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Feed Resource Availability, Livestock Migration Pattern and Synthesis of Feeding Calendar at Wag-Lasta, Ethiopia

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ABSTRACT

This survey was conducted from 2015 to 2017 to explore the pattern and reason of seasonal livestock migration, situation of different feed resources availability and seasonality at different agro ecologies of Wag–Lasta area in Amhara regional state of northern Ethiopia. A single visit formal survey, group discussion and individual interview were used during data collection. Grazing, crop residues and purchased feeds were the major feed resources with respective contribution of 56%, 22%, and 11% in the mid and lowlands of waghemira whereas 37%, 45% and 5% respectively in the highlands. Sorghum Stover followed by Tef straw were the major crop residues used at the mid and lowlands of Waghemira while barley straw followed by wheat straw and broad bean residue in the highlands of Wag-Lasta. Farmers used the residue effectively from January up to June when other alternative feed resources are not available in all agro ecologies. In the mid and lowland districts, average livestock holding were 5.62 TLU. Correspondingly, the average annual feed production from all feed sources was 6.1 tones. Based on the assumption of daily feed requirement of Farm animals, the total annual feed demand at house hold level were calculated as 12.9 tones. Thus, each house hold was under feed gap of 6.78 tons annually. In the highlands of Wag-Lasta, average livestock holding was 3.85TLU with annual feed demand of 8.7 ton and the available annual feed production was 4.5 tone thus, an average of 4.2 tone was in scarce annually.75% of the respondent at the mid and lowland districts of Waghemira were possess seasonal livestock migration while 25% were stable at their settlement area year round. The reason for migration was 95.6% for feed and 4.4% for both feed and water. 44.4%, 53% and 2.3% of the migrants were spend at the migration area for about five months, six up to ten months and for about four years respectively. Belessa, Tirari, Telajje, Tigray boarder, Dahna and Beyeda with respective migrant's percentage of 22,44,20,7,5 and 2 were identified as destinations. The distance covered during the migration were 37.8% (20-35km), 28.9% (36-60km), 24.4% (61-80km) and 8.9% (>80km).

Keywords: - Feed resource, Livestock migration, Livestock production

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1. INTRODUCTION

Livestock production which is an integral part of Ethiopian farming system constitutes a population of 56.71 million cattle, 29.33 million sheep, 29.11 million goats and 7.43 million donkeys (CSA, 2015). From the total livestock population of the country, about 40% cattle, 75% goats, 25% sheep and almost 100% of camels are raised in the rangelands (Alemayehu, 2004). For this large population, feed is the most important factor determining the productivity and marketability of livestock and its products. Feed resources as reported by Tolera and Said, (2012) can be classified as natural pasture, crop residue, improved pasture and forage and agro industrial by-products of which the first two contribute the largest share. The author have also described that fibrous agricultural residues contributes a major part of livestock feed i.e., about 50% of the total feed supply in Ethiopia. Under smallholder livestock production system, animals are dependent on a variety of feed resources which vary both in quantity and quality and the available feed resource should match with the number of animals in a given area. Livestock production is constrained by ecological, technical and economic limitations which result in severe feed shortages. Despite the fact that smallholder mixed crop-livestock farmers use diverse feed resources, inadequate and poor quality feed supplies continue to be major challenges. Market-oriented livestock development can only be realized once the technological, organizational and institutional opportunities and challenges are properly documented and innovative approaches to feed development and improvement approaches and metrics are identified and implemented.

Wag- lasta area which is located at the northern part of Ethiopia is characterized by low input subsistent mixed crop livestock farming. The area is the home for Abergelle goat breed belonging to rift valley family. It has an estimated population of over 300,000; widely distributed along the Tekeze River in Southern Tigray (Tembien and Inderta), Waghimra, Raya Azebo, and North Gondar (Simien) kept by the Agew and Tigray ethnic groups (Farm Africa, 1996). The area is known for erratic and short rain fall distribution, less available or dispersed watering points and poor pasture/browse distributions with poor availability and quality. As a result of the above factors or seasonal changes, communities move their animals for long distance and time period in search of feed and water during dry seasons. Therefore, it was thought worthwhile to document the available feed resources, season of availability, utilization and understand seasonal livestock migration pattern and develop appropriate adaptive measures to combat the above problem in the area. In view of these perspectives, this survey was conducted to assess Livestock migration pattern, feed resource availability, seasonality and utilization using feed assessment tool (FEAST) to determine the potential of site-specific feed interventions and options in the areas.

