

Small ruminant production in coffee-based mixed crop-livestock system of Western Ethiopian Highlands: Status and prospectus for improvement

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Abstract

The study was conducted in Goma district of Jimma Zone of Ethiopia with the objectives of documenting the reasons why farmers in coffee dominant mixed-farming systems of western Ethiopia keep small ruminants, and identifying the constraints and opportunities for improvement of this sector. Results are based on diagnostic survey of 160 sample households, group discussions and personal observation. The study district was stratified into three groups based on flock distribution as: sheep dominating, goat dominating and mixed flock sites.

The average land holding per household was 1.93 ha. In Goma where coffee and chat are the major cash sources for farmers, small ruminant are also primarily kept for cash generation as reported by 94% of the sampled households. The second main reason for keeping small ruminant in the study area was for saving mainly in time of coffee failure. Keeping small ruminants as a source of manure was the third important reason. From the interviewed households, 59.4, 32.1, 23.5, and 19.4% of them utilize communal grazing, aftermath grazing, roadside grazing, and riverside grazing, respectively for their animal as a sources of feed. Most small ruminants are either tethered or herded all the seasons due to the cultivation of perennial crops and predators. All small ruminants are housed for protection from adverse weather conditions and predators. The major problems for small ruminant production and marketing were: feed and grazing land shortage, lack of input, predators, diseases and parasites and marketing problems.

In order to exploit the current growing demand of small ruminant meat at local and international markets, research and development interventions are required with regard to the identification of alternative feed resources and strategic feeding management, identification of causes of diseases and their control methods and improving marketing efficiency through appropriate policy.

Key words: Coffee, farming system, production system, small ruminant

Introduction

Ethiopia has a larger livestock resource than most countries in Africa. It is estimated that 84% of the 70 million people live in rural areas and depend on agriculture for their livelihoods and the sector contributes 41.4% of the Gross Domestic Product of the country (World Bank 2006).

In Ethiopia, there are about 26.1 and 21.7 million heads of sheep and goats, respectively (CACC 2008). They are important components of the livestock sub-sector and sources of cash income, meat, milk and wool for smallholder keepers in different farming systems and agro-ecological zones

(Kassahun 2004, Markos 2006, Endeshaw 2007, Getahun 2008 and FAO 2009). They are also sources of foreign currency (Asfaw 1997, Berhanu et al 2006), and at a farm level small ruminants serve as investment and insurance due to high fertility, short generation interval and their ability to produce in limited feed resource and their adaptation in harsh environment (Asfaw 1997, Tsedeke 2007). Despite their large number and importance their productivity is low due to a number of factors ranging from feed shortage both in quality and quantity and health constraints (Markos 2006, Sisay 2006, Tsedeke 2007 and Getahun 2008). Other constraints also include low genetic potential, policy issues, market, institutional and credit facilities problems (Zinash et al 2001, Berhanu et al 2006).

Although various research and development activities have been carried out in the past, little increase in productivity has been achieved. Therefore, innovative research and development programs are required to increase the productivity of the flock and subsequently improve the contribution of the small ruminant sector to meet the demands of the human population, in the different farming systems of the country. However, such development outcomes, as a prerequisite, require a good understanding of the different farming systems, prioritization of the problems and simultaneously addressing some of the key constraints specific to a given locality and region. In addition, other issues which include feeding, health control, general management, as well as cost and availability of credit and marketing infrastructure need for further considerations (Workneh et al 2003, Baker and Gray 2004). This study was conducted to characterize the current *status* of small ruminant production systems and identify major constraints and opportunities for improvement in coffee dominant mixed-farming systems of western Ethiopia.

