} \times 100}{\text{GTDW}} \quad (2)
\]

Where, 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\(^{-1}\) [73, 119]. 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, technical assistance of ATARC experts (range experts) being assisted by guidebooks [18].

2.5 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 [73] 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 [73]. Whereas, a multiplier of 4.0 for linseed [73], 2.0 for maize [55], 2.5 for sorghum [104], and 0.5 for crop aftermath [73, 119] 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 [90] 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 [97, 90, 36].

2.6 Retrospective Status of Climate Condition in the Study Site

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 the two districts were also collected from the meteorology stations of the Zone and
ATARC and recorded on Microsoft office excel to show trends and compare with the perception of the respondents.

2.7 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 ATJK district and major crop residues from crop cultivation were sampled purposively from crop fields. Accordingly, 44 representative feed samples, 18 from natural pastures, and 24 from major crop residues were taken from the two districts. 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 dried in an oven at 65°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°C overnight and by igniting in a muffle furnace at 600°C for 2 hour, respectively [28] (%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 [29] in Batu/Ziway Soil 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 [168].

2.8 Data Management and Statistical Analysis

The data was organized and analyzed by Statistical Package for Social Sciences [144]. 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 [135]. When significant differences between means were detected at P<0.05, the Tukey’s Studentized Range (TSD) test was used to separate the individual means. The model used was; Yij= μ + Ai + eij; Where, Yij=quality and quantity of feeds, μ=over all mean, Ai = the grazing site of i

3. RESULTS AND DISCUSSION

3.1 Major Feed Resources and Feeding Systems in Study Areas

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 [152]. Accordingly, respondents from ATJK district indicated that the major feed resources during dry season for cattle were crop residues (68.33%), aftermath (14.17%), concentrate (11.67%), and hay (5.82%) and during wet season natural pasture (48.33%), crop residues (39.17%), and concentrate (5.83%), respectively. In terms of availability, crop residues in ATJK district, crop residues can hardly meet the requirement of the animals in dry season, as most of the feed resources are not available, which agree with the reports of Sisay [140] and Elias [67]. Generally, farmers in ATJK district zero grazing (5%), free grazing (70%), and cut-carry (25%). In terms of availability respondents indicated that livestock feeds in the wet season were adequate (20.8%), abundant (36.67%), and inadequate (42.5%), and during dry season were adequate (35%), abundant (25%) and inadequate (40%), 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 (140, 67).
3.2 Seasonal Availability of Feed Resources in ATJK

The months of the year classified according to feed availability (Table 1). In the ATJK district, natural pastures were the main feed resources from July to September. In the dry period (September to August), crop residues like maize stover, wheat straw, teff straw, haricot bean straw, and barley straw were the major feed resources. In wet season (July to the beginning of September), few of the respondents (25%) around ATJK district move with their cattle to Habernosa and Langano area, which was called ‘Godantu/Godansa’, where green grazing pasture was available as most farm land is used for crop production. Animals and some family members stay in the ‘Godantu/Godansa’ area from June to September. In the dry season (January to May), about 16.67% of respondents in ATJK moves their cattle to relatives far away from their residence. This was because some family relatives in other areas have relatively larger grazing pastureland and allow them to use by their relatives free of charge. Majority (75%) of the respondents do not move their cattle to other areas and they use their own grazing lands, borderlands in between adjacent crop fields, green maize stock and weeds for feeding.

Table 1. Feed resources availability across different months of the year in the study districts

<table>
<thead>
<tr>
<th>Feed sources</th>
<th>Months</th>
<th>ATJK</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural pastures</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Crop residues</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Crop aftermath</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Weeds and maize</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thinning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The feed resource mentioned is available in the specified month/months.

3.3 Estimation of Annual Feed Availability in Study District

3.3.1 Dry matter production from the different grazing area

In ATJK district about 29,203.5 tons per year of total DMY from natural pasture and 3477.6 tons of feed dry matter from the total 4968 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 6399.1 tons DM yield per annual were produced in ATJK district.

