ASSESSMENT OF LIVESTOCK PRODUCTION PRACTICES, FEED RESOURCES AND THEIR NUTRITIONAL VALUE IN DEGHABUR DISTRICT, SOMALI REGIONAL STATE, ETHIOPIA.

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DEDICATION

I dedicate to my dear mom KHADRA SIRAD MUSA with love and appreciation for her patience to grew me up and support over the all my life.

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this Thesis is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this Thesis. Any scholarly matter that is included in the thesis has been given recognition through citation.

This Thesis is submitted in partial fulfillment of the requirements for an MSc degree at Haramaya University. The Thesis is deposited in the Haramaya University Library and is made available to borrowers under rules of the Library. I solemnly declare that this Thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

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ABBREVIATIONS AND ACRONYMS

ADF	Acid Detergent Fiber
ADL	Acid Detergent Lignin
ANOVA	Analysis of Variance
AOAC	Association of Analytical Chemists
CACC	Central Agriculture Census Commission
CP	Crude Protein
CSA	Central Statistical Agency
DM/ha	Dry matter per Hector
EARO	Ethiopian Agricultural Research Organization
ESGPIP	Ethiopia Sheep and Goat Productivity Improvement Program
FAO	Food and Agricultural Organization
FDRE	Federal Democratic Republic of Ethiopia
GLM	General Linear Model
IBC	Institute of Biodiversity Conservation
IPS	Industrial Project Service
IVDMD	In-vitro Dry matter Digestibility
ME	Metabolizable Energy
N	Nitrogen
NDF	Neutral Detergent Fiber
PADS	Pastoral Area Development Study
PAs	Peasant Associations
RPPACC	Regional Program of Plan to Adapt Climate Change
SAS	Statistical Analysis System

SRS	Somali Regional State
SPSS	Statistical Package for Social Sciences
SRSS	Somali Regional State Strategy

BIOGRAPHICAL SKETCH

The author was born from his father Mr. Omar Ali and his mother's Mrs. Khadra Sirad on October 23, 1987, in Gashamo district Jarar Zone of Somali region. He started his elementary school in 1990 at Gashamo elementary school and attended his junior and high school education at Dire Dawa towns, and he took ESLCE in 2011. Then he joined Jigjiga University, College of Dry land Agriculture in 2012 and graduated with BSc in Animal and Range Science in July 2014. After graduation, the author was employed by the Jigjiga University in September 2015 and served for one year as staff member in Animal and Range science department and after this in one year in Jigjiga University employment, he joined the Postgraduate Program of Haramaya University, in September 2016 to study his Master of Science degree in Animal Nutrition.

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ASSESSMENT OF LIVESTOCK PRODUCTION PRACTICES, FEED RESOURCES AND THEIR NUTRITIONAL VALUE IN DEGHABUR DISTRICT, SOMALI REGIONAL STATE, ETHIOPIA.

ABSTRACT

The study was conducted in Deghabur district of Somali Regional State, with the objectives of generating base line information about the livestock husbandry practices, to identify the available feed resources. The study was undertaken in four purposely selected Peasant Associations (PAs) according to their road accessibility and potential for livestock population; total sample sizes of 120 household were used for the study. Semi structured questionnaires were held with pastoralists as well as group discussions followed data collected with the districts zonal offices. Feed sample was collected in dry and wet seasons. Livestock production plays an important role in pastoral area and pastoralists in the study district owned diversified livestock species that includes camels, Goats, Sheep, Cattle, Donkeys and Chickens but The overall mean of goat, sheep, camel, cattle, donkey and chicken owned by a household was 40, 25.49, 7.13, 2, 1.49 and 0.65, respectively. Goats and Sheep were the highly valuable livestock by the district followed by Camels. Livestock population in the study area was declining during the last three decades, due to feed shortage (rank 1), drought (rank 2), water scarcity (rank 3) and diseases (rank 4). Major livestock feed resources are rangeland pasture (50 and 79.2%) crop residue (15.7 and 8.3%), crop aftermath (10%), and indigenous fodder trees (70.8 and 61.7%) during dry and wet seasons, respectively. The DM content of range feed in the study areas was 90.7 and 92.0, in wet and dry season, respectively. There is no significant difference ($P>0.05$) in Dry matter of all feeds between seasons. The ash contents ranged from 10.91% during rainy season to 7.86% during dry season. No significant difference ($P > 0.05$) in ash contents was observed between the range feeds at different seasons. The CP content of range feed was significantly different ($P<0.001$) between both seasons and CP ranged from 10.6% to 14.7% and 3.8% to 9.3% in the species Sporobolus spicatus and Tephrosia villosafor both seasons respectively. Tephrosia villosa had the high content of 9.3% CP in the dry season followed by Dobera glabra 9.0%. But there was no significantly difference among the species for CP content in the wet season, while light to major drop was observed for the dry season results particularly in Sporobolus spicatus and Grewia tenex. The NDF and ADF contents of all range feed were significantly different ($P<0.05$) between dry and wet seasons, but there is no significant difference ($P>0.05$) in ADL content between all feed. Therefore, the livestock production is the main means of livelihood of the population so, it need Proper understanding for development actors to improve the livelihood of the pastoralists.

Key words: livestock, feed resources, nutritional value, Deghabur district.

1. INTRODUCTION

Animal production has been considered as the main component of agricultural development in most parts of Sub-Saharan Africa. Like in many developing countries, domestic animals play a crucial role in Ethiopia. They provide food in the form of meat and milk, and non-food items such as draft power, manure and transport services as inputs into food crop production and fuel for cooking. Livestock are also a source of cash income through sales of the above items. Furthermore, they act as a store of wealth and determine social status within the community. Ethiopia is known for its high livestock population, being the first in Africa and tenth in the world (Mekonnen*et al*., 1989; Gebrecherkos*et* and Birnun, 2012). Livestock in Ethiopia estimated 56.7 million cattle, 29.332 million sheep, 29.112 million goat, 1.2 million camels, 56.866 million poultry, 2.033 million horses, 0.43 million mules and 7.43 million donkeys (CSA 2014/2015) in number, the population of these animals in Somali region is 645,166 cattle, 3,200,303 shoats, 162,884 chickens, 111,491 Donkeys and 108,896 camels (CSA 2014/2015).

Livestock play an important role in providing export commodities in a form of live animals, hides and skins (FAO, 2009). This sector of agriculture plays a vital role in the livelihood of the majority of people in country. Despite the large livestock population with high potential for meat and milk production, a number of factors hindered the development of livestock sector in Ethiopia. These include shortage of animal feeds, poor genetic potential of the indigenous animals, inadequate veterinary services, as well as the absence of good management (Alemayehu, 2002).

The major livestock feed resources in Ethiopia are natural pasture and crop residues where all livestock depend on them, The availability of feed resources and the nutritional quality of the available feeds are the most important factors that determine the productivity of livestock. One of the major problems to low milk production in the country is associated with shortage of livestock feeds both in quantity and quality, especially during the dry season (Zewdie, 2010). The role of natural pasture grazing as a major livestock feed resource is diminishing from time to time due to poor management and overstocking, natural pastures are highly overgrazed resulting in severe land degradation, loss of valuable species and dominance by unpalatable species (Yayneshet, 2010).

Livestock feeds are one of the major factors that contribute to low productivity in Somali region. Feed resources provide crucially required nutrient such as energy, protein, vitamins and minerals for all classes of animals in order to fulfill maintenance and production requirements. The proportion of unsuitable land (land that are not appropriate for cultivation) for forage production in the region is 23.05% or about 7,382,000 ha. Shinile zone is the most affected unsuitability land for forage production with 86.4% followed by 40.4% in Afder and 19.1% in Degehabur, while Jijiga is the least affected zone by 0.5%. The existing feed couldn't satisfy the nutrient requirement of animals particularly during the long dry season. However, most of dry forage and roughage from rangeland is less than 62g CP/kg DM of the diet which is much less than the required amount (Tacher, 1986; Thomas, 1999; Malede*et*, 2013) In general, rainfall and forage production tends to decrease to the South and Southeast part of the region; hence, the area is characterized by; erratic rainfall, over grazing, over stocking, mismanagement and all these result in reduction of desirable plant species in the region (Malede, 2013).

The major feed resources in the area include communal grazing land, dry riverside grazing, indigenous browser and insubstantial amount of crop residue after harvest. Although there is difference in utilization across months of the years, communal grazing lands are utilized throughout the year (Fikru, and Gebeyew, 2015). But the availability and quality of forages are limited and not uniform in nutrient quantity all year round. As a result, for animal that is not supplemented the gains made in the wet season is totally or partially lost in the dry season (Alemayehu, 2003).As a result of that in highland part of the country, feed shortage is widely reported. But, few or no studies have been attempted to identify the type of feed source as well as their nutritional value in the study area, which needs critical study about feed resource, nutritional quality and feed management. However, this study will fill gaps and more importantly contribute some knowledge and information about the livestock husbandry practices, available feed resources and feeding systems throughout the months of the year that targeting for better utilization of the range feed resources. Therefore, this study was designed with the following objectives:-

- To assess livestock production practices, and management system in Deghabur district, and
- To identify major feed resource and evaluate chemical composition (nutritional value) of the major feed resources in Deghabur district

2. LITERATURE REVIEW

2.1. Livestock Production Systems in Ethiopia

Passim their long history, Ethiopians have constantly relied on livestock in order to survive. Livestock in Ethiopia are extremely important as they serve a wide variety of functions in society from social to subsistence purposes (Behnke, 2010; Kassahun, 2008; Halderman, 2004). Behnke (2010) further observed that currently about 53% of the agricultural capital stock, 30% of the GDP and 70% of the human population in Africa depend on livestock. In spite of the relatively low notice they are afforded, livestock are estimated to contribute to the livelihoods of 60-70% of the Ethiopian population (Halderman, 2004).Numerous authors used different criteria to classify livestock production systems in Ethiopia. However, about five production systems have been identified based on integration of livestock with crop production, level of input and intensity of production, agro-ecology and market orientation.

The following systems have been defined as follow. Pastoral, agro-pastoral, mixed crop-livestock farming, urban and peri-urban dairy farming and specialized intensive dairy farming systems (Yitaye, et al, 2007).

In the lowland agro-ecological setup with pastoral production system, livestock do not provide inputs for crop production but are the very backbone of life for their owners, providing all of the consumable saleable outputs and, in addition, representing a living bank account and form of insurance against adversity (Coppock, 1994). This system is characterized by sparsely populated pastoral rangelands, where subsistence of the pastoralists is mainly based on livestock and livestock products. The livestock husbandry in this system is dominated by goats, cattle, sheep and camels. Since the main source of food is milk, pastoralists tend to keep large herds to ensure mainly sufficient milk supply and generate income (IBC, 2004).

2.1.1 Pastoral production system

Pastoralism in Africa is practiced predominantly by small family units in lowland area at an altitude of below 1500 m.a.s.l. Pastoralism dominates arid and semi-arid areas and is characterized by mobility, often using communal grazing land under common property tenure (nomadism or transhumance); (De Leeuw and Thorpe, 1996).The primary livelihoods of the pastoralists are the rearing of livestock (cattle, goats, sheep and camels). Hence, livestock is critical to the well-being of the lowland pastoral society in terms of income, saving, food security, employment, traction, fertilizer and fuel (Blench, 2001). Generally, the pastoral and agro-pastoral areas are endowed with livestock resources and livestock production entirely depends on natural grazing land (PADS, 2004).Herds and flocks are raised that vary considerably in size, from a few sheep and goats in the poorest families to many hundreds of cattle and/or camels in the wealthiest (IBC, 2004). The size of the herd/flock determines the share of feed resources obtained from pastures grazed communally under an open access or common property tenure system characterized by mobility (nomadism or transhumance) as a survival strategy (De Leeuw and Thorpe, 1996).

Pastoralists in Ethiopia are dependent on their livestock. A livestock is a base for consumption and trade. Most of the pastoralists live in the semi-arid or arid areas which receive erratic rainfall. During drought, the livestock dies and prices of cereals increase which means a must-to-sell-off more livestock to survive. The increasing population growth has caused problems also to the pastoral communities. Land erosion and deforestation increase the vulnerability of the communities (FDRE 2002).

Pastoralists' knowledge of species, ecosystems and climate form the basis for sustainable land management. Management strategies include seasonal movement, use of trees leaves and pods during dry seasons, burning of old pastures, and feeding on crop residues. In many eastern African pastoral communities, selection of grazing sites is aided by scouts, who report on the condition of distant pastures, estimating how long the fodder and water will sustain a given number of livestock. In Sudan for examples, herds are not grazed at random, but in sites selected to be the best available, while sites in poorer condition are left to regenerate (Barrow *et al*.2007).

Pastoralists have permanent base in the territory occupied by their clan but travel from place to place in search of pasture and water. They have well established resource management system. During the dry season, they keep their livestock close to water wells while during the rainy season they keep their livestock in the open rangeland. In transhumance husbandry system, the herds' men and part of the family are migrate together and the rest remain in the permanent settlement. This is the second important type of animal husbandry system; especially those pastoralists near small towns and those who practice crop farming are used to such system. The system of seasonal grazing between dry and wet season grazing areas allows the grass and vegetation to regenerate. Somali pastoralists used to depend completely on the livestock products such as milk, meat butter and others. Socio-economic study conducted in the region indicated that pastoralists and agro-pastoralists generate their income from livestock and livestock products (Abdullahi, 1993).