2. MATERIAL AND METHODS

2.1 Description of Study Area

The study was conducted in seven districts representing low land (Abergelle,Ziquala and Sehala), mid land (Sekotazuria) and highland (Lasta, Dhana and Gazgibla) of Wag- Lasta districts of Amhara regional state of northern Ethiopia. The districts are located at 618-850 k.m north east of Addis Ababa, 500-550 km south west of the center of Amhara regional state and 65-128 k.m north and south west of Sekota town. Some of the districts (Sekotazuria, Abergelle and Sehala) have a national boundary of over 200k.m with Tigray regional state. The mean annual temperature, mean annual rain fall and altitude of the districts were 21.6 -28 ^{o}c, 300-700mm and 1100-2600masl respectively (Metrological data and personal observation, 2017). The rain fall distribution was very erratic with short rainy season of from June – August at the mid and low land districts of Wagehemira while better rain fall distribution were observed from Jun to August and short rain during May at the highland districts.

2.2 Sampling Technique

From each district of mid and low land agro ecologies of Waghemira administrative zone where seasonal flock migration was very common, two kebeles were selected purposely. For feed availability assessment, two kebeles were selected randomly from each district from the three agro ecologies of Wag-Lasta. Economic level of the respondents (low, medium and high economic class) in terms of land and livestock holding was considered during the FGD and individual interviewee selection from the sample kebeles.

2.3 Data Collection Method

Participatory rural appraisal (PRA) and individual interview were the approaches for data collection. Semi structured questionnaire type were used during interview session. 12 farmers with house hold role by consideration of all land holding categories and with consideration of equal involvement of women were used for the focus group discussion and 3 farmers from each land holding category which is a total of 9 farmers were further used for the individual interview session at each kebele (according to ILRI FGD and individual interview guide for FEAST). A total of 168 respondents from 14 kebeles were selected for the focus group discussion and 126 respondents were further used for the individual interview session. The group discussion and individual interview sessions were focused on general farming systems, livestock production systems, feed resource availability, seasonality and utilization. During the FGD and individual interview sessions, for the districts (Abergele, Ziquala, Sehala and Sekota zuria) where seasonal livestock migration was very common, data related with seasonal livestock migration was collected. While from the whole sample kebeles, data on feed resource availability, seasonality and

utilization were collected. Correspondingly, GPS coordinate points for study kebeles, settlement areas and migrants destination were taken.

2.4 Data Collected

The types of data collected from this assessment were: Socio economic characteristics of respondents, farming system records, season of livestock migration, reason of migration, species under migration, GPS coordinate points along the study kebeles, destination routs, watering points, settlement areas, pasture/browse area points, type of feed resource available and season of availability.

2.5 Some Standard Measurements and Classifications Used

To classify the districts in agro ecological bases, standard altitude classification range were used as:

Low land—500 to1500 masl
Mid land ---1600 to 2200 masl
Highland---2300 to 3700 masl

The Standard unit TLU (Tropical livestock unit) was used for livestock number quantification throughout this paper 1 TLU=250 kg. (Harvest, 2011).
The annual maintenance feed demand for 1TLU was estimated 2.3 tone on dry matter basis (FAO, 1987)

2.6 Data Analysis

Quantitative data collected during individual interviews and FGD were analyzed using feed assessment tool (FEAST) Excel macro program (www.ilri.org/feast) and descriptive statistics. Livestock migration data were computed with descriptive statistics, GIS were used for mapping the roots of livestock migration

3. RESULTS AND DISCUSSION

3.1 Major Farming Practices and Resources

As shown in Fig.1, the landholding status of Households under different agro-ecological categories were identified as; in the mid and lowland areas large land holding (19%), medium land holding (39%) and low land holding (42%).While at the highlands, large land holding (27%), medium land holding (53%) and low land holding (20%). The result revealed that relatively better land holding were seen at the highlands of Wag- Lasta than mid and low lands of Waghemira had which was in contrary from the report of (Dere, Mekdim , Alemayehu and Taffesse, 2012); land holding at the highlands of Ethiopia is lower than the low lands as the highlands have relatively better rainfall distribution and suitability for farming than lowlands. The disagreement might be associated with the reason that livestock production, especially goat production was an important part of the livelihood system at the mid and lowland districts so that farmers went towards those areas for such farming activity and at the same time the need for agricultural land increased and land holding

became diminished. In another way, most of the highland areas covered by this study were degraded, sloppy and not suitable for agriculture as a result of this the computation for land was lesser and farmers were participating in off farm activities.