Table 2. Estimation of dry matter yield from grazing land managed in different ways

<table>
<thead>
<tr>
<th>Districts</th>
<th>Land use type</th>
<th>Area of land (ha)</th>
<th>Conversion Factors</th>
<th>Total DMY (ton ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATJK</td>
<td>Grazing lands (protected private and communal) and unprotected communal grazing</td>
<td>14,601.75</td>
<td>2</td>
<td>29,203.5</td>
</tr>
<tr>
<td></td>
<td>Enclosure area of Shrub/tree lands and other forest</td>
<td>4,968</td>
<td>0.7</td>
<td>3,477.6</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>6,399.1</td>
</tr>
</tbody>
</table>

DMY=dry matter yield, ATJK= Adami Tulu Jido Kombolcha
3.3.2 Crop residues production
A total of 222122.3 tons of crop residues were produced from different crop types in ATJK district (Table 3).

3.3.3 Livestock feed balances in Adami Tulu Jido Kombolcha (ATJK) District
The total estimated annual feed supply in ATJK districts can only meet about 58.97% DM requirement for maintenance with low production and productivity (Table 4). Therefore, in ATJK livestock were a negative DM feed requirement. The observed lower in DM requirement of the current study agrees with earlier work reports [54] that noted quantities of available feed resources were very low and do not supply annual dry matter required by livestock. Therefore, under such a huge gap between availability of feed resources and livestock population, sustainable production and productivity of livestock in the future in the study area is difficult and requires strategic intervention in feed production and matching of livestock number with the available feed resources.

### Table 3. Crop residues yield from total cultivated land in ATJK District

<table>
<thead>
<tr>
<th>Crop type</th>
<th>Total cultivated land (ha)</th>
<th>Total grain yield (qt/ha)</th>
<th>Conversion factor (CF)</th>
<th>Crop residues yield in tones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>35,005.44</td>
<td>700108.8</td>
<td>2.0</td>
<td>200043.42</td>
</tr>
<tr>
<td>Wheat</td>
<td>12299.84</td>
<td>14759.81</td>
<td>1.5</td>
<td>2213.97</td>
</tr>
<tr>
<td>Haricot bean</td>
<td>9405.76</td>
<td>30098.43</td>
<td>1.2</td>
<td>3611.8</td>
</tr>
<tr>
<td>Sorghum</td>
<td>7855.2</td>
<td>62841.6</td>
<td>2.5</td>
<td>15710.4</td>
</tr>
<tr>
<td>Barley</td>
<td>1447.04</td>
<td>1447.04</td>
<td>1.5</td>
<td>217.1</td>
</tr>
<tr>
<td>Teff</td>
<td>4341.12</td>
<td>21705</td>
<td>1.5</td>
<td>325.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>72352</td>
<td></td>
<td></td>
<td>222122.3</td>
</tr>
<tr>
<td><strong>Aftermath</strong></td>
<td>72352</td>
<td>0.5</td>
<td></td>
<td>36176</td>
</tr>
<tr>
<td><strong>Total crop residues and aftermath produced</strong></td>
<td><strong>258298.3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*ATJK= Adami Tulu Jido Kombolcha*

### Table 4. Estimation of feed balance in study districts

<table>
<thead>
<tr>
<th>District</th>
<th>Annual feed supply (tons)</th>
<th>DM Estimated annual maintenance (tons)</th>
<th>DM requirement for maintenance (tons)</th>
<th>DM supply versus requirement (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATJK</td>
<td>264697.4</td>
<td>448891.7</td>
<td>-184194.4 (58.97%)</td>
<td></td>
</tr>
</tbody>
</table>

*ATJK= Adami Tulu Jido Kombolcha*

3.4 Major Livestock Constraints and their Consequences in the Study Districts

3.4.1 Major livestock production constraints
The most devastating phenomenon that restricts livestock productivity ranked was feed scarcity, land shortage, water shortage, and disease in study district (Table 5). The current result is in line with other earlier reports [153] who generally noted that scarcity of feed resource become a
critical constraint to livestock production in almost all parts of the country.