This is a system mainly operating in the range lands where the peoples involved follow animal based life styles which requires of them to move from place to place seasonally based on feed and water availability. The climate in these areas is characterized by low, unreliable and unevenly distributed rainfall and by year round high temperatures. Not only the unfavorable weather conditions but also uneven water point distribution and further the lack of proper management of the rangelands eventually leads tribal conflicts, introduction of new animal disease, low animal productivity and also trans-border issues (Behnke, 1993) Even though, information on both absolute numbers and distribution vary, it is estimated that about 30% of the livestock population and about 15% of human population of the country are found in the pastoral and agro-pastoral areas (Halderman, 2004). The livestock production system and diversity of the agro-pastoral and pastoral systems depend on climatic, vegetation and animal type. In areas of lower altitude and lower moisture content, camels and goats are the dominant livestock species while in relatively higher altitude, cattle rearing become the most dominant livestock herding. Moreover, pastoralists keep a diversified collection of herds based on variation in quality, quantity and types of feed, sensitivity to drought and diseases (SRSS, 1997).

The majority of the populations in the SRS (more than 85%) are pastoralists and agro-pastoralists whose live depend on animal husbandry (SRSS, 1997). Livestock is the backbone of the economy and almost 85% of the Somali populations depend for their livelihood on livestock products. The livestock sector of the region has been badly affected by inadequate and poor quality of the feed situation, weak sectorial support and poor marketing services (SRSS, 1997).

2.1.2 Agro-pastoralists production system

Agro-pastoralists may be described as settled pastoralists who cultivate sufficient areas to feed their families from their own crop production. Agro-pastoralists hold land rights, use their own or hired labor to cultivate land and grow staples. While livestock are still value property, their herds are on average smaller than other pastoral systems, possibly because they no longer solely rely on livestock and depend on a finite grazing areas around their village which can be reached within a days. Agro-pastoralists make greater investment in housing and other local infrastructures and if their herds become large, they often send them away with more nomadic pastoralists.

This system is characterized by less integration with crop production as compound to the crop-livestock production systems in the highland areas. Producers under this system have a permanent residence and their movement is limited in terms of both distances and duration. This system is characterized by a high degree of dependence on milk and meat production. Some crop agriculture is practiced around the permanent homestead. This is also a low input/ low output systems. This system is usually practiced below 1500 m.a.s.l., but with high rainfall to support short crops compared to the pastoral system (ESGPIP, 2008).

2.2 Livestock Management Practices and Water Sources in pastoral area

2.2.1 Livestock managements

In the rural areas of traditional animals husbandry practice the productivity of animals is generally low. Herd owners are interested to hold as many heads of animals as possible rather than keeping few numbers of productive herds. Systematic way of managing the rangeland and improved forage development strategy is not practiced. Conservation and Supplementary feeding to mitigate dry season feed shortage is undertaken only by few peasants/agro production (Malede, 2013). Furthermore, control breeding and record keeping is not well knows and ruminants are mainly left to feed for themselves in the grazing area of the region (Tsige, 2000).

2.2.2 Breeding practices and techniques in pastoral area

The keeping of mixed species herds has a number of advantages, including allowing for different types of vegetation to be utilized, livelihood risk reduction and the balancing of short-term gain with longer-term security, and the production of different types of livestock products (Catley*et al*. 2013). But the information on how the Somali pastoralists breed their animals to respond to this large market demand in terms of volume and quality. This aimed at addressing this gap, and specifically documents the pastoralists' perception of important livestock traits, the criteria they use to select male breeding animals and the criteria they use to cull female breeding animals, for camels, cattle, sheep and goats Berhanu *et al*., (2012). However Mating was predominantly uncontrolled in most of the production systems. However, controlled mating was practiced to some extent to match birth time with wet season and to avoid indiscriminate breeding in the pastoral production system. Methods of control included separating males from females at all times, especially during dry season, and castration. In the south-east lowlands and north-western of the Somali Region in eastern Ethiopia respectively indicated that controlled breeding to capture both the desired selection criteria and to match giving birth with the rainy season enhances the survival rate of the offspring Nigussie *et al.*, (2013).

2.2.3 Water sources for livestock

Somali pastoralists normally depend on natural water resources such as permanent and temporary rivers and streams, but all pastoralists do not have equal access to these resources, but with little or no availability during the dry seasons.

Water is one of the scarce resources in the region and the main sources of water for livestock and human are ephemeral ponds, perennial and seasonal rivers, seasonal streams, shallow wells and cistern. Ponds and seasonal streams are mostly used in the rainy season, while wells and cistern during the dry period. Rainfall is the main source of surface water and its distribution is irregular thus pastoralists move from place to place in search of water for both human and livestock (IPS, 2002). Accordingly, the main source of water for livestock and human in Jijiga zone are *Birkas* which account for (52%), ponds (39%), natural gorges (3.2%) and wells (5.8%), (Belaynesh, 2006). However, the water availability in the area has also declined and the livestock and human population depend mainly on rain.

Hand dug wells and small ponds (*Birkas*) are the main water sources used during the dry period, However, this water supply is inadequate for the full year due to high evapotranspiration rates, reduced water tables and discharges and a limited number of available wells (Amaha KG, 2006).

During the colonial era, British Somaliland colonial authorities which is also rules in Ogaden region introduced boreholes and cisterns (*Birka*), underground rain water collection points made of cement. Livestock trade found sizeable foreign markets in the Arab world and as a result, pastoralists with a good amount of herds sold livestock to urban livestock traders. With this extra cash they were able to build cisterns all over the Haud and the Sool Plateau, increasing their herds and overcrowding the water points, causing desertification around permanent water points (Fatima J, 2016).

Pastoralists understand the importance of boreholes as permanent water sources and believe that such solution can solve their water problems, but there is a lack in developing alternative water resources for human and livestock watering by the local, regional and national governments, as well as non-governmental institutions (Amaha KG, 2006).

2.3 Major Livestock Feed in Lowland Ethiopia

2.3.1 Grazing system in lowland Ethiopia

The pastoral rangelands of Ethiopia are located around the peripheral or the outer edge of the country, almost surrounding the central highland mass (Alemayehu 2004). The areas are classified as marginally arable and non-arable land. The lowland climates are arid (64%), semi-arid (21 %) and sub-humid (15%) and the zones are largely characterized by four rainfalls and temperature regimes. Most of these areas are below 1500 meters above sea level with the south west and the south eastern areas having an altitude of around 1,000 up to 1,700 meters above sea level. (Kidane, 1993). Thus Communal grazing land, roadside grazing, private grazing, riverside grazing and indigenous browser are the major types of grazing for livestock.

The natural vegetation's in the arid and semi-arid lowland of the region form the main natural and traditional sources of livestock feed (IPS, 2002). Grazing and browsing species of the natural vegetation are the only sources of livestock feed in the region. The distribution of such natural vegetation varies from place to place depending on climatic variation and consequently on the ratio of grazing to browsing resources. Depending on the type and ratio of feeding resources, the pastoralists diversify their herd to effectively utilize the available feed resources. The pastoralists also have a well- structured traditional resource management system that involves categorization of the range resource into dry and wet grazing which allow regeneration of natural vegetation during intermittent periods (SRSS, 1997).

This natural vegetation, which serves as livestock feed; commonly known as rangeland resources is affected predominantly by over-grazing and bush encroachment. One of the consequences of overgrazing is bush encroachment, which is a reduction of pasture heavily affecting the productivity of grazer, cattle and sheep. The other threat is the rapid invasion of unwanted weeds known as "kaliginool" Parthenium hysterophrus (Congress weed) in different parts of the region.

The destruction of forests and woodlands by humans caused certain parts of the region to be devoid of natural vegetation and this in turn resulted in the reduction of the rangeland resources, such problems have been clearly observed in areas close to the recently abandoned refugee camps (Ahmed, 2003).

Inadequate feed supply, both in terms of quantity and quality, is the major constraint affecting livestock production in Ethiopia. Feed scarcity is indicated as a factor responsible for the lower reproductive and growth performance of animals especially during the dry season (Legesse, 2008). The dry season is characterized by inadequacy of grazing resources as a result of which animals are not able to meet even their maintenance requirements and lose substantial amount of their weight. Animal feeds were classified as natural pasture, crop residue, improved pasture and forage and agro industrial by-products of which the first two contribute the largest share in livestock production (Alemayehu, 2003; Tolera*et al.*, 2012). The use of communal grazing lands, private pastures and forest areas as feed resources have declined while the use of crop residues and purchased feed have generally increased (Benin *et al.*, 2003). Though increased utilization of agro-industrial by-products has been reported (Benin *et al.*, 2004), they are not available, affordable or feasible for most of the farmers in the highlands of Ethiopia. Under smallholder livestock production system, animals are dependent on a variety of feed resources which vary both in quantity and quality. In spite of that commercial feed production and cultivation of feed has not been adopted in most areas of Ethiopia, natural pasture and crop residues are the major source of livestock feed (Bizuwerk *et al*., 2005).

2.3.2 Natural pasture

Natural pastures include annual and perennial species of grasses, forbs, shrubs and trees naturally grown. Many researchers and development workers agreed that natural pasture comprises the largest feed resource, but estimates of the contribution of this feed resource vary greatly (Alemayehu, 2004).

Seasonal fluctuations of feed resources in the tropics follow the pattern of vegetation growth that is affected by the availability of rainfall. This resulted in a seasonal pattern of wet season gain and dry season loss of live weight. Seasonal fluctuations in the availability and the poor quality of feeds are considered to be the main constraints on sheep production in arid regions (Guada, 1989). So the reliability of natural pasture as a feed source is restricted to the wet season (Alemu*et al*., 1991) and animals feed source is extensively based on roughages for long periods of the dry season.

This is mainly because of the continuous declining of natural grazing lands in the highlands and rangelands in the pastoral areas. Earlier, it was estimated that about 62 million ha of natural pastureland were available in the country (Alemayehu, 1985), but because of the continuous change of grazing land into cropping, the size has reduced to 40 million ha (EARO, 2001). It is likely that the available grazing land has diminished more during the last few years and is expected to continue in the future. Hence, the share of natural grazing pasture at the national level as livestock feed resource, has become reduced to about 57% (CSA, 2012) from an earlier level of 90% (AlemayehuMengistu, 1985). Moreover, the productivity of grazing lands is estimated to range between 0.5 to 6 tons DM/ha, which is typically low productivity as compared to yield from improved pasture (Alemayehu, 2006). It was reported that, Shrinkage and decline yield of grazing lands driven by increase livestock population and drought was the leading reasons for feed shortage in Degehbur district.in addition there is increases of human population and decline the carrying capacity of grazing land (Fikru, and Gebeyew, 2015).

Table 1. Shrinkage and decline yield of grazing-land in Degahbur district.

Particulars	**Frequency**	**Percentage**
Shrinkage and Declining yields of grazing land	**42**	**35.6**
Increase of livestock population	**32**	**26.7**
Drought	**21**	**17.8**
Increase of human population	**11**	**8.9**
Declining carrying capacity of grazing land	**11**	**8.9**
Cultivation of grazing lands	**3**	**2.2**

Sources: - Fikru&Gebeyew, (2015).

2.3.3 Crop residues

CPRs are the fibrous by-products which result from the cultivation of cereals, pulses, oil plants, roots and tubers and represent an important feed resource (Yayneshet, 2010).They are important in fulfilling feed gaps during periods of acute shortage of other feed resources. A report by (Tolera*et al*, .2012) indicated that crop residues contribute to about 50% of the total feed supplied in Ethiopia. The amount of crop residue produced is closely related to grain production, farming system, the type of crops produced and intensity of cultivation. About 12 million tons of crop residues were produced annually from 6 million hectare of farmland in Ethiopia (Daniel, 1988). A report by CSA (2008) indicted that crop residues production was increased to 31.52 million tones. (Zinash, and Seyoum. 1989) reported that 63, 20, 10, and 7% of cereal straws are used for feed, fuel, construction, and bedding purposes, respectively. Farmers in the Ethiopian highlands have a tradition of conserving crop residues from *teff* (*Eragrostisteff*), barley, wheat and sorghum (Reed and Goe, 1989). Straws from *teff*, barley and wheat form the largest component of livestock diet in the mid and highland areas, while maize, sorghum and millet stover's constitute larger proportion of livestock feed in lower to medium altitudes (Alemayehu, 1985).

Although pastoralist's dominant mode of production are livestock, crop production is also practicing to some extent and the practice is gradually expanding from the agro-pastoral to the pastoral areas, nearly Borana pastoralists indicated that they are currently practicing crop production in addition to livestock rearing. Traditionally the Borana Oromo and the Garri Somalis are pastoralists whose livelihood depends mainly on extensive pastoral livestock production. Thus crop production is a recent experience for most of them. Most of the pastoralists engaged in cultivation reported that they started cultivation since the last 3-15 years (Tolera and Abebe, (2007).

The CPRs have long been known as important maintenance feed for ruminants. However, when used alone, they are of very low feeding value with poor metabolizable energy (ME), negligible available protein and seriously deficient in mineral and vitamins (Reed, 1985). On the other hand, crop residues vary greatly in chemical composition and digestibility depending on varietal differences (Reed, 1985).The feeding value of crop residues is also limited by their poor voluntary intakes, low digestibility and low nitrogen, energy, mineral and vitamin contents (Alemu, *et al*., 1991). The CP content of crop residues ranges form 2.4-7% and the value of

IVDMD for straw is between 34 and 52% (Daniel, 1988). However, the nutritional values of crop residues vary according to the type of crop used (Daniel, 1988). For example, cereal straws have a CP, NDF, and IVDMD mean values of 4.5, 79.4 and 51.1%, respectively in contrast to pulse straws, which have a CP, NDF and IVDMD, mean values of 7, 62.9 and 63.5%, respectively. Furthermore, straw from oil crops have CP and NDF values of 5.4 and 66.4%, respectively (Alemu, *et al.*, 1991).