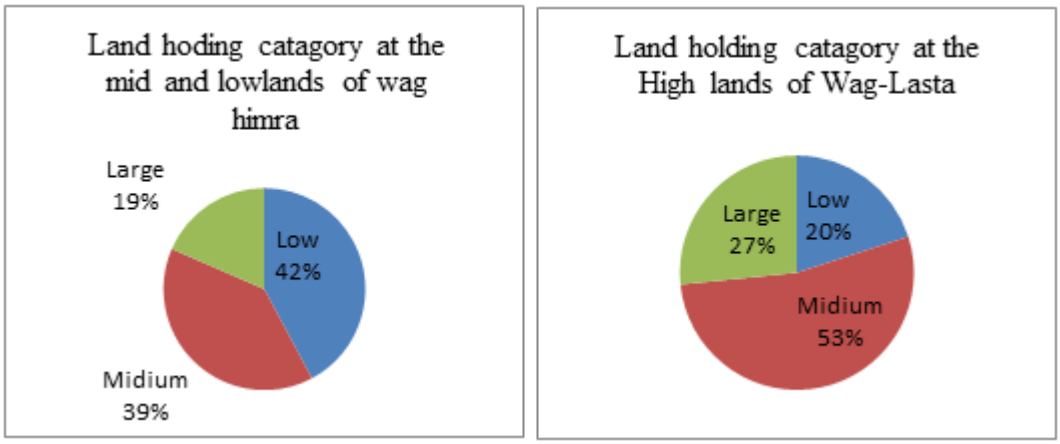


Fig.1 Land Holding Category

3.2 Livestock holding and crop diversities

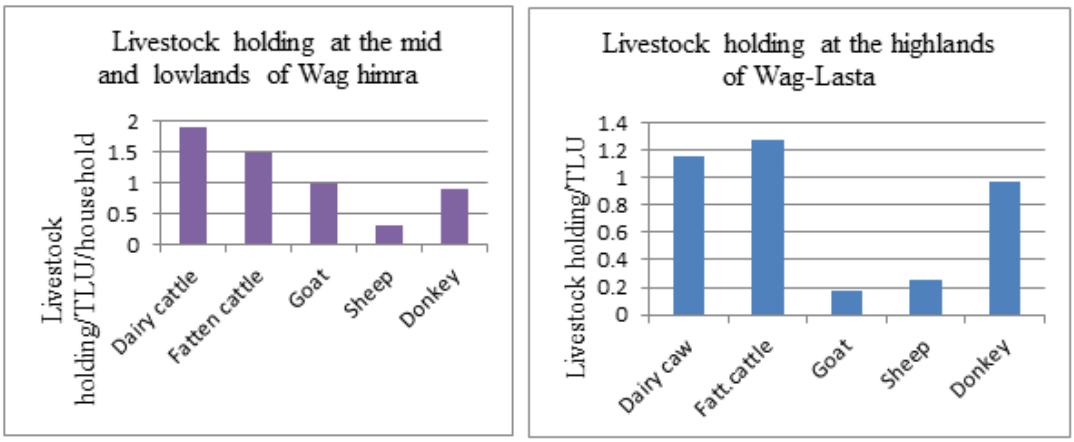


Fig.2 Livestock Holding

The survey explored livestock holding per household (TLU) and found for goat, sheep cattle and donkey as 1, 0.3, 3.4 and 0.9 respectively at the mid and low lands of wag hemira while 0.18, 0.26, 2.42 and 0.97 for goat, sheep, cattle and donkey, respectively at the highlands of Wag- lasta. The result showed that together with cattle, goat was reared very dominantly (1TLU) per household at the mid and low lands of Wag hemira while at the highlands of Wag-Lasta, sheep was in better holding per house hold (0.26 TLU) which clearly much with the reality of niche of the species as goat better suit the low lands and sheep in highlands ESGPIP, (2009).

The result was a bit lower from the report (1.62 TLU) per house hold of Goat holding at Ziquala district (Alubel, 2015). The discrepancy of findings might be associated with sample size; this survey had covered larger scope than the result reported by the above author.