3.5 Status of Available Grazing land in Study Districts

The majority 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 6). This current finding agrees with the reports of Amaha and Belaynesh [27] that the grazing areas were converted into cropland due to rapid population growth. This result is similar with the reports of Yoseph [183].

Table 5. Ranks of major livestock production constraints in ATJK districts

<table>
<thead>
<tr>
<th>No</th>
<th>Problems</th>
<th>Livestock production constraints in ATJK (Ranks)</th>
<th>PI</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
</tr>
<tr>
<td>1</td>
<td>Feed scarcity</td>
<td>28</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Land shortage</td>
<td>17</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>Disease</td>
<td>0</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Water shortage</td>
<td>13</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>Drought</td>
<td>12</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Management</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Inbreeding</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Lack of market</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Lack of AI</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Other</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3326</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

F-sum=3326 in ATJK No=number; AI=Artificial insemination; PI=Priority Index, F-sum=the sum of all weight constraints mentioned by respondents

Table 6. Status of grazing land and reason for shrinking grazing land in the study district (60 respondents)

<table>
<thead>
<tr>
<th>Reasons for decreasing grazing land (rank)</th>
<th>ATJK</th>
<th>Index</th>
<th>rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATJK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expansion of crop land</td>
<td>9</td>
<td>27</td>
<td>12</td>
</tr>
<tr>
<td>Land degradation</td>
<td>10</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Increase population density</td>
<td>31</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Expansion of investment</td>
<td>11</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>Reduction numbers of livestock numbers</td>
<td>0</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>932</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

ATJK=Adami Tulu Jido Kombolcha; NS= non-significant, F-sum=880 in ATJK
3.6 Quality Composition of Major Feed Resource in Study Districts

3.6.1 Chemical composition of major feed resource in the study area

The laboratory DM of all evaluated major feed resources in Adami tulu jido kombolcha (ATJK) district was more than 90% (Table 7), which was similar with the findings of earlier studies [62] that reported above 90% DM for different feed resource. The ash contents of wheat straw of the current study were higher than that reported by Mekuanint and Girma [114] (9.34%). The average mean ash content of maize stover recorded in the present study was far greater than the result reported by Yitaye [182], which was 7%. The ash content of all evaluated crop residues and natural pasture in the current study areas were not difference (p>0.05). However, the overall mean values of ash contents of natural pasture of the current results were lower than (10.99%) reported by Mekuanint and Girma [114]. The average mean value of CP of teff straw, maize stover, and wheat straw recorded in the current study agreed with that reported [182, 18]. The current result of CP value obtained from crop residues were lower than the minimum level of nitrogen (7%) which limit feed intake [117] (168). The average mean value of CP content of haricot bean straw obtained was significantly higher (P< 0.001) than that of the other crop residues in the study district (Table 7). 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% [138] and 2.7% [77]. The average 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 private and protected communal in ATJK district (Table 7).

The average 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 maize stover (82.13%), teff straw (81.5%) and wheat straw (78.6%) reported by Chalchissa et al. [87]. The current result of NDF value of cereal crop residues agree with the reports of Sisay [140] and Alemu et al. [25] 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 [62]. The higher NDF content could be a limiting factor on feed intake, since voluntary feed intake and NDF content are negatively correlated [70]. 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 [167]. Roughage feeds with NDF content of less than 45% categorized as high quality, 45-65% as medium quality and those with more than 65% as low quality [139]. The NDF content of maize stover of the current study in the study district were less than the NDF content of maize stover (82.13%) reported by Chalchissa et al. [87].

The Acid detergent fiber (ADF) contents of crop straws and natural pasture were shown in Table (15). The ADF content for crop residues of the current result were within the range reported by Ahmed and Abule [18] and Solomon et al. [142]. The averages mean value of ADF contents of natural pasture of the current study were lower than that reported by Ahmed and Abule [18], which were 78.9 and 77.8% in low altitude, and 73.9 and 75.6% in mid-altitude obtained from communal and private grazing, but in line with reported by Dirsha et al. [62].