Simple secondary data of the degahbur district done by (Fikru, and Gebeyew, 2015) indicates that supplement salt, stored fodder pods and leaves, maize and sorghum Stover, for all age, this is in line with the report of (Yeshitila A, 2007), also indicates Majority of the farmers supplemented small ruminant during dry season (40%) followed by both seasons (4.4%) and no supplementation in the wet season. According to (Yeshitila A, 2007), better feeds are available in wet season.

2.3.4 Improved forage and pasture crops

Forages play varying role in different livestock production systems. In general, however, they are important as adjuncts to crop residues and natural pastures and may be used to fill the feed gaps during periods of inadequate crop residues and natural pasture supply. Even in the presence of abundant crop residues, which are often free fed to ruminants, forage crops especially legumes are needed to improve the utilization of crop residues, crop residues often provide energy while forage legumes provide proteins. Forages also provide benefits such as soil fertility through their nitrogen-fixing ability and are useful in breaking insect, weed or disease cycles, which are likely to occur when they are not supplemented. In many situations, however, forages compete with other crops. In land scarce smallholder forages ` may compete with other crops for land, in land abundant pastoral systems, they may compete for the herders labor (John and Siegfried,1987). In addition to contributing to soil nitrogen and providing a break in cereal-dominated rotations, forage legumes contribute significantly to livestock production in crop livestock systems. Low quality crop residues need nitrogen supplementation, often provided by forage legumes to become productive diets. In the Ethiopian high lands, for example, *Viciafaba*is not fed to livestock except in combination with cereal straw (Anderson, 1985). It is also possible that forage legumes will increase food production and thus the quantity of crop residue available for feed (John and Siegfried, 1987).

In livestock production, one of the most important factors determining profitability is to achieve optimal level of feeding. This aim is most problematic during the dry season when available feed resource is scarce and is of low quality. Therefore, livestock farmers are facing their biggest challenge during the dry season. Producing supplementary feed on farm by establishing grass/legume pastures would reduce their problem. For instance mixed grass legume pasture produced higher DM yields of better nutritive value than sole grass swards (Onifade and Akinola, 1986).

2.3.5 Other feed resources

Livestock feed resources are classified as conventional and non-conventional (Alemayehu, 2003), where the non-conventional ones vary according to the feeding habit of the community and others, e.g. vegetable refusals, sugar cane leaves, Enset leaves, fish offal and etc. are non-conventional feed types. (Yeshitila et al., 2008) also identified non-conventional feeds and it includes like residues of local drinks coffee, *areke*, *tela*, *chat* left over called *geraba*, fruits and vegetables reject.

2.4 Livestock Feed Management

There is a marked seasonal variation in availability and quality of feed resources due to marked seasonal variation in rainfall distribution. The availability of feed resources (grasses and browses) is adequate during the rainy season. However, the grasses become depleted during the dry season. The over mature dry grasses also have very low nutritive value. The situation is further aggravated when the dry season is prolonged. Thus when dry season is prolonged or during drought years animals become unproductive, they lose condition and market value and eventually die due to inadequate feed and water supply and the very low nutritive value of the available feed. The over mature dry grasses are characterized by low nutrient content, high fiber content, low digestibility and low voluntary intake by animals (Tolera, and Abebe. 2007). The agro-pastoralists in around jigjiga have an indigenous mechanism of Feeding on browse species by sheep, goats and even cattle, did not occur only during the dry season; rather it has been observed even at the peak of the wet season. In the wet season, most of the foliages were consumed directly from the live plant and some of them were lopped and sometimes offered as cut and carry feed especially around town like Jigjiga and Fafan where there some improved types of browse plants like *Luecina*and *Sesbania* were available. Cut and carrying to home was mostly meant to feed sick or young animals however for most type of sheep and goats offering browse plant by cut and carry system also practiced because of some of the browse plant planted as fence part. In the dry season, leaves and pods from deciduous trees and shrubs were consumed after they had fallen naturally to the ground. These deciduous parts represented the larger quantity consumed during the first few months of the dry season depend on the amount of plant material available in the area (Somson et al., 2013).

However, cutting excess grass during the rainy season and making hay for dry season use is not a common practice. The excess forage could be conserved in the form of hay at the end of the main rainy season in June or July. During this time the pastoralists are also relatively free so that there is no competing demand for labor. Thus training of the interested pastoralists in hay making techniques and providing them with appropriate tools or any logistic support would contribute to alleviation of the problem of feed shortage during the dry season (Tolera, and Abebe. 2007**).**

2.5 Nutritional Evaluation of Forage Species.

Evaluation of feeds should provide nutritionists with the necessary information to formulate a diet from both a physiological and an economical point of view, in order to optimize the animal performance. It is also known that local knowledge-based of pastoralist management strategies could ensure a focus on the optimal use of species and vegetation types that are most valuable to local communities (Sulieman, et al., 2012).

Pastoral herders recognize all the desirable and undesirable plant species by local names (Gemedo-Dalle, et al., 2005). The herders categorized forage plants into desirability classes based on livestock preferences. The 'very desirable' forages are highly selected by livestock and given preference during grazing.

Grasslands have generally been observed to have nutritious and palatable forage (Reid *et al*., 2005). Under arid conditions, the nutritional quality of herbaceous species is typically influenced by the seasonality of rainfall. But the use of browse species as fodder to ruminants has increasingly become important in African semi-arid environments (Abdulrazak, et al., 2000a). According to Selemani*et al*. (2012), in Africa Acacia trees are considered to be dominants and are important sources of feed to livestock throughout the year

2.5.1 Chemical composition

Addition of nutrients is essential to improve the quality of pasture and to replace nutrients which are lost through chemical reaction with the soil constituents or by removal through animals. Dressing of fertilizer can markedly affect also known that the application of nitrogenous fertilizer can increase the crude protein of pasture herbage and influence the amide nitrate content (McDonald *et al*., 1995). Forage digestibility is associated with intake, dietary N content and physical form of the forage. Generally, forages with protein contents above 6 - 8% have greater digestibility because of the availability of required N for ruminant microbes (Styler*et et al*., 1979). Kazemi *et al*., (2012) also noted that the CP values lower than 8% are considered to be of inferior quality.

Tropical grasses are characterized by low nutritive value due to the higher lignin content and less degradable materials in their cell wall due to rapid rate of achieving maturity (Minson, 1990). At advanced maturity, forages are characterized by high levels of cell wall fiber of neutral detergent fiber (NDF), acid detergent fiber (ADF), lignin, and low nitrogen (N) which resulted in low animal performance (Van Soest, 1982). The structural constituents of plant material forms fiber which are digested completely or incompletely by the animal, the lignin part resists microbial enzyme attack and reduces digestibility. Higher leaf to stem ratio is reflected in lower cell wall content since leaves contain less cell wall than stems at comparable physiological stage (Norton, 1982).

The reduction of fiber concentration in the plant tissue is indicators of increasing voluntary intake in ruminants (Van Soest, 1994). Tropical grasses generally have higher neutral detergent fiber (NDF) levels than temperate grasses. The increase in cell wall constitutes (NDF) is a very important limiting factor of nutritive value of feeds (Van Soest and Robertson, 1985). The NDF value greater than threshold level, 60% resulted in decreased voluntary feed intake, increased rumination time and decreased conversion efficiency of ME (Reed and Goe, 1989).

Acid detergent fiber (ADF) is widely used to measuring the fiber contents in feeds. It may range from 20% to over 45% in very mature species of grasses (McDonald *et al*., 2002). Higher ADF values indicate lower nutritive value. The ADF content of grass increased from 22.4 - 42.9% when harvesting days increased from 30 - 120 days (Adane, 2003). Lignin is the non-carbohydrate component of the forage cell wall and identified as limiting fiber digestibility and is the prime factor influencing the digestibility of plant cell wall material. As lignin increase, the digestibility, intake and animal performance usually decrease and the percent of ADF and NDF increases.

2.5.2 Feed digestibility and degradability

Utilization of protein and energy in ruminants at cellular level is preceded by a hydrolytic degradation process called digestion, converting the ingested organic matter (OM) into compounds suitable for transportation across the cell walls of microbial cells in the fore stomachs or of epithelial cells of the digestive tract (Miller, et al., 1982). Digestibility of feed denotes the percentage of the whole feed, or of any single nutrient in the feed, which is not excreted and is thus assumed to be available to the animal for absorption from the gastrointestinal tract. The most important facet of nutrient utilization is that evaluation of digestibility involves the determination of how much of a feedstuff or an individual nutrient is not degraded and absorbed while passing through the animal (Bitende, 1994).

Forage digestibility is associated with intake, dietary nitrogen content and physical forms of the forage. Generally, forage with protein contents above 6-8% has higher digestibility because of availability of required nitrogen for microbe in the rumen (Rafique, *et al.*, 1993). Digestibility of forages is determined largely by structural factors like degree of lignification, but it also influenced by factors such as physical processing, level of intake, diet protein concentration and other associative effects in mixed diets (McDonald, *et al.*, 1995). The potential digestibility of all chemical compounds in plant material except lignin, cutin, and silica is 100%. Complete digestion never occurs owing to lignin encrustation protecting cellulose and hemicellulose from degradation by rumen micro-organisms. Thus, digestibility declines as lignin contents increases but relationship between lignin content and digestibility varies between plant species (Whiteman, 1980). It has long been known that there is a positive relationship between dietary crude protein concentration, DM digestibility and ultimately intake level in ruminants (Schneider and Flatt, 1975). Increases in DM digestibility with increasing diet CP content can be attributed to the innately high digestibility of protein, or positive effects on microbial fermentation and digestion in the rumen (Tyrrell, 1980).

3. MATERIALS AND METHODS

3.1 Description of the Study Area

The study was conducted in Deghabur district, Jarar zone. Jarar Zone is one of the 11 administrative zones in Somali Regional State (SRS) and consists of 10 districts. The districts are: Aware, Deghabur, Deghamadow, Gunagado, Gashamo, Bir-qodDaroor, Araarso and yoo'aale. Deghabur is the capital of the zone and it is an administrative town. Degehabur is located between 8^{o}13' North longitude and 43^{o}34' East latitude. The altitude 1044 meters above the sea level, while the annual rainfall ranges between 300 to 400 mm per year, from April to June(spring) and October to December(autumn) periods. The rainfall pattern is erratic and uneven distribution (Wiki, 2015).

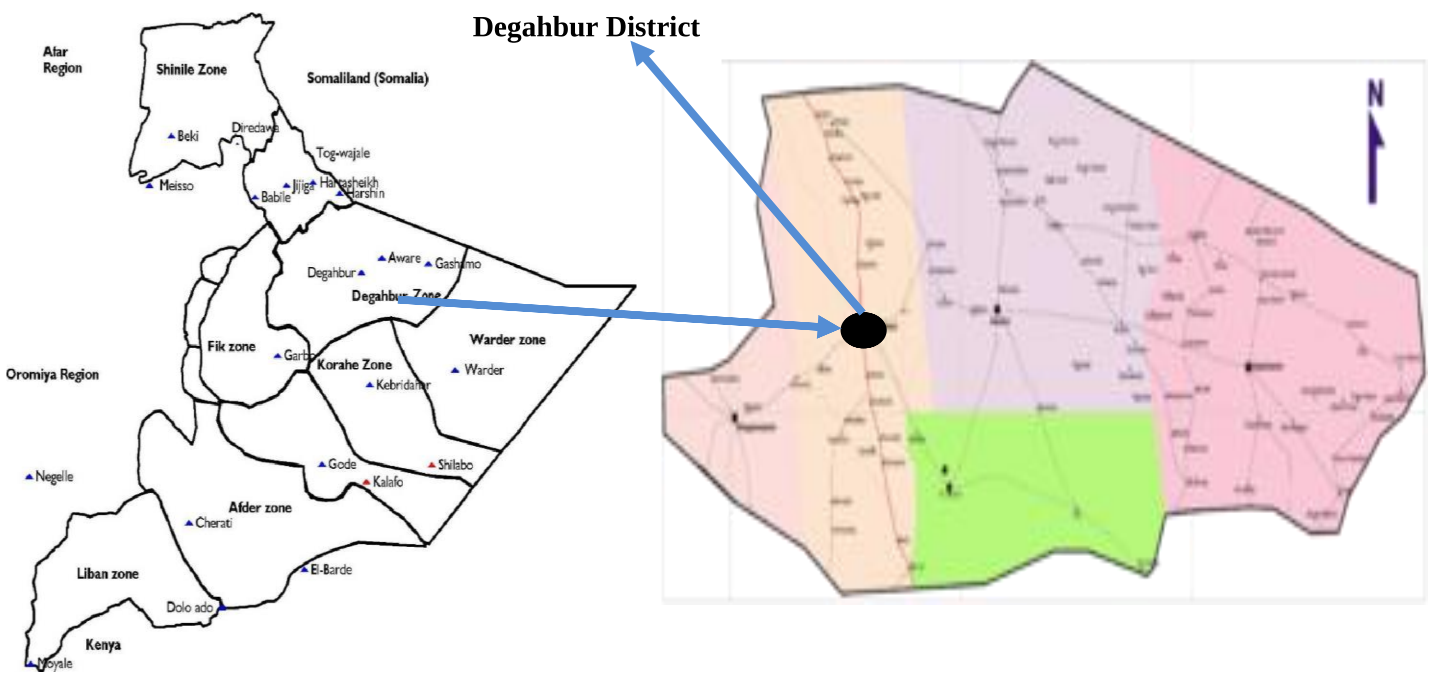

Figure.1 Map of Ethiopia together with Somali regional zones and Deghabur Zone indicating the study site Deghabur district.