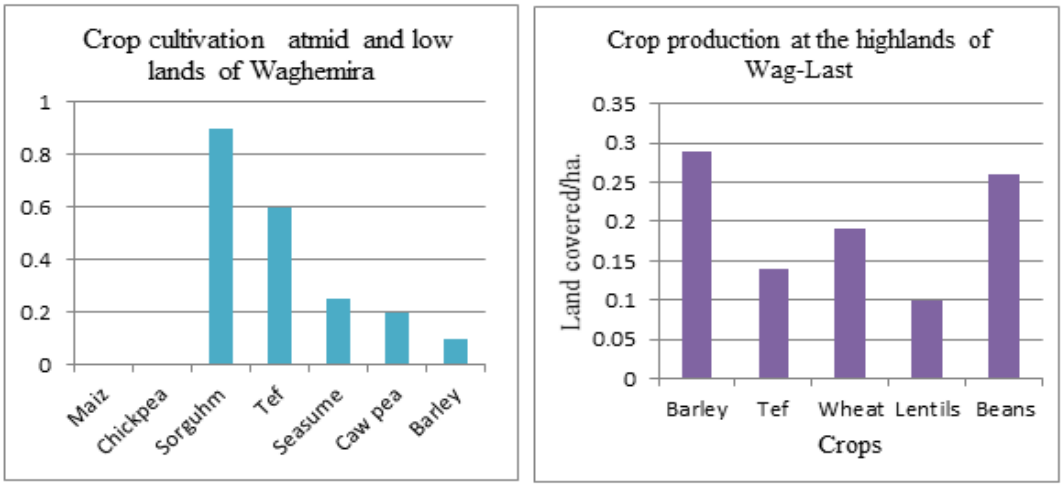


Fig.3 Crop Diversities

Besides livestock, crop cultivation was an important part of the small- holder's livelihood with the dominant crop varieties of sorghum, tef, sesame and local cow pea with respective per household production of 0.98, 0.58, 0.225and 0.22 hectares at the mid and low land areas of Wag hemira while barley, tef, wheat, lentle and broad beans of 0.29, 0.14, 0.19, 0.1 and 0.26 hectares respectively at the highland districts of Wag-Lasta. The mixed livestock crop production system observed in this study revealed that smallholder farmers could derive livestock feed resources from such crops to compliment gazing and browsing. Apart from crop production, farmers specially at the mid and lowlands of Waghemira where frequent rain failure is very common, cultivate food crops in target of crop residue production for their animals and most of the time its common that farmers are going to harvest the food crops at vegetative stage and store as crop residue for further use for their animals.

3.3 Source of income and livestock marketing

The assessment indicated that in all of the agro ecologies income were made from livestock, crop and family labor for the households. In annual basis, the cash contribution of livestock sell for small holder farmers regardless of total livelihood contributions was 75% and 44% at the low and midlands of Waghemira and highlands of Wag-Lasta areas respectively. The result was slightly differed from a report (53%) cash contribution from the livestock sector at ziqual district (Alubel, 2015). The difference might be associated with sample size; this survey had covered larger scope than the result reported by the above author. The result also showed that in exception from other livestock species, goat were the most liquid form of income

source sold year round by the farming community. The reason for this year round selling might be associated with presence of wider involvement of goat traders, active goat marketing along Wag-Tigray market outlet and presence of goat meat processing and exporting abattoirs at Mekele town. Out of the total cattle sold per year in household level, 60% of cattle were sold from January up to June which indicates farmers destock their herd during feed scarce seasons with selling price of up to 297 USD and 27% of the cattle were sold from September up to December; for the reason that during this season animals are relatively in good body condition these can be sold with better price of up to 327.9 USD while 13% were sold from July up to august. During this season cattle selling were low indicating farmers need to stay with their animals unless there is feed shortage.