The ADF content of maize stover of the current study were greater than that reported by Chalchissa et al. [87] (51.72%) and Dirsha et al. [62] (47.6%). Whereas the ADF content of teff straw (46.8%) and wheat straw (58.1%) reported by Chalchissa et al. [87] was lower than teff straw and higher than wheat straw in ATJK district (Table 7). 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 are negatively correlated (McDonald et al., 2002). The highest concentration of lignin found in haricot bean straw followed by wheat straw (Table 7). The lignin content of haricot bean straws found in the current result in the study district were lower than the results of 12.72% for pulse crops reported by Mekuanint and Girma [114] and 15.42% reported by Ahmed and Abule [18]. The ADL content of legume crop residues (haricot bean straw) recorded in this study was higher than the maximum level (7%) that limits DM intake and livestock production [132]. This may be due to stage of maturity, management, and environmental factors.

The average mean value of lignin contents in maize stover of the study area was greater than the value of 7% that limits DM intake [132]. The average mean value of ADL contents of natural pasture harvested of the current study was lower than the critical level (7%). The average mean value of ADL contents of natural pasture (5.95) in ATJK, district were lower than the value of 7.24 and 7.55% in lower altitude and 7.49 and 7.30% in mid-altitude, respectively reported by Ahmed and Abule [18].

### In vitro dry matter digestibility

The IVDMD for maize stover in Adami Tulu Jidokombolcha (ATJK) district shown (Table 7) were lower than the value reported for maize stover (58.65%) by Chalchissa et al. [87]. The highest IVDMD content recorded in haricot bean straw (52.99±2.277) and the lowest from wheat straw (41.94±1.505) in ATJK district. The mean value of IVDMD obtained in the current study for wheat straw (41.94%) were in line with the value of cereal straws recorded in Gassera (41.92%) and Ginnir (42.22%) districts [114]. The mean values of IVDMD for cereal crop residues were lower than the minimum level required for quality roughages [137]. Lower IVDMD values 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 obtained from unprotected communal grazing land in ATJK district. This difference may be due to overgrazing, few or no palatable, legume species composition, and higher unpalatable species indicating the degradation of grazing land. 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 [13] 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, length and condition of storage.

#### 3.7 Botanical Composition and Dry Matter Yield of Grazing Land in Study District

##### 3.7.1 Herbaceous composition of grazing lands in study Districts

The highest proportion of grass DM yield obtained from unprotected communal grazing lands (62.43%) in ATJK district, which may be due to small share of total DM yield from the same area of land. The highest proportions of forbs observed in PPGL (24.03%) and PCGL (24.85%) in ATJK district. This showed that there was the degradation problem on grazing land of ATJK district. The lower proportion of legumes observed in unprotected communal grazing lands (UnPCGL) in both study districts might probably be due to climbing or sprawling growth habit, which makes them more susceptible to loss through grazing in the lower altitudes. 23 herbaceous species were identified and out of the grass species, 24, 51, and 25% were highly desirable, desirable, and less desirable as feed for livestock, respectively. The less desirable grass species increased in the vegetation due to severe overgrazing and they are generally indicators of declining range condition [185].
Table 7. Chemical composition of major feed ATJK