3.1.1 Farming system in the study Area

The farming system in the study area is primarily transhuman pastoralist and crop production is also practiced to some extent. Livestock mostly depend on rangeland vegetation all year round, but during dry season crop residues were used as supplements. Transhuman pastoralists depend on livestock and sometimes they follow nomadic lifestyle which uses much of the land for rangeland fodder along with livestock production whereas, when they are back to their centers cultivate some crops like sorghum and maize in river side of the Deghabur district.

3.1.2 Human population

According to the population and housing census by CSA (2006), the district has a total population of 115,555, of whom 65,081 are men and 50,474 women. 30,027 or 25.99% are urban inhabitants, whereas 45,818 or 39.65% are pastoralists. And Livestock, particularly cattle, small Ruminants and camel are important integral components of rural livelihood systems in the district.

3.1.3 Livestock population of the deghabur Zone

Pastoralist in the Deghabur zone have an estimated total 287,000 head of cattle 538,000 sheep, 574,000 goats, 104,000 camels and 11,000 donkeys by CSA (2006).

3.2 Design of the Study

The study had two parts (survey and laboratory experiment). In the survey, livestock production system, traditional livestock management practices, availability and potential of feed resources (grasses, forbs, fodder trees and crop production) were assessed. Major feed resources were ranked by respondents and nutritional compositions were analyzed for selected species.

3.3 Study Procedures

The Deghabur district of Jarar Zone was purposively selected as it is a representative potential area for livestock production in the Zone (CACC, 2003). From the District, 4 PAs were selected purposively based on the proportion of the number of PAs and accessibility. The four PAs are characterized by transhuman-pastoral production system.

Thirty (30) households (10% total HHs) from each PA*s* were randomly selected for the survey, in total 120 sample households. In addition to the household interviews, information was collected from group discussions (one group per PA). Data were indexed and ranked.

3.4 Method of Data Collection and Sources of Data

Both primary and secondary data were collected. Primary data was collected by using semi-structured questionnaire, focus group discussion and field observation. Secondary data was collected from district and zonal offices targeting on livestock production situations, the availability of feed resources in the area and overall husbandry practices.

3.4.1 Questionnaire

Before embarking on the collection of primary data, Eight (8) enumerators who were diploma holders, familiar with the study area and know the local language were recruited, trained and given orientation on how to collect questionnaire data. The questionnaires was pre-tested and readjusted before the actual data collection started the contents of the questionnaires focused primarily on households, socio-economic characteristics (family size, age, sex, and educational level), livestock species composition, and purpose of livestock keeping, housing, animal breeding and disease, constraints and problems of livestock production. Data were also collected on available feed resources, type of feed, seasonal availability of feeding calendar (Appendix 10).

3.4.2 Focus group discussions

Group discussions consisting of 7-9 participants were conducted. The group discussions involved 1 group in each PAs and the researcher facilitated the discussions at all sites. The main points for discussion included relevant information about livestock production system, purpose of keeping, livestock breeding system, availability of feed resources in livestock, and their water resource and major livestock constraints (Appendix 11).

3.4.3. Field observation

Field observation was made to enrich the data about livestock husbandry practices (handling, watering point and welfare conditions), feed resource type and feeding systems.

3.5. Feed Sample collection and Preparation

The sampling for chemical analysis was done twice; early in the rainy season in (April 2017) and at the middle of dry season in (August 2017). Species selected were those nominated by the pastoralists within the focus group discussions as best known grasses, herbs, browse trees and shrubs in the area.

Six individual plants of each species (*Sporobolus spicatus, Tephrosia villosa, Acacia mellifera, Grewia tenex, Dobera glabra* and *Acacia bussei*) were identified and used for nutritional analysis. The samples of Browse trees and Shrubs were hand picking at three heights (top, middle and bottom of the tree) whereas, Grasses and herbaceous plants were taken at 5cm from stalk and were clipped with scissors. One kg of pasture material of each sample was air dried in a well-ventilated room until transported to the nearby laboratory and further dried in an oven at 65^{o}C for 72hours. Then the samples were separately ground in a grinding mill to pass through 1 mm sieve (for chemical analysis) and were equilibrated to room temperature for 24 hours. The samples were then put in plastic bags and sealed for further analysis. Names of pasture species were given in Somali dialects, and then identified by the Corresponding scientific names using Flora of Somali plants dictionary by (Ahmed, 1990).

3.6. Chemical Analysis

Analysis of feed samples was undertaken for DM, CP, and Ash at the Haramaya University central laboratory, according to the proximate method (AOAC, 2005); with the objective of determining the chemical composition of the major feed resources for livestock. CP content was calculated by multiplying nitrogen with a factor of (6.25).But for feed sample containing the structural plant constituents were calculated undertaking for neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL), by using the detergent extraction method (Van Soest et al., 1991).

3.7. Statistical Analysis

Statistical Package for Social Sciences (SPSS version 20) was used to summarize the data on the overall livestock husbandry practices and available feed resources. Furthermore, the summarized data was analyzed by the same software using descriptive statistics (i.e., mean, frequency, standard error and percentage). Analysis of variance (ANOVA) was employed for the analysis of data collected on livestock holding and chemical composition of major feed resources using the statistical analysis system (SAS version 9.0).

Indices were calculated to provide ranking of the Major constraints of livestock production. Index was calculated as:

Index = sum of [5X number of households who ranked first + 4 X number of households who ranked second + 3 X number of households who ranked third + 2 X number of households who ranked fourth + 1 X number of households who ranked fifth] for the constraints divided by sum of [5 for rank 1 + 4 for rank 2 + 3 for rank 3 + 2 for rank 4 + 1 for rank 5] for all constraints.

Statistical models:

Data on livestock holding and chemical composition of feed samples were analyzed using the following statistical model:

$Y_{ij} = \mu + S_i + L_j + e_{ij}$

Where,

Y_{ij}= Individual observation for feed chemical composition and livestock holding

μ = overall mean

S_i = effect of i^{th} the season.

L_j= the effect of j^{th} livestock holding

e_{ij} = random error

4. RESULTS AND DISCUSSION

4.1 Household Characteristics in Deghabur District

4.1.1 Household size and age of respondents

The profile of the surveyed households is presented in Table 2; the average family size per household across the surveyed areas was higher than the average values at the national (5.2) levels (CACC, 2003). However the average family size was less than that reported by Lishan (2007) in Shenille and Dembel districts, and also report of Fikru, and Gebeyew (2015) (11± 0.6) for Jarer zone Somali regional state. But comparable to that of Abule (2003) in Awash Fantale districts (6.74), the high family size around lowland area may be due to the cultural practice of polygamy for most of the pastoralists in the study area. Or could be related to the relatively labor sharing for diversified herding management and the weak family planning services.

The age of the respondents ranged from as young as 20 to 65 years old, overall, the proportion of the respondents with the age range between 20-35 years were young adult and those within the age range of 36-60 years were adults above 36, while those in the above (>60) years were small in number in all *PAs* of the of the district. This indicates high proportion of nonproductive population and fair population growth number in the study area.

Table 2.Profile of family size and age of the respondents in the district

Variables	**Mursal (N=30)**	**Higloley (N=30)**	**Agasur (N=30)**	**Labialan (N=30)**	**Overall (N=120)**
Average family size of the respondents(Mean±SD)	6.8±0.57	7.37±0.72	6.6±0.47	6.3±0.44	6.8±0.28
Age of the respondents (%)					
20-35	43.33	40	46.67	46.67	44.17
36-60	46.67	46.67	36.67	36.67	41.67
Above 60	10	13.33	16.67	16.67	14.17

N=number of respondents, SD= standard error.

4.1.2. Educational background and sex of the respondents

Table 3 shows that overall sexes of respondents in the selected PAs were males and the rest of the respondents were female-headed households. The fact that only 5% completed primary school showed the high level of illiteracy in the study area, the educational level attended by the household heads were very low, and this is in line with the case reported by Simenew *et al.*, (2013) reported that education is very poor and most of pastoral areas in (Somali Regional State) were illiterate (94%). This low level of educational achievement in the study area is attributed to less number of basic primary school coverage in the study area and pupils are required to travel long distances even to the nearest primary schools, which leads to limited access to modern education opportunities, this result also in line with the findings of Abayneh, (2013)in the Yabello Woreda, Borena zone. Consideration of the education status in pastoral area is useful for successful livestock husbandry improvement strategies and other development works, but most of the respondents were illiterate which had negative effect on the development of livestock husbandry practice in the study area. This result is in line with the (Asaminew, 2007) finding that, the majority of the household members were illiterate, and this will have a negative effect on the development of dairy sector.

Table 3.Educational background and sex of the surveyed pastoralist household in the district

Variables	**Mursal (N=30)**	**Higloley (N=30)**	**Agasur (N=30)**	**Labialan (N=30)**	**Overall (N=120)**
Sex of respondents (%)					
Female	40	36.67	43.33	53.33	43.33
Male	60	63.33	56.67	46.67	56.67
Educational level of respondents (%)					
Illiterate	70	100	83.33	86.67	85
Read and write	20	0	13.33	6.67	10
Primary school	10	0	3.33	6.67	5
Secondary school	-	-	-	-	-

N=number of respondents,

4.1.3 Major farming activity

Traditionally the Somalis are pastoralist whose livelihood depends mainly on extensive pastoral livestock production Tilahun, *et al.*, 2006). Overall, the dominant farming activity in the district was livestock production. This implies that most of the inhabitants were transhuman pastoralists as shown in (Table 4). Whereas cropping is practiced to some extent in only two PAs out of the four PAs (Higloley and Labi-alan villages), cropping season for that villages were from late April to early June during the main rainy season whereas the short rainy season cropping extends from early October to late November. The major reasons that made those PAs pastoralists to start crop production way of life was a decline in livestock holding per household and this because vegetation composition in communal grazing land were reduced resulting from unreliable rainfall and frequent drought, highly grazing pressure and expansion of new settlement due to human population pressure. This concurs with the reports of (Tolera and Abebe 2007) in Borana pastoralists finding that, although livestock production was the dominant mode in Borana pastoral area, crop production is also practiced to some extent and the area was gradually expanding from the agro-pastoral to the pastoral areas. According to Fikru and Gebeyew, (2015) and Tilahun, *et al.*, (2006),Crop residues were the only feeds used as supplements by pastoralists during dry season and feed deficit in Jijiga and Deghabur districts respectively. Although there is a general trend of shifting from pure pastoral to transhuman-pastoral production system the transhuman-pastoralists rarely make meaningful for their cropping activities due to very frequently recurring drought and very unreliable and unpredictable pattern and timing of rainfall. Thus, livestock production remains to be the mainstay of their livelihood.

Table 4.The dominant production system

	Kebeles or PA				
Farming system	**Mursal (N=30)**	**Higloley (N=30)**	**Agasur (N=30)**	**Labi-alan (N=30)**	**Overall (N=120)**
Transhuman pastoralist	100%	76.2%	100%	72.22%	91.75%
Crop practicing pastoralist	-	23.8%	-	27.78%	8.25%
Sedentary	-	-	-	-	-

N=number of respondents

4.1.4 Livestock holding

The major livestock species reared in the study area included goats, sheep’s, camels, cattle’s and donkeys presented in (Table 5), goats and sheep were the most highly valuable livestock by the district followed by camels. However there is significant difference among the goat holding in the kebeles. The goat holding per household in both Mursal and Labi-alan were significantly different ($p < 0.05$) than the other two PAs. The higher proportion of goats in the study area may be an adaptation and suitability of area and more availability of browse feed for goats effectively. This is in line with report of IPS (2002) which indicated that the species and herd composition of ruminant livestock in the lowlands depend on the agro-ecological condition of a particular area.

Sheep holding per house hold in Mursal was highly significant ($p<0.001$) than the other three PAs. This was probably due to grazing condition of the kebele. Small ruminant holding per household in the study area was larger than the finding of Tilahun *et al.*,(2006) who reported that an average mean small ruminant owned by a household of 9.56 and 8.64 for Jigjiga and Shinile districts respectively, and (Asfaw, 2009) 20.9 per house hold for Gursum district. The relative lower small ruminant size in those districts might be due to limitation of grazing land as there was engagement of Agro-pastoral production system besides livestock rearing, both goats and sheep were very important as immediate sources of cash income and source of food for home consumption as reported by respondent. This confirms with the findings of previous studies (Tolera and Abebe, 2007) which showed that small ruminants have a high reproduction rate and they are very important as quick sources of cash income and as source of meat for home consumption in Borana pastoralist. But

There is no significant difference between all PAs at ($p>0.05$) in the case of camel, cattle and chicken. Numbers of cattle and chicken was very rare. Only very few number of pastoralists own cattle and chickens. The attention given to rearing cattle is very low in all PAs, because of reduced herbaceous vegetation in communal grazing land which is source of feed for cattle, while Pastoralists due their major livelihoods dependency in livestock production particularly large animals like camel, cattle and shoats makes chickens least preferred animal. Apart from this their natural living pattern which involves high mobility and traditional taboo to keep chickens and consume its meat are among the factors that makes the chickens to be ignored in the pastoralist community.

during focus group discussion, key informants reported that the goats and camels have great potential due to their characteristics and adaptability to a wide range of climatic conditions and provide milk to the pastoralist households in the district rather than grazers (cattle and sheep), on the other hand the pastoralist had higher preference for camel rearing as compared to other livestock species because camels are drought tolerant, produce high amount of milk and meat and can fetch a high price when sold. They also claimed that camels were tolerant to feed and water shortage.