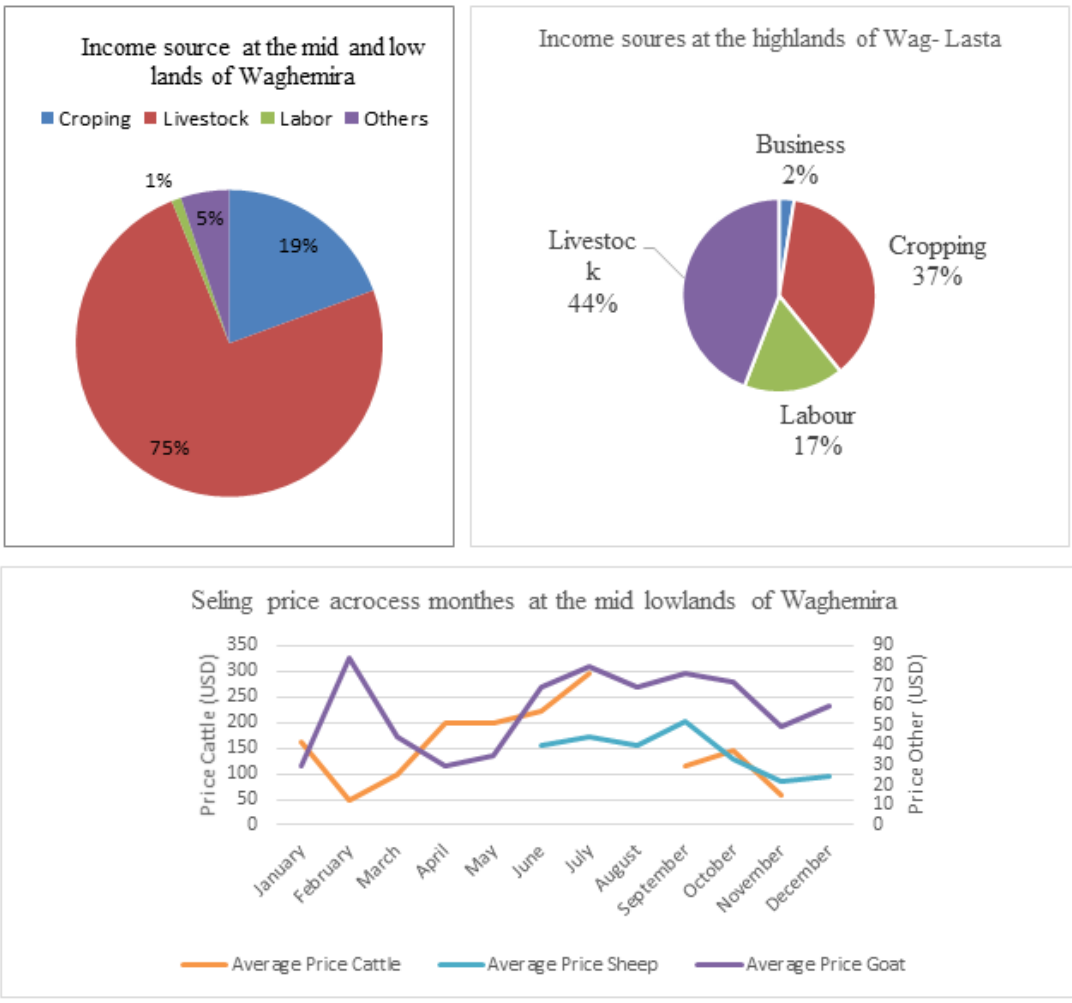


Fig.4 Source of Income and Livestock Marketing

3.4 Major feed resources availability and management practices

The major feed resources available in the study districts are presented in table 1 below.

Table 1. Estimated Feed Production/Tons/Year in Dry Matter at Household Level

Districts	Grazing	Improved fodder	Crop residue	Purchased feeds
Abergele	4.42	1.57	0.93	0.43
Ziqual	2.98	0.74	0.58	0.92
Shala	1.83	0.79	0.18	0.41
Sekota zuria	4.2	2	0.26	0.55
Dhana	1.78	0.5	1.85	0.436
Gasgibla	0.35	0.02	0.2	0.108
Lasta	**1.14**	**0.152**	**1.26**	**0.094**

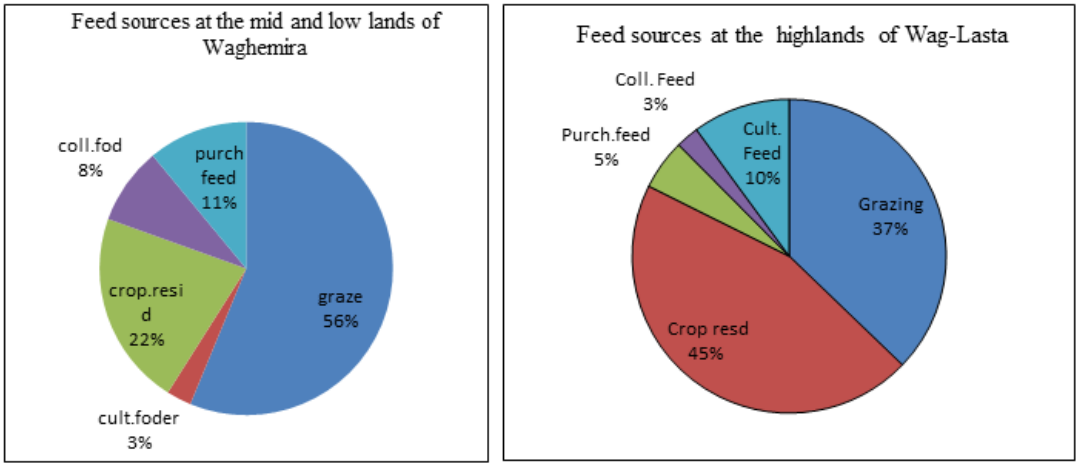


Fig. 5 Major Feed Resources

As summarized from the FGD and individual questionnaire and estimated using the Feast excel macro program, the contribution of grazing lands to livestock feeding was 56% in the mid and low lands of Waghemira and 37% in the highlands of Wag-Lasta districts which was a bit in line with the report (ranges from less than 25 to 50%) on feed resource availability and utilization at central and eastern Tigray (Yayeneshet, Abrehaley, Dawit and Haile 2016) and (55.7%) on range land condition and feed resource in Metema district of northern gondar (Azage, Lisanework, Tesfaye and Worku, 2007). As shown in table1, gazing contributed much in its dry matter basis per year in comparison with other feed sources in the mid and lowland districts (Abergele, Sekota zuria and Ziquala). This might be the reason that the mid and low land areas have relatively vast communal grazing lands than the highlands had.

The overall contribution of crop residues was 22 % in the mid and low lands of Waghemira and 45% in the highlands of Wag-Lasta districts. This is in line with the report that shows about 50% contribution of crop residues; on feed resource availability and utilization in central and eastern Tigray (Yayeneshet, Abrehaley, Dawit and Haile 2016). However, this result is different from the above report in the case of mid and lowlands of waghemira of which the difference might be associated with productive land shortage and unfavorable ecological condition for crop production in the the mid and lowlands which in turn yield low crop and residue production. Nevertheless, these results are in line with the report demonstrating about 20.7% contribution of crop residue in livestock feed in Metema district of north Gondar (Azage, Lisanework, Tesfaye and Worku, 2007). Except in few cases, practice of improved forage production and utilization was minimal in the study area which needs more to be done on introduction and extension of forage varieties in the areas. The figure below shows the different feed sources and utilization in the study areas.