<table>
<thead>
<tr>
<th>Wet</th>
<th>Feed types</th>
<th>DM</th>
<th>Ash</th>
<th>CP</th>
<th>NDF</th>
<th>ADF</th>
<th>ADL</th>
<th>IVDMD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(±0.4</td>
<td>(±0.2</td>
<td>(±0.3</td>
<td>(±0.1</td>
<td>(±0.2</td>
<td>(±0.3</td>
<td>(±0.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>9</td>
<td>46</td>
<td>9</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS</td>
<td>91.87</td>
<td>10.65</td>
<td>4.06</td>
<td>77.22</td>
<td>55.18</td>
<td>10.89</td>
<td>45.73</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(±0.49)</td>
<td>(±0.47)</td>
<td>(±0.346)</td>
<td>(±2.58)</td>
<td>(3.173)</td>
<td>(±0.72)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS</td>
<td>91.21</td>
<td>10.37</td>
<td>3.78</td>
<td>71.94</td>
<td>49.12</td>
<td>11.36</td>
<td>41.94</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(±0.59)</td>
<td>(±0.46)</td>
<td>(±0.15)</td>
<td>(±2.84)</td>
<td>(±0.251)</td>
<td>(±0.51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCB</td>
<td>91.11</td>
<td>9.81</td>
<td>6.51</td>
<td>63.50</td>
<td>52.63</td>
<td>10.58</td>
<td>52.99</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(±0.34)</td>
<td>(±0.29)</td>
<td>(±0.99)</td>
<td>(±1.16)</td>
<td>(±0.205)</td>
<td>(±0.28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td>92.10</td>
<td>10.75</td>
<td>3.51</td>
<td>79.74</td>
<td>55.83</td>
<td>10.77</td>
<td>43.83</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(±0.18)</td>
<td>(±0.20)</td>
<td>(±0.17)</td>
<td>(±1.69)</td>
<td>(±0.38)</td>
<td>(±0.83)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall mean</td>
<td>91.57</td>
<td>10.39</td>
<td>4.47</td>
<td>73.10</td>
<td>53.19</td>
<td>10.90</td>
<td>46.12</td>
<td></td>
</tr>
<tr>
<td>CV</td>
<td>1.15</td>
<td>8.137</td>
<td>27.79</td>
<td>7.50</td>
<td>10.87</td>
<td>8.93</td>
<td>9.845</td>
<td></td>
</tr>
<tr>
<td>LSD</td>
<td>1.2724</td>
<td>1.0185</td>
<td>1.4951</td>
<td>6.6042</td>
<td>6.967</td>
<td>1.1719</td>
<td>5.469</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.3009</td>
<td>0.2462</td>
<td>0.0016</td>
<td>0.0003</td>
<td>0.2066</td>
<td>0.5609</td>
<td>0.0024</td>
<td></td>
</tr>
<tr>
<td>Sign</td>
<td>Feed type</td>
<td>___</td>
<td>___</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Wet</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPGL</td>
<td>91.92</td>
<td>10.73</td>
<td>5.6</td>
<td>67.51</td>
<td>48.54</td>
<td>6.11</td>
<td>49.59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(±0.33)</td>
<td>(±0.29)</td>
<td>(±2.0)</td>
<td>(±1.98)</td>
<td>(±0.5)</td>
<td>(±0.79)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCGL</td>
<td>92.53</td>
<td>10.32</td>
<td>5.99</td>
<td>69.24</td>
<td>44.52</td>
<td>5.69</td>
<td>49.68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(±0.18)</td>
<td>(±0.21)</td>
<td>(±1.8)</td>
<td>(±3.29)</td>
<td>(±0.5)</td>
<td>(±0.56)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UnPCGL</td>
<td>92.63</td>
<td>11.26</td>
<td>4.69</td>
<td>70.27</td>
<td>54.527</td>
<td>6.06</td>
<td>46.37</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(±0.46)</td>
<td>(±0.57)</td>
<td>(±0.7)</td>
<td>(±0.2)</td>
<td>(±1)</td>
<td>(±1.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall mean</td>
<td>92.36</td>
<td>10.77</td>
<td>5.43</td>
<td>69.01</td>
<td>49.195</td>
<td>5.95</td>
<td>48.55</td>
<td></td>
</tr>
<tr>
<td>CV (%)</td>
<td>0.91</td>
<td>9.41</td>
<td>10.40</td>
<td>5.87</td>
<td>13.16</td>
<td>22.07</td>
<td>4.97</td>
<td></td>
</tr>
<tr>
<td>LSD</td>
<td>1.0362</td>
<td>1.2467</td>
<td>0.695</td>
<td>4.9828</td>
<td>7.9686</td>
<td>1.6174</td>
<td>2.9697</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.3081</td>
<td>0.3042</td>
<td>0.0037</td>
<td>0.0504</td>
<td>0.0519</td>
<td>0.8337</td>
<td>0.0508</td>
<td></td>
</tr>
<tr>
<td>Sig</td>
<td>Grazing</td>
<td>___</td>
<td>___</td>
<td>**</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td></td>
</tr>
</tbody>
</table>