Table 5.Livestock holding (number of heads of animals per household) in different PAs as per the interviews (N=120)

Number of animals per HHS

Livestock	**Mursal (N=30) mean±SE**	**Higloley (N=30) mean±SE**	**Agasur (N=30) mean±SE**	**Labi-alan (N=30) mean±SE**	**Overall mean±SE(N=120)**	**SL**
Camel	6.97±1.6	8.8±2.76	5.23±1.08	7.53±1.59	7.13±0.93	NS
Cattle	1.53±0.5	2.33±0.66	2.1±0.44	1.83±0.4	2.00±0.25	NS
Goat	43.73^{a}±3.18	37.63^{b}±2.14	35.20^{b}±1.69	43.47^{a}±3.11	40.01±1.33	*
Sheep	29.47^{a}±2.50	24.57^{b}±1.83	24.37^{b}±1.71	23.57^{b}±1.62	25.49±0.98	**
Donkey	1.57±0.19	1.40±0.18	1.60±0.16	1.40±0.15	1.49±0.08	NS
Chicken	0.5±0.34	0.93±0.39	0.9±0.38	0.27±0.2	0.65±0.16	NS

N=number of respondents; SD=standard error; a, b, = means with different superscripts within row are significantly different; **=significant at (p< 0.001), *= significant at (p< 0.5), NS= non-significant.

The average holdings of donkeys in all four PAs were not significantly different (p> 0.05) and donkeys are owned by all pastoralists and can be used as pack animals and play very significant roles in transportation of goods from the district to PA areas.

4.2Livestock Management and Husbandry Practices

The nature of livestock rearing is dependent on several factors. The culture of Somali regional pastoralist is influenced by their environments, customs and values. Among Somali pastoralists of that region, the study found out that there were different parameters that could explain the practice managements of livestock i.e. ways of treating, feeding and selection of traits for breeding livestock.

4.2.1 Purpose of Livestock Keeping

Purposes of livestock keeping are given in Table 6, for Deghabur district. Livestock was an important asset and source of income, food and transportation for the pastoral households. The finding of the current study is in agreement with that reported by Muhyadin, (2010) in Kebribeyah district and Awoke *et al*, (2015)who also found that all livestock were reared for multipurpose role. Small ruminants (goats and sheep) were the most important component of livestock in the district, the primary reason for rearing small ruminants in the study area was for generating cash incomes and source of meat this was closely followed by rearing them for obtaining milk and skin sales, while some of them reported that they rear sheep to meet the cultural and social obligations. This is in line with the findings of Muhyadin, (2010) in Kebribeyah district who also reported that most commonly, small ruminants were slaughtered during "*Id Al-adha and Id Al-fitri*" of Muslim and to welcome family members, and honorable guests in the house hold. In the district, camels are kept mainly for milk production followed by use as a means of transportation for water and firewood or commodities (charcoal and farm produce). Camels are also reared for cash income generation, social obligations to protect revenge for blood compensation among the clan members and Dowry for bride marriage, meat and social prestige. The result obtained in this study is in agreement with other results of El-Amin (1984) who reported that there are five main areas where camels can contribute under the Borana setting: these are milk and meat production, wealth status determination, source of income generation and transportation service.

According to group discussion results, cattle were less valued animals by the study area compared to small ruminants and camels, and in their order of importance ranked as the milk production were primary purpose for cattle rearing, followed by draught power for cultivation or land preparation and cash income generation. Cattle were also used as source of meat. This finding is in accordance with the findings of Solomon *et al.* (2007) who reported that the most important reason for keeping cattle is milk production for food, selling of cattle for generating an income and the provision of meat and prestige.

Equines are primarily raised for transportation of both goods between PAs; and districts and fetching water from water sources. This partially agrees with other reports, equines are primarily raised for transportation of both men and agricultural inputs and outputs in all woredas of Metema, Debark and Layarmachiho of north Gonder zone (Sisay, 2006).

In overall, this results in line with Wondimu, (2011) who found that, among the pastoral communities wealth is measured by the number of livestock a household owns. He continued, livestock are considered as the most important sources of livelihood by most pastoralists because the main livestock product used by pastoralists was milk and the main purpose of keeping livestock could be for subsistence, though social and cultural functions might be important.

Table 6.Purpose of keeping Livestock in Deghabur district (Ranked according to priority

	Species of livestock							
Purposes of keeping	**Camel**		**Cattle**		**Small ruminants**		**Equines**	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Milk	0.38	1	0.30	1	0.223		-	-
Meat	0.1	5	0.15	4	0.33	2	-	-
Income generation	0.13	3	0.20	3	0.45	1	0.34	2
Draught power	-	-	0.28	2	-	-	-	-
Social prestige	0.06	6	-	-	-	-	-	-
Transport	0.34	2	-	-	-	-	0.67	1
Skin	-	-	-	-	0.14	4	-	-
Social obligations	0.11	4	-	-	0.1	5	-	-

4.2.2 Labor and Livestock Husbandry

All family members are involved in feeding, watering and milking of livestock, respectively in the study areas as shown in Table 7. In the study areas husband and boy children were involved watering all livestock. All family members are responsible for herding of livestock; whereas husband and wife were responsible for livestock sells and treating sick animal. But among the family members, milking of camel is done by husband and boy children they were main actors in camel managements, whereas Barn cleaning was the responsible for wife and boy children. This is in agreement with the findings of Hussein, (2005) who reported that, herding and caring for livestock is considered hard work and imposes upon the family a specific division of labor, so Somali pastoralists use a division of labor by age and sex to manage their livestock. Each household member has specific tasks to perform. Besides that wives mostly were responsible for milking and processing livestock product, this result agreeable by (Zinash, 2015) who reported that women were responsible for livestock products processing that has been adopted as a culture. It was made clear from focus group discussion that women spend considerable amounts of time in collecting and storing fodder, and in watering weak animals tethering in the house, They were also responsible for caring and counting the grazing animals as they come home during night, and for detecting any problems (sickness, birthing, poor health, missing animals). But women are not allowed to herd camels, since it difficult work by herding the camels. The present finding is in line with the result reported in many lowland areas of Ethiopia(Simenew *et al.*, 2013; Awoke *et al.*, 2015).

Table 7.Labor distribution in livestock management system among family members of study area (N=120).

	Labor distribution (%)							
Family members	**Feeding**	**Herding**	**Milking**	**Barn cleaning**	**Butter making**	**Waterin g**	**sellin g**	**Treatme nt of sick animal**
Husband	55	70	18	-	-	82	82	76
Wife	76	66.7	67	27	82	4	35	30
Children	38	5.8	63	85	27.7	19	-	-

N=number of respondents**; -** =imply not sharing responsibility

4.2.3 Mobility linked causes

Table 8 shows that the majority of the respondents were stated that the most important causes of mobility for livestock were drought occurrences, followed by deterioration of rangeland (means of shortage of feed). And the remaining were included increases of livestock population pressure, these factors to be considered causes of mobility in the study area. But due to the nature of aridity ecosystem with relatively high frequency of droughts, the need of Mobility was to access pasture lands and water, and the adapting environmental conditions due to climate change as well as other externalities that help the pastoralists to cushion risks. This report agrees with previous report done by (RPPACC, 2011) found that migration and/or mobility were a climate adaptation strategy which increases population pressure and environmental degradation. Failed rainy seasons can be result in reduced agricultural yields and feed shortage for livestock and increased climatic shocks will fuel conflict over resources and access. (As mentioned by pastoralists during focus group discussion) to overcome the limitation in above causes, mobility is one of the major copping strategies, and the problems faced during mobility included death of livestock, shortage of feed, shortage of water and incidence of disease. These problems of migration, more or less were similar to reports from those pastoralists in other area during mobility, by (Tolera and Abebe, 2007;Abdirahman, 2016).But this contrary with the report of (Asfaw, 2009) reported that the frequency of mobility have been decreased due to changing pastoralist lifestyle into agro-pastoral way, decline in livestock ownership per household, increase in human population, getting education services and permanent settlements around all year available water points in Gursum district area.

Table 8.Ranking causes of mobility in Deghabur district (N=120)

Causes	**Frequency**	**%**	**Rank**
Drought	76	63.3	1st
Deterioration of rangeland	32	26.7	2nd
Increase livestock population	12	10.0	3rd
Total	120	100.0	

N=number of respondents

4.2.4 Traditional livestock breeding practices

Breeding are the most important husbandry techniques and used to Regulate the breeding season of livestock in arid and semi-arid area is an important aspect to go with the birth of young animal with a period of better nutrition which is usually the wet season time. But there is no suspended study and research work on the genetic and breeding potential for traditional livestock breeding practices in the area. According to information obtained from focus group discussion, there is only seasonal and controlled mating method of livestock in study area. In the study area, 66.7% of the elders Pastoralist during group discussion, were said that livestock breeding practices using tested livestock traits regarding indigenous knowledge techniques and Herders pay great attention to phenotypic and genotypic variation of their animal and practice strict selection of pairs, usually one male is kept each livestock species for the purpose of reproduction, while the rest of males of bad traits are either castrated, sold or slaughtered in order to meet owners need. Selection is employed to maintain or improves productivity, endurance, drought resistance, body size and structure and high milk production, this result in line with finding (Birhan, 2013) which state that pastoralist in Somali region believed that inherent makeup of indigenous stock have special adaptive traits for disease resistances, heat tolerances and ability to utilize poor quality feed. In general a strong alignment exists between the livestock selection criteria used by pastoralists in study area, the close connectedness with their livestock, keeping approaches and marketing requirements. This a clearly gives understanding of why there is intimate and long-standing relationship between Somali pastoralists and their livestock (RPPACC, 2011).

4.2.5 Livestock housing

Housing system of livestock in the study area is given in Table 9. In the study district, housing animals was practiced during the nighttime to keep animals from predators the houses were an open Kraal **.**Housing usually made up of thorny branches of acacia attached to or separated from the owner's residence, or around the residences, except young stocks or calves were kept in well protected calf's pen, this report concur with previous report done by (Awoke *et al*, 2015), finding that young animals managed separately from other livestock in Jigjiga districts. But, the equines were the houseless animal among other livestock, but during at night they were approach around homestead in human residences to escort themselves from predators. The present result was in agreement with the survey results reported by Workneh (1992), from the southeast lowlands where open pens were used commonly for small ruminants and larger animals.

Table 9. Housing condition of livestock in the study area.

	Animal species									
Types housing	Small ruminant		Camel		Cattle		Kids		Equines	
	N	%	N	%	N	%	N	%	N	%
Open kraal without shelter but fenced	120	100	107	89.1	114	95	11	9	17	14.3
In protected house or shelter	0	-	0	-	6	5	109	91	0	-
Houseless	0	-	13	10.9	0	-	0	-	103	85.7

N =number of household; - imply not applicable houses in the livestock

4.3 Livestock Water Sources and Relating Problems

Main sources of water in the study areas were rain water (Fig 2). The sources of water for all livestock during main dry season were Cistern or *birked,* Dry River after water fallow, pipeline water and wells. So the study shows that pastoralist depended less on the wells. But in the above the first two main sources, cistern and dry river after water were not sustain livestock as they dried off after short unreliable rainy seasons in the study area. There are two primary rainy seasons throughout most of the study area, the *Gu* (heavy rainy season) from March to May, and the *dayr* (light rainy season) from October to December. A customary technique in water harvesting includes the collection of water in wells and storage *birked* (cistern) to ensure the availability of supplies during the dry season.

Rotational frequency of water were developed in the water sources area, during dry season where cattle have 3 days intervals, small ruminants have 4 to 5 days, camels have 7-15 days and donkeys 2-3 days gaps depending on severity of the dry period and water access. In the study district, the watering frequency of animals depends on season like the case with the Borana pastoralists (Coppock, 1994).As mentioned by pastoralist elders during group discussion, the traditional pastoral herd consist of goats and sheep (shoats) and camels, these different species have ability to withstand the harsh conditions of the study area, camels and goats particular are better adapted to harsh condition than cattle and sheep. Camels which can stay without water for a month, they were continued that the general trekking distances to water point averages 15-25 kilometers in dry spells compared to wet period of 5-10 kilometers, but wet season all livestock get their basic water need from abundance green vegetation available in grazing land. This result agree with the report done by Abdilatife and Ebro, (2015) for pastoralist in Afar region.

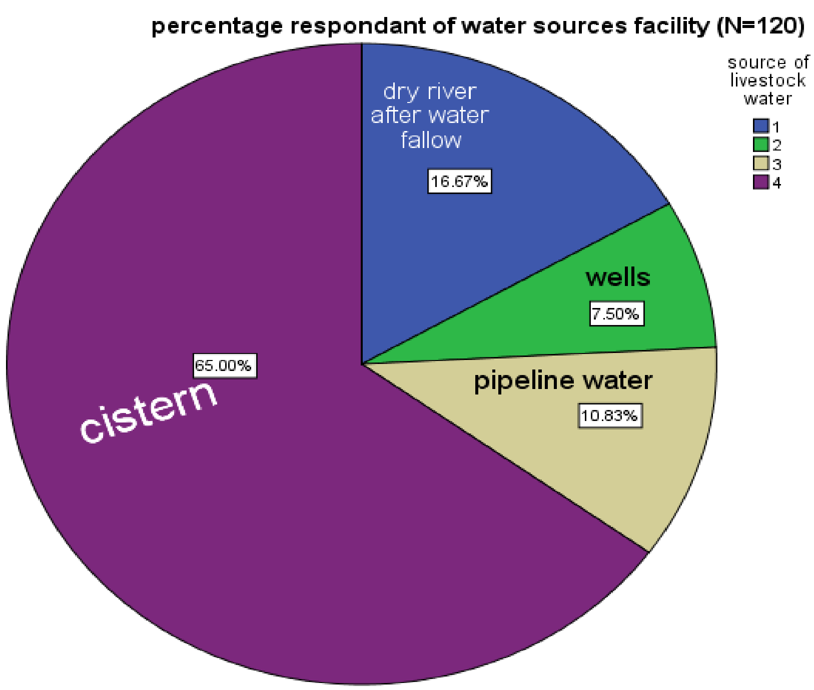

Figure.2Water facilities for livestock sources in study area.