Fig. 6 Major Feed Sources and Management Practices

3.5 Seasonality of major feed resources

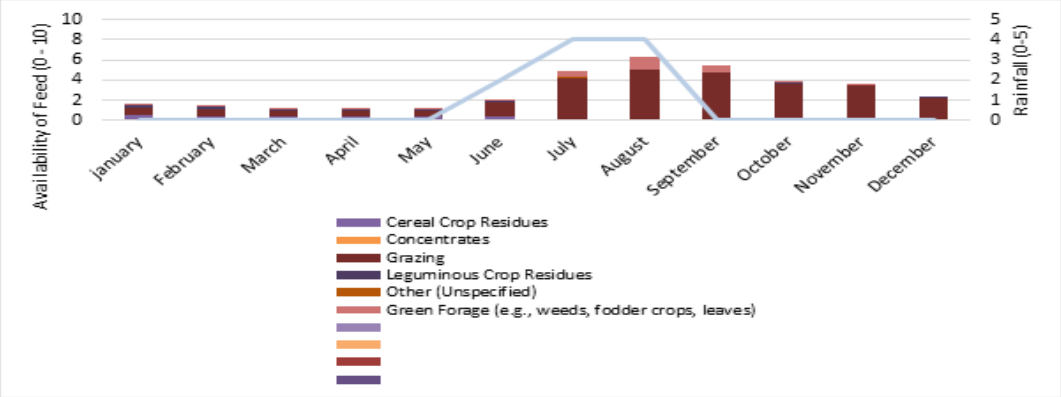


Fig.7 Feed Resources Availability across the Mid of Months and Low Lands of Waghemira

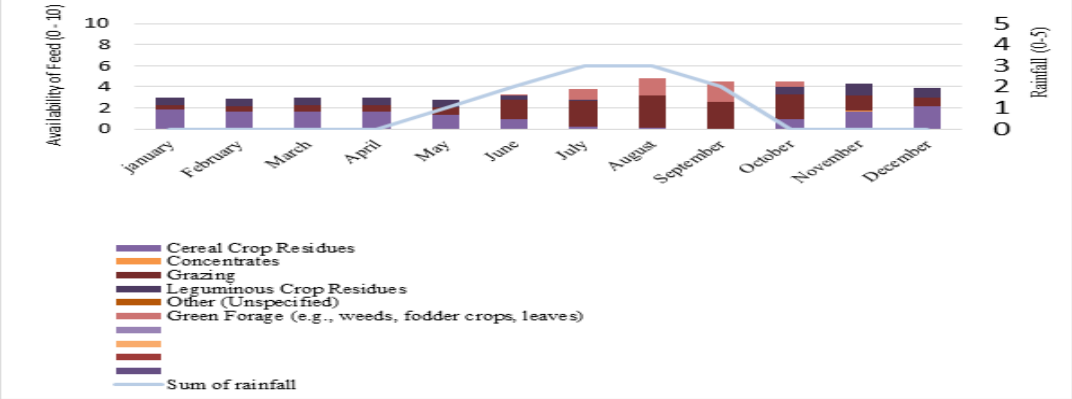


Fig. 8 Feed Resource Availability across Months at Highlands Of Wag- Last

The results show that in each month, feed sources were used in combination; from January to May. Livestock feed was complimented predominantly from cereal and legume crop residues and from grazing in all of the agro ecologies. While from June to September, livestock feed was obtained mainly from grazing and green forage, weeds and different fodders in all of the agro ecologies. This indicates that in this season, there is relatively better rainfall distribution in the areas; as a result animal feed can be available from grazing lands and weeds and different fodder can be harvested from the cropping activities. From October up to December, in all of the agro ecologies, feed from grazing was in more abundance with some supplementation of cereal and legume residues. During all the seasons, grazing together with crop residue were an important sources complimenting the livestock feed in the areas which is in agreement with Alemayehu (2004), Tolera, (2007) and Gashu, Geremew, Tegene and Aster (2017) who reported natural pasture and crop residues to be the major feed resources for highlands of Ethiopia. These all combination of

animal feed sources indicate that each source was not abundantly found and farmers used the residue very effectively from January up to June when the graze lands becoming less abundant and other alternative feed resources were either not available or expensive in all agro ecologies. This calls for increasing attention to improve feeding value using different options as Crop residues are characterized by low digestibility.