Means with different superscripts within a column and *** in rows are significantly different (P<0.05), --- 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; PPGL = Protected private grazing land; PCGL= Protected communal grazing land; UnPCGL = Unprotected communal grazing land, TF = Teff straw, WS = Wheat straw, HCB = Haricot bean straw, MS = Maize stover

According to the elders response, *Cynodon dactlon*, *Eragrostis tenuifolia*, *Andropogon abyssinicas*, *Cenchrus ciliaris*, *Chloris pictnotrics*, *Aristida arsensinosis* are the common species in ATJK district. *Cynodon dactlon* is the dominant grass species in both protected and unprotected communal grazing areas and the dominant legume species were *Indigofera linnaei*, local *Seratro*, *Desmodium* (*Grean and Silver*) species and from forbs/weeds were *Acharants* species (*Amaranthaceae* like *alternanthere pungens*), *Tribules*, *Teretures* (dominant on cultivated land), *Partinium*, *Leucas martinicensis* (*dargu adii*) and Cogogiisa/qarcabbaa (local name) in ATJK district. The most valued grass species identified by herders in ATJK district were *Cynodon dactlon*, *Eragrostis tenuifolia*, *Chloris species*, and *Cenchrus ciliaris*. The availability of grasses like *Harpachne schimperi*, *Sporobolus pyramidalis*, *Chloris pictnotrics*, *Aristida arsensinosis* species were reported to be characteristics for degraded land, which faced heavy grazing pressure.

The study further indicated that *Psydrax schimpefiana* and clover species are fast...
disappearing and rarely seen. The current result also agreed with that reported by Zewdie [186] who indicated that unpalatable herbaceous species like *H. schimperi*, *S. pyramidalis*, *H. contortus*, and *Partinium* were invading the natural pasture while palatable species like *Cenchrus*, *Chloris*, *Bracharias*, and *Andopogon* were disappearing in Ziway (ATJK) district. As reported by Chadhokar [46] such incidences may be due to over grazing in the area and this has resulted in the domination of unpalatable species of grasses in the study area and the pasture to be dominated by unpalatable grass species. This may in turn affect the photosynthetic area of a plant as well as species composition in the area [146].

### 3.7.2 Dry matter yield from different grazing land in ATJK District

The average mean dry matter yields (ton ha\(^{-1}\)) of grass, legumes, and forbs obtained from PPGL, PCGL, and UnPCGL were shown (Table 8). The dry matter yield of grass obtained from PPGL and PCGL was significantly (P<0.001) higher than dry matter yield obtained from UnPCGL in ATJK district and the dry matter yield of legumes obtained from PPGL and PCGL was significantly (P<0.05) higher than the dry matter yield obtained from UnPCGL in ATJK district. The dry matter yield of forbs obtained from PCGL was significantly (P<0.05) higher than the dry matter yield of forbs from UnPCGL in ATJK district. The dry matter yield of forbs obtained from PPGL and PCGL was significantly (P<0.05) higher than the UnPCGL in ATJK district. This showed that due to over grazing; all species present on UnPCGL were grazed by livestock species. The present result was higher than Beyene *et al.* (2010) were. This variation might be due to low livestock pressure, soil fertility, and rainfall in that area and the grazing area in ATJK district was degraded and invasive species have reduced the effective size of the pastureland. This result agrees with the reports of Gizachew [88] and Alemayehu [24].

In general, the conditions of the protected private and communal grazing/enclosure land areas were in good status, which implies that making enclosures is a practical method of improving the grazing area. Whereas, the unprotected communal grazing land of the study district were in poor condition for grazing animals like cattle and sheep, and this implies that there is a need to improve the condition of the grazing land. The result of this study further demonstrates that given proper management like resting of the grazing land, the grazing sites could improve [154].