4.4 Major Constraints to Livestock Production

The PAs in the study area, indicated that the main constraints associated with livestock rank were feed shortage, followed by drought, water shortage, animal health problem and predators (Table, 10). However, the factors in the above to be considered as a production constraint in the study area were shortage of rain and the frequently recurring drought in the area is a major cause for reduced feed availability and quality. The frequency drought is also challenge the pastoralist facing loss many of their livestock and pastures are not able to regenerate and rangeland remain bare even when rainfall is available. Shortage of feed and water and the harsh climatic condition of the area seriously affect the health and productivity of animals. These constraints were more or less similar to the constraints faced by livestock herders in different pastoral areas of Ethiopia (Mizan, 2010; Kiros Welay, 2011; Fikru and Gebeyew, 2015).

The study found out that the scarcity of water is one of the constraints, in last year that were affects the livestock. Due to the low rainfalls in the area, pastoralists have been opted for buying water from water truckers who were asking 20 birr for 20 liters of water. During the dry spells and drought periods pastoralist are forced to seek pastures location with no water. This forces them to obtain truck water. But water trucking acquisition is either done in groups and or buying directly from businessmen who deliver it on the site. Animals may also be attacked by predators such as hyena, cheetah and foxes.

Table 10.Major Constraints to livestock Production ranked according to importance

Constraints	**Score**	**Index**	**Rank**
Shortage of feed	525	0.29	1
Drought	506	0.28	2
Water scarcity	293	0.16	3
Predators	171	0.09	5
Animal health problem	220	0.122	4

The major constraints of economic losses and low productivity of livestock is a widespread prevalence’s of different diseases and parasites. According to the perception of interviewed group discussion, the major killer livestock diseases in study area includes; Peste des petits (PPR), Anthrax, Trypanososmosis, Brucellosis, CBPP (Contagious Bovine Pleuropneumonia), CCPP (Contagious Caprine Pleuropneumonia), external and internal parasites Rinderpest, Foot and mouth disease(FMD), pox, (Table, 11). Incidences of diseases affecting livestock in different parts of the country have also been reported by Tsedeke and Entrias (2011) and Fikru and Gebeyew, (2015). And by cross checking livestock disease conformation in labaratory report done by FAO (2004) in appendex.

There are also some poisonous plants that are known to cause ill-health and even death when consumed by animals. The most important of such plants are plants that are scientifically known as *Solanum somalensis, Solanum jubae, Prosopis juliflora, Albuca abyssinica, Phyilanthus somalensisi, Adenium obesum and Loewia glytinosa.* were reported to affect all classes of animals and the pastoralists in study area indicated that it is the major cause for high mortality rate of camels and other animals during the dry season in the area. Due to acute shortage of alternative feed resources animals would be forced to consume such plants during the dry season. This agrees with Abebe *et al.*, (2012) who reported that most of the poisonous plants remain green and attractive during dry periods and ingested by hungry and thirsty animals which cause animal illness and death in southern rangelands, Ethiopia.

Table 11.Major livestock diseases in study area

Local term	**common name**	**ranking**
Furuq	pox	10
Gudo-walac	Brucellosis	3
Sunsun	Peste des petits(PPR)	1
Sambabkalo’da	Contagious CaprinePleuro Pneumonia	5
Sambabkaadhiga	Contagious CaprinePleuro Pneumonia	6
Cabeeb	Foot and mouth disease	9
Kud	Anthrax	2
Dulin	Parasites	7
Dukaan,mallaig	Trypanososmosis	4
Dabakarub	Rinderpest	8

4.5 Major Feed Resources Available

The major feed resources for livestock in Deghabur district are presented in Table 12.The result of the information gathered from the selected respondents on major sources of livestock feed revealed that the livestock owned by pastoralists depend on rangeland feed, few crop residue, crop aftermath (10%), and indigenous fodder trees during dry and wet season, respectively. The feed resource that was available in study area was rangeland feed (grasses, forbs and short shrub plants) these concur that of Muhyadin, (2010) who indicated that the major livestock feed resources available in Kebribeyah District were natural pastures, browses such as shrubs, tree leaves and pods and crop residues, which varied with seasons. In Ethiopia more than 90% of the livestock feed depend on natural pastures and Rangeland is defined as land producing natural forage for animal consumption, which varies in composition depending on the agro-ecology (Alemayehu 2005). And this holds true for the pastoral production system in Ethiopia where extensive grazing on rangeland has been the only way for livestock production and contributed to the major portion of feed consumed by livestock. But question raised about the extent of availability of different feed resources in PAs, the majority of the respondents said that grasses, herbaceous and browse plants can help the animals to stay alive and produce even during dry season of the district. But the availability of these feed resources varied depending on season This was also supports the finding by researchers of (Fikru and Gebeyew, 2015; Asfaw, 2009; Muhyadin, 2010) indicated that major feed resources of Somali region to be range pastures, browse trees and little crop residue were major feed for livestock which varied with season.

During dry season according to focus group discussion the level of rangeland feed to some extent reduced in the study area so it is possible to say that range pastures support animal productivity in the rainy season, while in the dry season these pastures can hardly maintain the animals as most of the feed resources are less available and of poor nutritional quality. This might be due to unreliable rain and area more frequent drought. Other studies have reported similar results (Alemayehu 2006; Sisay 2006; Elias et al. 2007).

In certain PAs (only two kebeles) around Deghabur district, crop residues were also available for animal as feed in addition to rangeland feed. Crop residues especially in wet season around crop producing areas can be used as feed for sick animals tied in home. The common type of crop residue used as feed for livestock includes maize and sorghum stovers. But few respondents reported that industrial by products has been used but minimum intensity, and it provided by government when drought is prolonged, this result is in line with the study of Mizan, (2010) in Yabello District Southern Ethiopia. The respondents have clearly stated that in some areas, during dry months (drought) when the grasses and herbaceous plants were completely grazed and the above ground cover is finished, the animals have been observed uprooting the underground parts like succulent roots and unusual type of plant materials have been consumed by livestock.

Table 12.Available major feed resource in the study area during dry and wet seasons

Feed sources	**Frequency**		**Percent**		**Ranks**	
	Dry	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**
Rangeland feed	60	95	50.0	79.2	2	1
Crop residues	19	10	15.7	8.3	3	3
Crop after math	12	-	10.0	-	4	-
Indigenous Fodder trees	85	74	70.8	61.7	1	2

4.5.1 The Native Pasture Plants of the Area

According to the field survey and feedback of the focus group discussion based on their indigenous knowledge, a total of (41) natural pasture (Grasses, Forbs and Browse) plants were identified representing potential source of feed for their livestock (Table 13).

Table 13.Some important natural pasture species of the study area

Local name	**Scientific name**	**Family name**
	Grasses	
Dhikil	*Sporobolus spicatus*	Gramineae
Badhoole	*Afrotrichloris hyaloptera*	Gramineae
Dareemo	*Chrysopogon aucheri*	Gramineae
Birqin(bire)	*Aristida sieberiana*	Gramineae
Duur	*Schizachyrium kellerif*	Gramineae
Eir-dhuq	*Cenchrus ciliaris*	Gramineae
Gargood	*Panicum sp*	Gramineae
Bile	*Jatropha dichtar*	Euphorbiaceae

Table 13. Some important natural pasture species of the study area (**continued)**

	Forbs	
Haqa-qaro	*Tephrosia villosa*	Papilionaceae
Yamaarug	*Blepharis ciliarist*	Acanthaceae
Jilab	*Indigofera ruspolii*	Papilionaceae
Saar	*Coccinia grandis*	Cucurbitaceae
Labi-yar	*Sesbania somalensis*	Papilionaceae
Balan-baal	*Abutilon anglosomaliae*	Malvaceae
Baar	*Hyphaene benadirensis*	Palmae
Ga-gabood	*Vernoniao gadoxensis*	Compositae
Hiil	*Veronia cinerascens*	Compositae

	Trees and shrubs	
Cadaad	*Acacia Senegal*	Mimosaceae
Cadeyga	*Salvadora persica*	Salvadoraceae
Bilil	*Acacia mellifera*	Mimosoceae
Dhebi	*Grewia bicolor*	Tiliaceae
Dhuyac	*Balbergia commiphoroides*	Papilionaceae
Gaheydh	*Blepharispermum fruticosum*	Composite
Dhafaruur	*Grewia tenex*	Tiliaceae
Garas	*Dobera glabra*	Salvadoraceae
Galool	*Acacia bussei*	Mimosacaea
Hob-hob	*Grewia penicillate*	Tiliaceae
Madheedh	*Cordia sinensis*	Boragginaceae
Maraa	*Acacia nilotica*	Mimosaceae
Mey-gaag	*Boscia minimifolia*	Capparidaceae
Sarmaan	*Acacia hoodia*	Mimosacea
Qudhac	*Acacia tortilis*	Mimosacea
Qlan-qal	*Boscia coriacea*	Capparidaceae
Hagar	*Commiphora agar*	Burseraceae
Haddi	*Commiphora erlangeriana*	Burseraceae

Table 13 .Some important natural pasture species of the study area (**continued)**

Qansax	*Acacia reficiens*	Mimosacea
Sog-sog	*Acacia etbiaca*	Mimosacea
Mal-mal	*Commiphora molmol*	Burseaceae
Gob	*Ziziphus mauritiana*	Rhaminaceae
Reydab	*Albizia anthelmintica*	Mimosaceae
Jeerin	*Acacia edgeworthii*	Mimosaceae

4.5.2 Utilization of Browse Plant As a Livestock Feed

According to the responses of the respondents reported that indigenous browse species was being used as feed sources by livestock depending upon fodder availability and preference of livestock species. All the domesticated ruminants in the survey area consumed browse species at one time or another during the year and utilization of browse by livestock depends on the preference of the animal and seasonal availability.

According to group discussion of browse analysis, District's acacia species consists 86%, other than the bushes and tree with broad leaves, whereas only 14% belongs woody vegetation. Theses acacia families were *A. mellifera*, *A. tortilis*, *A. bussei*, *A. reficiens,* and *A. hoodia.* Field survey also showed that, most acacia species are widespread in study area, both leaves and pods are used by various kinds of livestock, these belong to the leguminous family and has high protein content, but displays chemical as well as mechanical defense mechanisms, protecting the fine leaves from being browsed (Owen-Smith, 1982). In Deghabur district, some acacia species were observed to grow green leaves before first rain. Typical browsers such as Goats and Camels are able to browse on Acacia species due to their long and flexible lips, as well as their narrow shaped mouths and therefore endure long droughts better, and without a massive loss of bodyweight. But it difficult Cattle and Sheep to use browse resource effectively due to the fact that they are not able to feed directly on the protected early green leaves on the bushes and tree, except when leaves, pods or flowers drop to the ground, this is similar with the findings of Fikru and Gebeyew,2015) whose reported that, indigenous browse plant of communal grazing land in Deghabur district are utilized as feed for livestock across months of the yearin different grazing habit. Certain browses were consumed preferentially certain species but not by others. Using the integration of different livestock species in browsing field is common practice in the study area. The camels fed the branches of trees, next goats, but cattle and sheep feed on the leaves and pods dropped under the trees. Goats and Camels were generally showed high preference for browses. Similarly this function was reported by Yeshitila (2007) in alaba districts. This finding may so far indicate browse species preference by livestock in the area in addition to their ability of selection Presented in Table 14.

Table 14.The percentages of animal species dependence on browse as assessed by the respondents (N =120)

Category	Percentage
Goat	21.67
Camel	50.33
Sheep	1.3
Goat and Camel	26.6

N=number of respondents

4.6. Feeding Calendar and Seasonal Availability of Feed Resources

Information about the seasonal availability of livestock feed resources in the areas of study was obtained from group discussions and observations during the field work, (Table15) In the study area, rangeland feed, browses and crop residues were the dominant feed resources available for livestock. The available of these feed resources vary across season.

Almost all respondent households in the present study district indicated that grazing lands (communal grazing lands) and woody vegetation provide pasture and browses starting from April to June and October to December, during both wet season (i.e., light and heavy rainy season). Feeding of harvested crop residues (maize and sorghum stover), were the main supplement sources of feed during the dry period from late February to late September when pasture ceases. Although there is difference in utilization across months of the years, communal grazing lands are utilized throughout the year. And the maximum shortage was observed from March to September during dry season in the study area which is agrees the study of Muhyadin, (2010).

Table 15.Seasons of major feeds availability (feeding calendar) during the dry and wet Seasons, in Deghabur district.