For feed resource availability assessment in all of the agro ecologies, ten indices were used as 1= extremely low and 10= extremely high feed availability in the areas (according to ILRI guide for Feast). Access for feed resources in the mid and lowlands of Waghemira was two from January up to May and four from June up to December. While at the highlands of Wag- lasta, the access for feed resources from ten were three during January up to May and five during June up to December. These results clearly show that the highlands had relatively better feed production potential as they had better rainfall distribution and crop cultivation pattern than low lands in the present study areas. The result are in agreement with the report of Yayeneshet, Abrehaley, Dawit and Haile (2016) on feed resource availability and utilization in central and eastern Tigray.

3.6 Feed Balance Analysis

Based on the total feed production presented above, indicative feed balance was calculated at house hold level for the three agro-ecologies of seven districts of Wag-Lasta. The average livestock holding per household at the four mid and low land districts of Waghemira were 5.62 TLU and the average annual maintenance feed demand of 1TLU was estimated 2.3 tone (FAO, 1987) Based on this assumption, the total annual feed balance per house hold was calculated as 12.9 tone and the average annual feed production from all feed sources was 5.5 tones with an average annual feed purchase of 0.6 tons per household. As a result, each house hold was under feed gap of 6.78 tons annually which is equivalent with six months. Thus, livestock keeper in the areas tried to cop up this serious feed shortage problem either by migrating to distant areas in search of better feed resource or by under feeding of that limited feed resource. Similarly, in the highlands of Wag-Lasta, the average livestock holding in household level were 3.83 TLU and the total feed production from all feed sources annually was 4.25 tons based on the above calculation, the annual feed demand in household bases was 8.85 tons which calls each household were under feed gap of 4.3 tons annually equivalent with around four months. The result was in line with the report of about four months feed gap (Yayeneshet, Abrehaley, Dawit and Haile 2016) in central and eastern zones of Tigray and negative feed balance report in Wolayita Sodo, Alaba District and central Rift Valley of Ethiopia (Admasu, 2008) and (Wondatir, 2010) .