Materials and methods

Description of the study area

Goma district (South-western Ethiopia) is located 390 km south west of Addis Ababa and about 50 km west of the Jima Zone capital. The district is predominantly known for its coffee production and center of diversity for coffee in Ethiopia. It has well distributed annual rainfall with very low temporal and special variability (IPMS 2007). Based on 15 years weather data obtained from Goma district, the average annual rainfall was 1524 mm with bi-modal distribution. The small rains are from March to April and the main rainy season extends from June to October; there are about 7 rainfall months in the district (IMPS 2007). Crop and livestock production is not constrained by the amount and distribution of rainfall as in the other parts of the country. The mean monthly temperature varies between 12.7⁰C-29.1⁰C. There are 36 rural kebeles (Kebele is the lowest administrative unit in rural Ethiopia and normally consists of small number of villages and hundreds or thousands of households) and 3 urban kebeles in Goma district. The number of agricultural households in the district was 45,567 from which 35,533 are male headed and 10,034, female headed (IPMS 2007). The total population of the district was 216,662 (110,448 males and 106,174 females) (CACC 2008). Goma is the second most densely populated district in the zone with the total area of 96,361.72 ha (96.4 km²) including the two coffee state farms which cover an area of 2704 ha (IPMS 2007).

There are two farming systems namely coffee-livestock mixed and cereal-livestock farming systems. More than 92% of the people in Goma district are categorized under coffee-livestock mixed farming system and this consists of thirty-two kebeles. The major cash crop commodities in this farming system include; coffee, chat (*Catha edulis*), tropical and sub-tropical fruits (mango, avocado, papaya, banana, orange, pineapple) and spices (mainly ginger and Ethiopian cardamom). Among cereals,

maize, teff (*Eragrostis tef*) and barely are grown in the area, but the dominant cereal crop in the farming system is maize. Livestock species include cattle, small ruminants (sheep and goat), apiculture, poultry and equines. Sheep are larger in number than goats in this farming systems and in general, as altitude increases the goat population reduces. The cereal-livestock mixed farming system consists of four rural kebeles. Coffee and tropical fruit are also produced in these kebeles though the productivity is low. Maize is the dominant cereal crop in this farming system. Relatively high flock densities of cattle and goats with limited sheep population were found in the cereal-livestock mixed farming systems.

Sampling and data collection

Before undertaking the formal survey, initially discussions were held with district livestock experts and secondary data were collected from published and unpublished sources for assessment of the situation. In addition, the district was visited for better understanding of agriculture in general and small ruminant production in particular. Based on the assessment of the informal survey, the 36 kebeles were stratified into small ruminant density zones using the proportion of sheep and goats as classification criteria. Accordingly, 26, 6 and 4 kebeles were found to be 'Sheep dominant', 'Mixed flock' (almost similar proportion of sheep and goats) and 'Goat dominant', respectively. From these strata of kebeles, 4, 2 and 2 kebeles were selected from sheep dominant, goat dominant and mixed flock zones, respectively.

Households that have at least 2 small ruminant or landless farmers who have a minimum of one year experience in small ruminant production (including fattening) were randomly selected. Accordingly, 20 households from each kebeles (a total of 160 households) were randomly selected to participate in the study.

Structured questionnaire was used to collect information on the following variables: socio-economic characteristics of households, purposes of keeping sheep and goats, inventory of sheep and goats, feeds and feeding, feed resource utilization trend across seasons of a year, problems and constraints and opportunities in small ruminant production. The questionnaire was prepared first in English and then translated into Amharic and technical words were again translated into Oromiffa, a language spoken by the local community. Development agents (DAs) and supervisors who were working in the district and who speak the local Oromiffa language were recruited, trained and collected the data under close supervision. Group discussions were held with 7-12 key informants once in each study area in order to gain an in-depth insight about the topics covered during the structured interview and to check whether patterns found in the households were validated by focus groups.

Data analysis

The data were organized, summarized and analyzed using SPSS statistical package (SPSS 13.0 2003). For data involving frequencies, descriptive statistics were employed and Pearson chi-square were used to compare variables across the small ruminant density groups, where as quantitative variables were analyzed using analysis of variance procedure. When the F test declared significant differences for a certain parameter Tukey test was used to separate group means (Samuels 1989).

In describing results of analysis wherever appropriate, the numbers of households providing data are included in each table. Whenever the data analyzed are based on single responses to questions the percentage values should add up to 100%. In multiple answers percentages will not add up to 100%.

Percentage units (%) are shown alongside the levels of one of the classification variables, either along the top or down the side, to indicate how the contents of the tables are to be interpreted and in which direction the percentage values are to be summed.

Indexes were developed to provide the aggregated ranking of some parameters of small ruminant production and marketing in the study area. The index was calculated as the sum of single item ranks [(3 for rank 1)+(2 for rank 2)+(1 for rank 3)] divided by the sum of all weighed items mentioned by each density group.