### Table 8. Mean DMY (ton ha\(^{-1}\)) and species proportion (%) from different grazing land

<table>
<thead>
<tr>
<th>District</th>
<th>Grazing types</th>
<th>Mean DMY (ton ha(^{-1})) of herbaceous species</th>
<th>Total DMY (ton ha(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Grass</td>
<td>Legumes</td>
</tr>
<tr>
<td>ATJK</td>
<td>PPGL</td>
<td>2.427 (58.33%)</td>
<td>0.734 (17.64%)</td>
</tr>
<tr>
<td></td>
<td>PCGL</td>
<td>2.36 (57.28%)</td>
<td>0.736 (17.86%)</td>
</tr>
<tr>
<td></td>
<td>UnPCGL</td>
<td>1.187 (62.57%)</td>
<td>0.26 (13.71%)</td>
</tr>
<tr>
<td>Overall mean</td>
<td></td>
<td>1.99</td>
<td>0.58</td>
</tr>
<tr>
<td>CV (%)</td>
<td>32.67</td>
<td>49.13</td>
<td>45.18</td>
</tr>
<tr>
<td>P-value</td>
<td>0.0075</td>
<td>0.0148</td>
<td>0.0276</td>
</tr>
<tr>
<td>Sign **</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

**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.
3.8 Perception of Household on Climate Change and Coping Mechanisms in Study District

Climate change by definition is vast and difficult to see from all perspective for a given region. The majority of the respondents in ATJK (78.3%) 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 was in line with [42, 159] stated that effect of climate change on livestock production was measured through its effects on natural pastures, water sources, livestock diseases, and biodiversity. Similarly, few studies, which assessed farmers’ perception elsewhere in Africa, have reported comparable findings [127]. National Meteorological Agency [125] reported that the average minimum temperature in Ethiopia has been increasing by 0.37°C in lowland and by 0.3°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, selling large ruminant, rearing small ruminant and poultry, herd diversification, and migration. This is in line with the reports from the other pastoral areas of Ethiopia and the East African countries [155].

Table 9 Perception and coping mechanisms to climate change in study district (n=60)

<table>
<thead>
<tr>
<th>How you compare current climate change to 10 and above years ago?</th>
<th>Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature increasing</td>
<td>47(78.3%)</td>
</tr>
<tr>
<td>Temperature decreasing</td>
<td>0</td>
</tr>
<tr>
<td>The same</td>
<td>13(21.67%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drought coping mechanisms</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of tree leaves and conserved feeds</td>
<td>27(45%)</td>
</tr>
<tr>
<td>Sale of large ruminants and rearing small ruminants and poultry</td>
<td>18(30%)</td>
</tr>
<tr>
<td>Keeping mixed species</td>
<td>5(8.5%)</td>
</tr>
<tr>
<td>Migration</td>
<td>10(16.7%)</td>
</tr>
</tbody>
</table>

*ATJK =Adami Tulu Jidokombocha, n=respondents*

3.9 Annual Rainfall and Temperature Trends in the Study District

The annual average rainfall and average annual minimum and maximum temperature trends from 1987 to 2017 of the study district are presented in Figure 1. In this study, the (annual rainfall and temperature) of 30 years in both districts indicates that as temperature increase, the annual rainfall decrease (Figure 1) and this current study agrees with the report of Kassie [98]. Hence, the result of the present study highlighted the possible impact of climate change on agriculture in the study area and this result agrees with the reports of Tsegaye et al. [163].

4. SUMMARY AND CONCLUSION

The study was conducted in ATJK districts, with the objectives to assess the major available grazing feed resource and examine their chemical composition and to assess community perceptions regarding the challenges and
opportunities of available feed resource under climate change. The livestock feed resources were assessed by the formal and informal survey. A descriptive cross-sectional study were conducted to assess major available feed resource, quantity during the wet and dry season, feeding systems, and its constraints, effects of climate change on animal feeds under the current situation and coping strategies, and secondary information from the district and Zonal Agricultural and Rural Development offices were utilized. In the study district, 60 respondents purposively selected for the interview that had long experience and knowledge of livestock production. A structured questionnaire was prepared and pre-tested for its applicability before its administration.