Feed resources	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Communal grazing (rangeland feed)	**X**	**X**	**X**	*	*	*	**X**	**X**	**X**	*	*	*
Browses (pods and deciduous leaves)	**X**	**X**	**X**	-	-	-	**X**	**X**	**X**	-	-	-
Crop residue	**X**	**X**	**X**	-	-	-	**X**	**X**	**X**	-	-	-

*= period of plentiful; **X** = period of less available;-= period of unavailable

4.7. Nutrient Components of Rangeland Feed

One of the criteria used to identify the nutritional value of plant species consumed by foraging animal is its nutrient content (chemical composition). Nutritional fractions of both seasons (dry matter, crude protein, neutral detergent fiber, ash) influences acceptability of forage plants to herbivorous animals.The chemical composition of *Sporobolu spicatus*, *Tephrosia villosa, Acacia mellifera, Grewia tenex, Dobera glabra* and *Acacia bussei*, of range pasture species of feed samples collected for analysis in the study area was categorized into feeds for wet and dry season and were given in Tables 16.

The DM content of the all major species in the study area at dry and wet season is given in Table 16.The mean DM content of range pasture in the study areas was 90.7 and 92.0, in wet and dry season respectively. Moreover, there is no significance different (P>0.05) in dry matter of the all feeds between seasons, *Dobera glabra* has the highest DM content numerically among rangeland feed sampled in both season. The DM content of rangeland feed obtained in this study was agreeable that reported Muhyadin (2010) in Kebribeyah district.

There was no significant difference among the species for CP content in the wet season, while minor to major drop was remarkably observed as for the dry season results particularly in *Sporobolus spicatus* and *Grewia tenex*. There is strongly significance difference (P<0.001) between both season in CP content and the highest CP content was found in *Tephrosia villosa*, for both seasons respectively. *Tephrosia villosa* had the highest content of CP in the dry season followed by *Dobera glabra* , the high CP value of these species during dry season may be an advantage to feed livestock's When nutritional value of rangeland feed were low. This result was in agreement with the report of Muhyadin (2010) who reported that there is high CP content makes some range feed (herbaceous and browsers) suitable as protein supplements to poor quality pasture and fibrous crop residues and these values were above the critical value of 7.5% reported to be required for optimal rumen function Van soest (1982). The CP for the rangeland pasture was higher than that reported by Sisay (2006) in Metema and Layarmachiho districts.

The ash contents ranged from 10.91% during rainy season to 7.86% during dry season in Deghabur district. No significant difference (P>0.05) was observed between both seasons. Among the rangeland feed the Ash contents in *Sporobolus spicatus* were the highest in Wet and dry seasons respectively, whereas the lowest were scored *Tephrosia villosa* in Wet and dry seasons respectively. Generally the Ash contents decreases in all range forages as dry season with advances maturity. This is agreement by Kafeel *et al.,* (2013) reported that, increase or decrease of ash contents at all pasture lands by different plants may be due to variation in soil and other habitat features that need to be explored. However, Sisay (2006) observed that ash contents of rangeland pasture in Metema district during the both seasons influenced by seasonal changes.

The mean NDF, ADF and ADL contents of range feed are given in Table 17. The NDF and ADF content of all natural pasture from Deghabur district is significantly at (P<0.05) between dry and wet seasons, but there is no significant difference (P>0.05) in ADL content between all pasture. The highest NDF was found in *Sporobolus spicatus* between both seasons respectively. The NDF contents of the study lie above the critical value of 60% which was reported to result in decreased voluntary feed intake, feed conversion efficiency and longer rumination time by Reed and Goe (1989). The mean NDF content obtained in this study is comparable with that reported by Sisay (2006) for Metema, but higher than that of Kebribeyah by the Muhyadin (2010). According to Singh and Oosting (1992) if the roughage contains above 65% NDF, it is considered as poor quality feed. Moreover, Norton (1982) indicated that the NDF content that ranged from 67% to 78% to be high enough to limit DM intake and digestibility, yet the study by Linn (2004) reported that Neutral detergent fiber is the major determinant of overall forage quality and digestibility, and has a direct effect on animal performance.

The mean ADF content of rangeland feed were found to be no significant (P>0.05) between seasons in the district. This ADF content of natural pasture was low during rainy season and high during the dry season, which is in agreement with the reported by Sisay (2006). According to McDoland *et al.,* (2002) reported that forage species having high contents of ADF may have lower digestibility since digestibility of feeds and ADF contents negatively correlated.

The lowest ADL content was recorded in *Acacia mellifera* and *Tephrosia Villosa* for both seasons respectively and the highest ADL content in both seasons was found the same plant *Grewia tenex.*

Table 16.Mean chemical composition of preferred forage species with seasons and Variation of chemical composition of preferred forage species from Deghanur district during (Dry and Wet season).

Growth form	**Variation**	**DM %**	**CP%**	**NDF%**	**ADF%**	**ADL %**	**Ash%**
		NS	***	*	*	NS	NS
	Seasons						
All type	Wet	90.7	12.93^{a}	52.76^{b}	36.35^{b}	13.38	10.91
All type	Dry	92.0	7.06^{b}	65.16^{a}	47.45^{a}	11.55	7.86

Chemical composition of some preferred forage sample from the study area (in both wet and dry seasons).

Growth form	**Pasture species**	**Wet-Season feed sample type**					
Grasses	*SporobolusSpicatus*	90.2	10.6	65.1	45.3	10.4	14.9
Herbaceous	*TephrosiaVillosa*	89.3	14.7	55.8	40.3	15.1	6.9
Browses	*Acacia Mellifera*	90.8	12.3	56.7	41.6	9.3	8.4
Shrubs	*GrewiaTenex*	88.6	14.2	53.2	36.7	22.6	11.2
Shrubs	*DoberaGlabra*	93.1	13.8	40.5	20.8	13.1	14.2
Browses	*Acacia Bussei*	92.5	12.0	45.3	33.4	9.8	9.9
Dry-Season feed sample type							
Grasses	*SporobolusSpicatus*	92.5	3.8	75.4	51.1	7.5	11.6
Herbaceous	*TephrosiaVillosa*	90.4	9.3	63.2	52.5	8.8	4.1
Browses	*Acacia Mellifera*	92.1	6.9	68.6	46.5	13.8	5.6
Shrubs	*GrewiaTenex*	91.0	5.6	62.3	53.6	17.8	8.3
Shrubs	*DoberaGlabra*	95.3	9.0	64.9	35.3	9.9	9.1
Browses	*Acacia Bussei*	90.7	7.8	57.6	45.7	11.5	8.5

a, b, = means with different superscripts within column are significantly different *= (P<0.05) ;*** (P<0.001); NS=;Not significant; DM= dry matter; CP= crude protein; ADF=acid detergent fiber; ADL=acid detergent lignin; NDF=neutral detergent fiber

5. SUMMARY AND CONCLUSION

The current study was undertaken in Deghabur district of the Somali Regional State, which represents a predominantly pastoral production system. The objectives of the study were to assess livestock production practices, and management system, to identify major available feed resource and evaluate chemical composition (nutritional value) of the major feed resources of the study area. For this study 4 peasant associations (PA's) were purposively selected.

Data were collected by, supported with secondary information collected from district and zonal offices. The data on identifying the available feed resources were based on through also interviewing selected pastoralists and chemical analysis of the major feeds available in all of the selected species were done in laboratory.

The result of this study revealed that the mean household size of the study district was 6.8 persons per family. Large proportion of the respondents did not attended formal education. The fact that only 5% attends primary school and study showed that the high level of illiteracy in the study area.

Traditionally the most Somali population is pastoralists and the dominant framing activity in the district was livestock production (91.75%), which implies that most of the inhabitants were pure pastoralists. These pastoralists owned diversified livestock species that includes goats, sheep's, camels, cattle's and donkeys with the mean of 40, 25.49, 7.13, 2, 1.49 and 0.65 respectively. They are major livestock species reared in the area, which are important assets and sources of income, food and transportation for the pastoral households.

There was division of labor within the household for different activities. Accordingly watering, selling of livestock and treatment of sick animals are activities mainly accomplished by men (household heads). Household wife is responsible for stall feeding, milking, barn cleaning and selling of livestock products. Boy children mainly are involved herding and watering livestock while girl children are involved in barn cleaning and milking.

The causes of mobility for livestock were drought occurrences, followed by deterioration of rangeland 26.7% (means of shortage of feed). And the remaining 10% were included increases of livestock population pressure.

The breeding system of livestock was seasonal and controlled mating which were based on time tested livestock traits regarding indigenous knowledge techniques and herders pay great attention to phenotypic and genotypic variation of their animal and practice strict selection of pairs, usually one male is kept from each livestock species for the purpose of reproduction.

The housing system of livestock were housed in open kraal at night which made is up of thorny branches of acacia attached to or separated from the owner's residence, or around the residences, to protect the livestock from predators except young stocks or calves that were kept in well protected calf's pen.

The major constraints that hindered the performance of livestock production were feed shortage, drought, water scarcity, and animal health problem, respectively in order of importance.

Peste des petits (PPR), Anthrax, Trypanososmosis, Brucellosis, CBPP (Contagious bovine pleuropneumonia), CCPP (Contagious caprine pleuropneumonia), external and internal parasites Rinderpest, Foot and mouth disease (FMD), and Pox are the major disease challenges in the study district.

The types of available feed resources obtained in the study area include; rangeland feed, few crop residues, and indigenous browse trees and shrubs during dry and wet season, respectively. Crude protein content of major range pasture species dropped from 12.93% in wet season to 7.06% in dry season. The high variability in the nutrient content of natural pasture species could be attributed within species variability factors, like plant parts and seasons, these factors influences the chemical compositions of the feed and nutrient utilization by livestock.

Generally, Livestock production is the main means of livelihood of the population in the area. The shortage and erratic nature of rainfall and frequently recurring droughts are the main constraints affecting both livestock and availability of feed. The marked seasonality in rainfall distribution causes seasonal fluctuation both in the quality and quantity of forage supply. Thus there is acute shortage of feed during the dry season and drought period with very low nutritive value of the available forage during these periods. The manner of feed management in the study area was something poor. There is no any conservation practice for the available feed except in a few areas where poorly conserved crop residue practiced. In this context, It is recommended that;-

Recommendations

- There is no clearly defined extension system or policy which resulted in badly organized and unsystematic efforts to the development actors of the pastoral production system. Therefore Proper understanding of the pastoral production system under changing socio-economic, environmental conditions and problems and opportunities available within the production system is a pre-requisite to improve the livelihood of the pastoralists.
- It is recommended that further studies be considered in assessing the nutritive value of the other feed resources which is not major feed for livestock to make it as optional feed during the time of extreme feed shortage.
- Moreover, it is also recommended to conduct a training program for transhumant pastoralists to practice growing improved forage around their area by using water harvesting techniques especially in the months of strong rain fall exhibit.

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7. APPENDICES

Appendix Table.1: Livestock Population in (SRS) at different zonal level in (000)

Typesof livestock	Shinile	Jigjiga	Fig	Deghabur	Warder	Kebri-dhar	Godey	af-der	Liban
Cattle	288	439	252	287	274	168	402	985	711
Sheep	913	1,316	560	538	1,372	1,150	1,004	1,231	969
Goat	776	548	672	574	1,960	719	636	788	1,874
Donkey	46	42	18	11	5	6	8	14	63
Camel	72	85	74	104	480	275	812	99	954
Horse	11	2	1	1.2	*	*	1.1	*	*
Mule	*	*	0.1	*	*	0.11	*	*	0.2

Source: CSA, 2007. * = no data, SRS= Somali regional state

Livestock mating systems and mating methods in Kebribeyah District

Livestock Types	Mating system			Method of mating		
	N	Seasonal %	Continuous %	N	Controlled %	Uncontrolled %
Cattle	120	7.5	92.5	120	11.6	88.4
Camel	101	9.9	90.1	101	13.9	86.1
Goat	117	7.7	92.3	117	10.3	89.7
Sheep	114	98.2	1.8	114	98.2	1.8

Sources; (Muhyadin2010)

Appendix Table.2.Analysis of variance all livestock holding and composition per respondent household in Deghabur district

For camel

Source	DF	SS	Mean Square	F Value	Pr> F
Model	3	197.26667	65.75556	0.63	0.5960
Error	116	12074.60000	104.09138		
Corrected Total	119	12271.86667			

For donkey

Source	DF	SS	Mean Square	F Value	Pr> F
Model	3	1637.89167	545.96389	2.66	0.0515
Error	116	23809.10000	205.25086		
Corrected Total	119	25446.99167			

For sheep					
Source	DF	SS	Mean Square	F Value	Pr> F
Model	3	648.82500	216.27500	1.89	0.1352
Error	116	13277.16667	114.45833		
Corrected Total	119	13925.99167			

For chicken					
Source	DF	SS	Mean Square	F Value	Pr> F
Model	3	9.3666667	3.1222222	0.91	0.4362
Error	116	395.9333333	3.4132184		
Corrected Total	119	405.3000000			

For cattle					
Source	DF	SS	Mean Square	F Value	Pr> F
Model	3	10.7000000	3.5666667	0.46	0.7092
Error	116	895.0000000	7.7155172		
Corrected Total	119	905.7000000			

For goat					
Source	DF	SS	Mean Square	F Value	Pr> F
Model	3	1637.89167	545.96389	2.66	0.0515
Error	116	23809.10000	205.25086		
Corrected Total	119	25446.99167			

Appendix Table.3 Analysis of variance for DM during wet and dry season

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	4.68750000	4.68750000	1.46	0.2541
Error	10	32.01500000	3.20150000		

Corrected Total	11	36.70250000			

Appendix Table.4 Analysis of variance for CP during wet and dry season

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	103.2533333	103.2533333	30.10	0.0003
Error	10	34.3066667	3.4306667		
Corrected Total	11	137.5600000			

Appendix Table.5 Analysis of variance for NDF during wet and dry season

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	461.280000	461.280000	8.39	0.0159
Error	10	549.646667	54.964667		
Corrected Total	11	1010.926667			

AppendixTable.6 Analysis of variance for ADF during wet and dry season.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	369.6300000	369.6300000	6.14	0.0327
Error	10	602.1300000	60.2130000		
Corrected Total	11	971.7600000			

Appendix Table.7 Analysis of variance for ADL during wet and dry season.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	10.0833333	10.0833333	0.51	0.4909
Error	10	197.2033333	19.7203333		
Corrected Total	11	207.2866667			

Appendix Table.8Analysis of variance for Ash during wet and dry season.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	27.9075000	27.9075000	3.26	0.1011
Error	10	85.6016667	8.5601667		
Corrected Total	11	113.5091667			

Appendix Table.9 many important livestock disease have been diagnosed with laboratory confirmation in Somaliland and Somali regional state Ethiopia

English name	**Somali name**
Anthrax	Kud
Babesiosis	Kadidhig
Brucellosis	Gudawalac
Caseous lymphadenitis	Mal-qaxo
Contagious bovine pleuropneumonia (CBPP)	Sambab
Contagious caprinepleuropneumonia (CCPP)	Sambab
Contagious ecthyma	Bog
Enteroxaemia	Darato
Foot and mouth disease	Habeb
Hearth water	Hulumbe
Mange	Addo
Nairobi sheep disease	Hulumbe
Pasteurellosis	Qarir
Peste des petits ruminant (PPR)	Sun-sun
Pox	Furuq
Rabies	wele
Render pest	Tabakaruub
Trypanososmosis	Dhukaan

Questionnaires survey for Assessment of Livestock Production Practices, Feed Resources and Their Nutritional Value in Dhegahbur District, Somali Regional State, Ethiopia.