Results and discussion

Household characteristics

In the study area, the majority (94.4%) of the small ruminants owning households were male headed while only small proportions (5.6%) were headed by females. The proportion of landless young was very low (6.3%). According to key informants, the number of landless young people involved in small ruminant fattening has been growing from time to time may be due to the market demand and high profit margin. About 94% of the interviewed household heads belong to Oromo ethnic group while heads from other ethnic groups constitute only 6% and most of them were found in sheep dominant areas.

The average family size/household was 5.5 of which 42, 51 and 1% are between the age of 0 to 14, 15 to 65 and above 65 years, respectively. According to the report of CACC (2008), the average household member in the region is 5.0 which is comparable with the current results. There were on average 2.50 females and 2.71 males in the house. The ratio of male to female for the studied household is almost similar to the value given for the region, *i.e.* 50.4:49.6 (CACC 2008).

Flock structure

With regard to flock structure, the distribution by age almost follow similar trend for both sheep and goats except for age 3-6 months and breeding males (figure1 and 2).

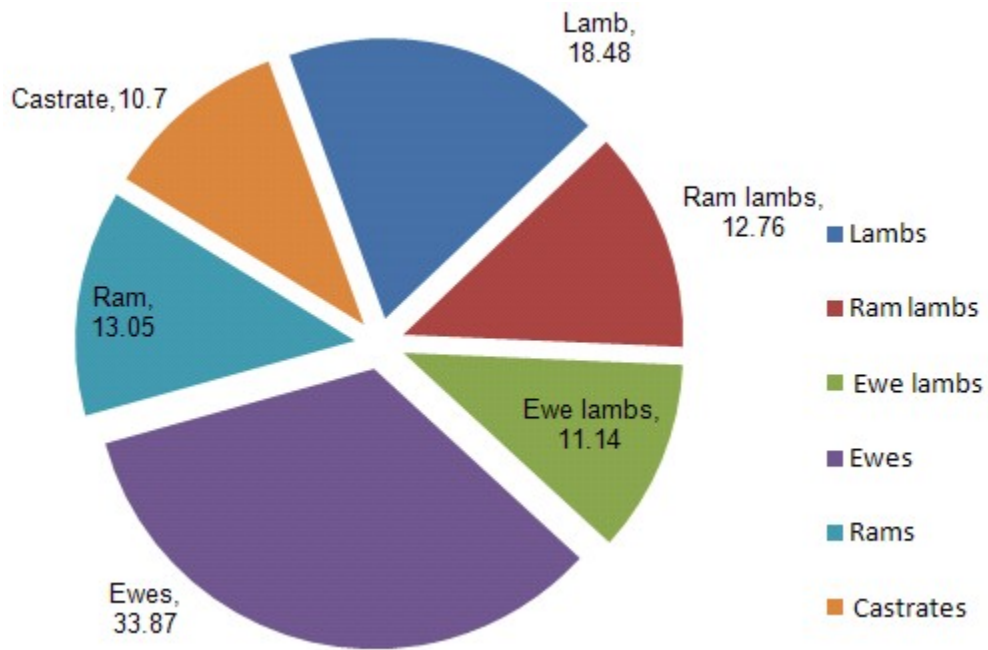


Figure 1. Flock structure of goats (numbers represent percentages of respective groups)