Three grazing sites such as protected communal/enclosure protected private and unprotected communal grazing areas were selected using systematically stratified random sampling technique. Before harvesting, a quadrant of 0.25 m$^2$ was placed on grazing sites. From one grazing site, three samples apart from each and a composite of one sample per site from 0.25m$^2$ quadrants and three samples from different grazing lands at height of 0.5cm above the ground were harvested. The numbers of available crop residues (DM basis) were estimated from the total crop yields of the households, which was obtained from the questionnaire survey, using the conversion factors. The effects of climate on animal feed under the current situation were gathered from both primary and secondary sources of data, and the temperature and precipitation data of 30 years were collected from meteorology station of the Zone. Collected feed samples from natural pasture and crop residues were used for chemical composition evaluation.

![Fig. 1 Trends of annual rainfall and temperature for Adami Tulu Jido Kombolcha district for 30 years (1987-2017)](image)

The average mean landholding per household was 2.27 ha hh$^{-1}$ in ATJK. Of this, the total lands used for food crop cultivation was 2.61 ha hh$^{-1}$ in ATJK district. According to the responses’ of respondents, the shares of protected communal protected private and unprotected communal grazing area were 9.7, 1.02, and 0.6 ha, per household in ATJK district. About 50% of the respondents in ATJK district respond that the total number of cattle and herd composition was declining from time to time due to shortage of grazing land, increase of population density and expansion of cropland, shortage of feeds and water, and animal diseases. About 86.7% of the
respondents respond that grazing land size was decreasing from time to time in ATJK districts. Generally, 75% of the major feed resource during the dry season in the ATJK districts is crop residue, but during the wet season, natural pastures (46.67%) in ATJK was the major feed resource. From three sites of grazing lands in ATJK district, 23 herbaceous species were identified and Cynodon dactlon, Eragrostis teniufolia, Andropogon abyssinicas, Cenchrus ciliaris, Chloris pictnotrics, and Aristida arsensinosis were the common species. The DMY of grass obtained from PPGL and PCGL was significantly (P<0.001) higher than dry matter yield obtained from UnPCGL in ATJK district and the dry matter yield of legumes obtained from PPGL and PCGL was significantly (P<0.05) higher than the dry matter yield obtained from UnPCGL in ATJK district. The dry matter yield of forbs obtained from PCGL and PPGL were significantly (P<0.05) higher than the dry matter yield of forbs from UnPCGL in ATJK district.

Furthermore, the chemical composition of major feed resources from natural pasture and crop residues were determined. The highest (p<0.05) crude protein (CP) content was recorded from haricot bean straw (6.51±0.93) in ATJK district and the lowest from maize stover (3.51±0.165) in ATJK district. The highest NDF recorded for teff straw (77.22±2.58) in ATJK districts. The highest ADF contents were obtained from maize stover (55.83±1.69) and teff straw (55.18±3.17) in ATJK districts (p<0.05). The highest ADL content obtained from wheat straw (11.36±0.46) in ATJK district. The current study indicated that the statuses of grazing land declined, which may need immediate intervention. To improve degraded grazing land, there is a needs of rehabilitation and restoration of the grazing areas through establishment of community based enclosure or resting highly degrade/bared areas, re-seeding depleted grazing areas, developing water points on the grazing areas and introducing water harvesting mechanisms were crucial to improve the grazing land status of the study district.

4.1 Conclusion
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 feed resource in quality and quantity, 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 Adami Tullu Jiddo Kombolcha 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.

5. RECOMMENDATION
As grazing lands are shrinking from time to time intensive pasture or forage development strategies especially in areas where dairy and fattening activities are practiced should be implemented.

SCOPE FOR FUTURE RESEARCH
Effects of species variability on the nutritive value, productivity, and nutrient composition of feed resource with the effects of other environmental factors such as soil and climatic factors should be investigated.

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