I. General information (household characterization)

1. Date of interviews ________________________

2. Region ______________________________________

3. Zone and District______________________________

4. PA’s? Kebele’snames ____

5. House holders’ names ____

6. Sex -------------------------- ages ----------------------------

7. Literacy status, circle one of it.

(A) Illiterate (B) read and writes only (C) elementary (D) Junior or secondary (E) Secondary (F) above secondary

II. Household characters tics

1. Family size

2. How many family members do you have?

A) Male---------------------- B) Female-------------------- C) Total-------------

3. Children (under 15 years) ________ Adult (around 15 -64) ________ Dependent (> 65 years)

4. What is your main farming activity presently? Circle one of it.

A. Livestock production
B. Crop production
C. Both
D. Others specify.

III. Livestock production practices and management.

1. Livestock holding and their major use in the family

Species	Type	Number of livestock			
		Local	Cross	Exotic	Total

		Breed	Breed	Breed	
Cattle	Ox				
	Bull				
	Cow				
	Calf (<1year)				
	Heifer				
	Young bull				
Camel					
Sheep					
Goat					
Equine	Donkey				
	Mule				
	Horse				
Chicken					
Beehive					

2. What are the major reasons for keeping livestock and (rank them).

Type of Animal	**Purpose Kept**					
	Source of Food and Other non-food items	**Transport**	**Sources of income**	**Buy food grains**	**For social value**	**Others (Specity)**

Cattle						
Goat/Sheep						
Poultry						
Equine						
Camel						

3. Do you keep more than one livestock species? A. Yes B. No

If yes, why

a) to compensate animals lost due to disease
b) Feed shortage
c) to include animals that withstand water stress in the herd due to shortage of water
d) As drought coping mechanism
e) to get more diversity product.
f) Others (specify)

4. From the above livestock you havewhich one you want to produce more in the future

And why? ______________________________________

5. Share of responsibility in livestock management (rank from 1-4)

Labor responsibility	**Husband**	**Wife**	**Children**	**Hired labor**
Feeding				
Herding				
Milking				
Barn cleaning				
Butter making				
Watering				
Selling livestock Selling livestock products				
Handling disease				
Others (specify)				

6. Do you move livestock to other places in search of feed and water? **A.** Yes **B.** No

If yes, why the frequency of migration increases? Tick and Rank them

A. Increase of livestock population ( )

B. Drought ( ) C. deterioration of grazing land ( )

D. Others specify

7. If you move animals mention animal category, place moved and distance (Km / Hr).

Animal category	Place moved	Distance (Km / Hr).

8. What problems do you face during migration? (Rank them)

A. Death of animals and human ( )

B. attack by wild animals ( )

C. feed & water shortage ( )

D. Incidence of disease to human & livestock ( )

E. Other (specify) ( ) ---------------------------------

9. Housing condition

Types of animal	**Types of housing**				
	Open without enclose	Corrals	Separate barn or shed	In family house	Others (specify)
Calves					
Adult Cattle					
Small ruminants					
Camels					
Equines					

10. Constraints to livestock production (put in rank 1 -8)

Constraints	**Cattle**	**Small Ruminants**	**Camels**	**Equines**
Shortage of Feed				

Shortage of grazing land				
Health problem				
Low Productivity				
Predator				
Water Scarcity				
Scarcity of Labor				
Other –specify				

IV. Feed resources

1. What are the major feed resources in the area? (Rank 1 - 7 in order of importance)

Season	Natural pasture	Crop residues	Hay	browse trees	Crop after math	Industrial by product	Others
Dry Season							
Wet Season							

2. Do you think that your animals have adequate feed throughout the year? Yes / No

If No, on which months of the year do the shortage of feed become more severe? ------------------------

3. Do you vary feeding depending on animal species? 1, Yes ☐ 2, No ☐

4. Is the land grazing resource adequate to your animals?

a) Yes

b) No

5. If not what measures do you take to alleviate problems of feed shortage?

(Rank 1, 2, 3 …in order)					
a.	Storing the feed during available in surplus in the area ___				**b**. Using browse trees___
c.	Destocking ___	**d**. Hay making ___	**e**. Purchasing feed supplement___		

f.	Traveling long distance for searching feed ___	**g**. Others (specify) ---------------------

6. List/rank major problems related to grazing other than shortage.

___
___
___
___

7. How do you feed your animals?

a) Indoor feeding (confined in a house) using individual feeding system
b) In a collection yard using group feeding
c) Let to graze in a grazing land (grazing in an improved forage pasture land, natural
d) Other (specify).

8. Do you have access to grazing land? 1. Yes 2. No

If yes, is it communal or private? ---------------------------------

9. What is the size of your grazing land? ---ha

10. If you let your animals to graze, for how long do they graze per day? -------------hours

11. Do you have any bylaw on communal grazing land management? 1. Yes 2. No, if yes mention it---

12.is a grazing system differing during wet and dry season in your area? 1. Yes 2. No

13. Do you feed /supplement your animals a concentrated feed? A. Yes b. No

If yes, where do you get the concentrated feed? ....

14. For what type of animals do you give the concentrate feed? ....

In above Q4.12. If No, why? (Cost, distance, low supply………)

15. What are the major strategies you follow to solve this feed shortage?

___

___

16. What do you feed animals at different months?

Feed management	Months											
	1st			2nd			3rd			4th		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	May	Apr	Jun	Jul	Aug
Grazing own pasture												
Grazing communal land												
Grazing on crop residue												
Crop after math grazing												
Zero grazing												
Weeds from crop farms												
Improved forage												
Others												

17. Do you think important grass species decrease for last decades on your grazing land? 1. Yes 2. No; if yes name the grass species that has decreased? ---------------

18. Crop Residues

18.1. What are the major crop residues in the area? (Rank according to preference)

Crop Residues	Rank
Maize Straw	
Sorghum Straw	
Pulse Straw	
Oil Straw	
Others (specify)	

18.2. How did you utilize crop residues? (Rank 1-3 according to importance)

Types of Crop residues	Feed	Fuel	Selling	Construction	Others-(specify)
Maize					
Pulse					
Sorghum					
Others					

18.3. How do you store crop residues?

a) Stacked outside

b) Stalked under the shed

c) Baled

d) Other (Specify

18.4. When do you start feeding crop residues?

a) Soon after collection

b) During wet season

c) During feed shortage

d) During dry season

e) Others (specify)

18.5. In what form do you feed your crop residue?

a) Whole

b) Chopped

c) Treated
d) Mixed with other feeds
e) Other (specify)--

19. Improved forages production

19.1. Would you accept the introduction of improved forage production?

a) If Yes, why---
b) If No, why---

19.2. Do you Practice improved forage production before? Yes/No

✓ if yes fill the table

Species	Names of forages	Area	Strategies of development 1
Grasses			
Legumes			
Fodder tree			

Strategies of development1; 1= over sowing/reseeding on private/communal grazing; 2=under sowing; 3=planting tree legumes as fence 4= planting as pure stand

✓ If no, what are the reasons not to produce forages?
a. Lack of seed
b. Seed expensive
c. Shortage of land
d. Others (specify) ---------------------------------

20. Major feed source and feeding system constraints in your area (rank 1, 2, 3…5 where 1 is the most important constraint and 5 is the least important constraint)

Constraints	**Rank**	**Remark**

Shortage of rainfall		
Livestock population pressure		
Shortage of grazing land		
Land use conflict		
Land degradation and low biomass yields		
Low quality and variability of feed across seasons		
Water logging on grazing land		
Lack of extension services		
Lack of high quality forage seeds		

21. Browse species

21.1. Do you use browse species?

- Yes
- No

21.2. If Q2.1. Is yes what type of browse species do you use?

- Exotic
- Indigenous

21.3. Is browse species fodder tree available all year round?

Yes
No

21.4. Which animal given priority in feeding browse species fodder tree

a) Lactating Cows
b) Camels
c) Small ruminant
d) Heifers
e) Draft animals
f) Others - specify

21.5. Do you conserve the browse tree for dry season?

Yes	
No	

21.6. If yes, which feed do you conserve?

…………………………………………………………

21.7. Which one of the browse species is found more abundantly in your peasant association? Rank them on the basis of their relative dominance?

Species																				
Rank																				

21.8. List the browse species that are used as livestock feed?

Species	**Presence of foliage**											
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**

21.9. List their uses other than as livestock feed (√ Tick one).

Browse species	**Fuel wood**	**Construction**	**Traditional medicine**	**Farm utility**	**Edible fruit**	**Bee keeping**	**Incense tree**

V. Water sources and watering management

1. What sources of water are available for your livestock?

Sources of water	✓ **Tick**	**Distance from the home(Km)**
Dry River after water fallow		
Wells		
Ponds		
Pipe water		
Cistern		
Others (specify)		

2. What type of watering system you are following while watering your animals?

a. Group watering
b. Individual watering
c. Both

3. What are the major problems you are facing related to watering of your animals?

Problems	Tick	Rank
Shortage of water supply		
Source of water is far		
Shortage of labor to fetch water		

The water is not pure		
Others (specify)		

4. How frequently animals are watered during dry season?

	Time frequency						
Animal	Once in a day	Twice in a day	Ad *libitum*	Once in two days	Once in three days	Once in a week	Others (specify)
Cows							
Camels							
Small ruminants							
Equines							

VI. Disease

1. What are the major types of disease that affect your animals which are available in your locality? State with their major problems.

Animals.	Local name of the Disease	Signs and symptoms	Season of occurrence	Local Treatments	Type Spp affected

Appendix Table.10 Questionnaire designed to collect information on the perception and indigenous knowledge of Group discussion in the Degahbur pastoralists.

Pastoralist demography

Districts/ kebeles:

Gender:Female Male

Ages: **35-45** **46-55** **56-65** **66+**

Livelihood:pastoral **gro-pastoral**

Section one

1. What are the main purpose of livestock in your PAs, and explore how HH feed and manage livestock.____

____

____

____

____

____

____

2. What are main coping strategies and indicators for difficult times?____
____
____
____
____

2.1. Do these strategies have negative implication for future livelihood security?____
____
____
____
____
____

3. Are there different classes of livestock which are managed separately in your area? If yes how?____
____
____
____
____
____
____
____

4. What type of water sources you use for livestock watering in your around PAs?
____

4.1. Specify the name of water source
____
____
____
____

4.2. Specify the average distance to the water source
_________________________________ (hr)

5. What type of breeding and mating system you use to reproduce your animals?

a) Natural
b) AI
c) both

6. What measure you take when your animals become sick?
____
____
____
____
____
____

Section two

1. What are the major feed sources of your animal in your PAs?

A. Natural pasture grazing
B. Communal grazing land
C. Road sides
D. Zero grazing
E. Tethering
F. Others specify

2. What are the attributes you used to assess the potential of a grazing area in terms of its quality?____
____
____
____
____
____
____

3. What are the most nutritious/palatable species in your rangelands? Rank them.____
____
____
____
____
____
____
____
____
____

4. According to your perception what are the importance of knowledge of plant species?____
____
____
____

5. What are the dominant species in your rangelands? Rank them on the basis of their access to livestock_feed.____
____
____
____
____
____
____
____
____
____
____

6. Mention those forage species that do not dry throughout the year and used as feed source for livestock in your locality.____
____
____
____
____
____
____
____
____
____
____

7. What considerations do you make in selecting the forage species as key resource in Relation to animal feeds? (*Mention the criteria you set for selection)*____
____
____
____
____

4. Have you ever noticed the key forage species disappeared due to the recurrent drought effect of last decade's? If there any list it.

5. How often continual feed scarcity does takes places? And how do you cope it?

6. Are there improved forages in your PAs? If yes do you have any knowledge on how to feed improved forage to livestock?