3.7 Seasonal livestock migration

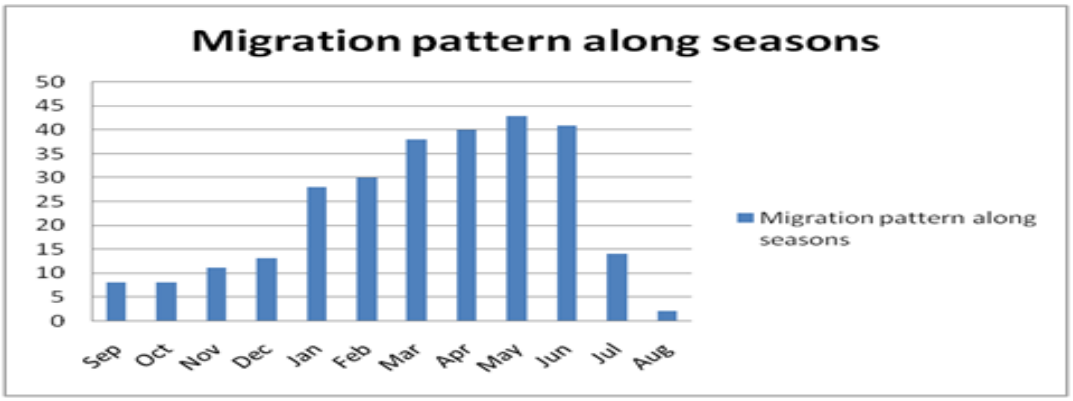


Fig.9 Livestock Migration Pattern along Months at Mid and Low Lands Of Waghemira

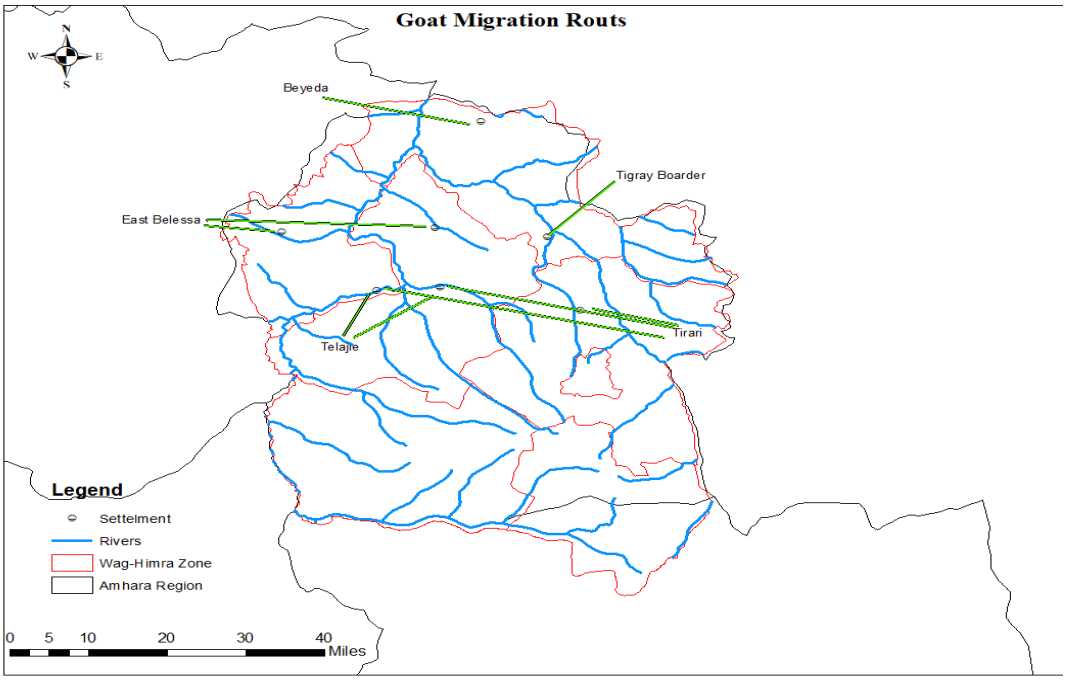


Fig. 10 Livestock Migration Routes and Settlement Areas

The result revealed that, migration was very common from January up to June in the mid and low land districts of the study area and 75% of the respondents were agreed as they were under seasonal migration with their animals while 25% were stable at their settlement area year round. The reason for migration was 95.6% of cases for feed and 4.4% of cases for feed and water. Thus Feed shortage was found to be the driving factor for seasonal livestock migration with owners in the study areas which is in agreement with the report of Mounir and Sarker, (2015) on livestock migration

in the arid areas of India. For long distance migration, mostly the male family heads from the villages go in group with their animals and may stay for months up to their settlement areas can produce better feed for their animals. During the migration, donkeys were important for carrying the owner's food. Wives and elder sons had responsibility of handling and managing farming activities around their home till the house hold head come back. While for short distance and for short period of migration, mostly sons were assigned to be went with the animals as an attendant. Cattle (10.87%), goat (10.87%), sheep (7%) and all species together (78.26%) were the identified species under seasonal migration.

Out of the of the total, migrants, about 44.4% , 53.3% and 2.3% were stayed at the migration area up to five months, ten months and four years respectively. Moreover, the distance covered during the migration was about 20-35 km (37.8%,), 61-80km (28.9%) 36-60km, (24.4%) and (8.9%) >80km respectively. This is a bit higher than an earlier report which has shown about 18- 22km travel in search of water and feed at the arid areas of India (Mounir and Sarker , 2015). According to the result obtained from FGD and individual interview, six sites were identified as potential destinations for the migrants viz., Belessa,Tirari, Telajje, Tigray boarder, Dahna and Beyeda with their respective migrants percentage of 22,44,20,7,5 and 2. According to the respondents as is depicted in our observation, the reason for choosing these areas were availability of vast communal grazing lands with better feed availability year round and water was available at the areas as major rivers (Tirari, Zamira, Tekeze and menna) were crossing the areas.

4. CONCLUSION

Livestock production is constrained by many of the factors like feed sources. Grazing and crop residues were identified as the major feed sources for livestock in the study areas. The development and wide use of improved forage species were negligible in the areas. From January to June, crop residue was fed very dominantly when grazing lands becoming less supporting which calls for improving the quality of crop residues through different treatment technologies. Minimal trend of purchasing animal feed during scarce seasons and destocking of the herd/flock during dry season were identified as the common farming practices of livestock keepers in the areas. From the feed balance calculation made in the areas, livestock were under feed gap of (6.78 tons) and (4.3 tones) in mid and low lands of Waghemira and the highlands of Wag-Lasta areas respectively; thus a lot is needed to be done to improve the present situation.

To cope up the prevailing feed shortage, livestock keepers adapt seasonal migration with their animals and six major places have been identified as their potential destinations (Tirari,Belessa, Dhana, Tigray,Telajje & Beyeda). Therefore, as mitigation option of such serious scenario, proper feed resource development and strategic plan need to be drafted and implemented beyond the research and extension bodies so as to design and implement sustainable feed resource interventions in the areas.

5. RECOMMENDATIONS

As grazing lands are the major sources of livestock feed at the areas, there is an imperative need to actively work on pasture improvement by designing appropriate intervention plan together with community members and local administration. Improved forage development and crop residue improvement research out puts should be urgent tasks for research institutions and extension bodies for filling the existing feed gap problems By working much on market issues, flock/herd destocking during dry seasons needs to be promoted as an important approach of feed gap copping mechanism by livestock keepers. Feed development and marketing business need to be promoted as an important mitigation option of feed gap problem Further study on the livestock migration pattern need to be done for the highlands of Wag-lasta as this study has coved only the mid and lowlands of Waghemira zone.

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