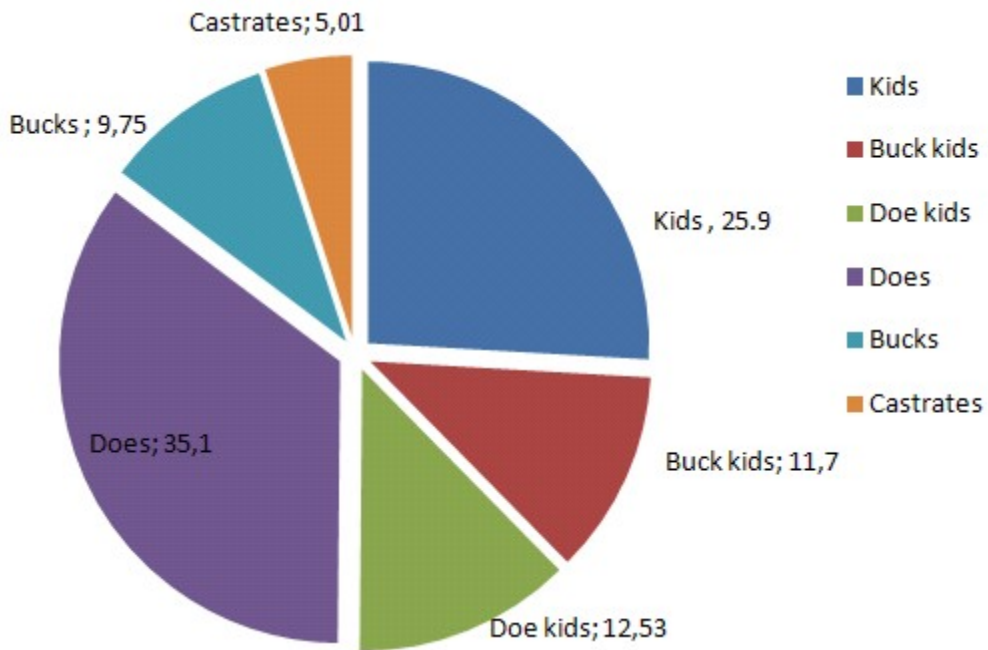


Figure 2. Flock structure of sheep

Breeding females represent larger proportion while suckling age are the second largest age group in the flock; and the castrates represent the lowest proportion in the flock for both species. From the sheep flock, 33.9%, 18.6%, 13.1%, 12.8%, 11.2% and 10.7% are represented by ewes, lambs, rams, ram lambs (3-6 months), ewe lambs (3-6 months) and castrates, respectively. There are 35.1%, 25.9%, 12.5%, 11.7%, 9.8% and 5.0% does, kids, doe kids (3-6month), buck kids (3-6 month), bucks and castrates, respectively. The larger proportion of breeding females in a flock observed in this study is also reported by Ahmadu and Lovelace (2002) under the extensive production system. The breeding male to female ratios obtained in this study for sheep and goat were greater than the recommended breeding male to female ratio for sheep and goat under traditional production system which is 1:25 (Wilson and Durkin 1988). This could be attributed to farmers in the area used to fatten the male animals so that they used to keep intact until one year after which they castrate to be fattened. In addition farmers have coffee as sources of income instead of selling their few small ruminant holdings.

Purposes of keeping

About 94% of the small ruminant keepers keep them mainly for income generation (Table 1).

Table 1. Purpose of keeping small ruminants as ranked by the owners in the study area

Purpose	Households ranked purpose of keeping small ruminants					Index
	1 st	2 nd	3 rd	4 th	5 th	
Income	150	8	0	1	0	0.44
Saving	7	53	24	10	3	0.19
Meat	1	33	21	13	1	0.13
Manure	0	15	38	18	5	0.12
Risk/benefit distribution	1	17	20	15	7	0.1
Sacrifice	0	1	0	6	2	0.01
Social heritage	0	5	2	0	0	0.02
Total	159	132	105	63	18	1

Index = [(7 for rank 1)+(6 for rank 2)+(5 for rank 3)+(4 for rank 4)+(3 for rank 5)+(2 for rank 6)+(1 for rank 7)] divided by sum of all weighed purposes mentioned by respondent.

Similar to this finding, small ruminants are reared in many parts of the country mainly for income generation (Markos 2006, Sisay 2006, Endeshaw 2007, Tsedeke 2007, Getahun 2008). The second main reason for keeping small ruminant in the study area is for saving purpose. According to the opinion of group discussion participants and key informants in the area, coffee is the main cash crop followed by chat. For most farmers, however, their economic profitability is highly limited by various factors. In most cases, there is fluctuation of coffee yield due to erratic rainfall so farmers nowadays keep small ruminants as saving and insurance. Keeping small ruminant for meat and manure purposes were ranked as third and fourth important reason. Although its amount is small, in most households farmers prefer small ruminant manure to cattle manure. Other important reasons include for risk distribution, sacrifice and social heritages.

Feeds and feeding: major feeds available and their utilization

Grazing is the common feed source for small ruminants in the study area. Common forms of grazing and non-conventional feed sources and their season of utilization are given in Figure 3 and 4, respectively.

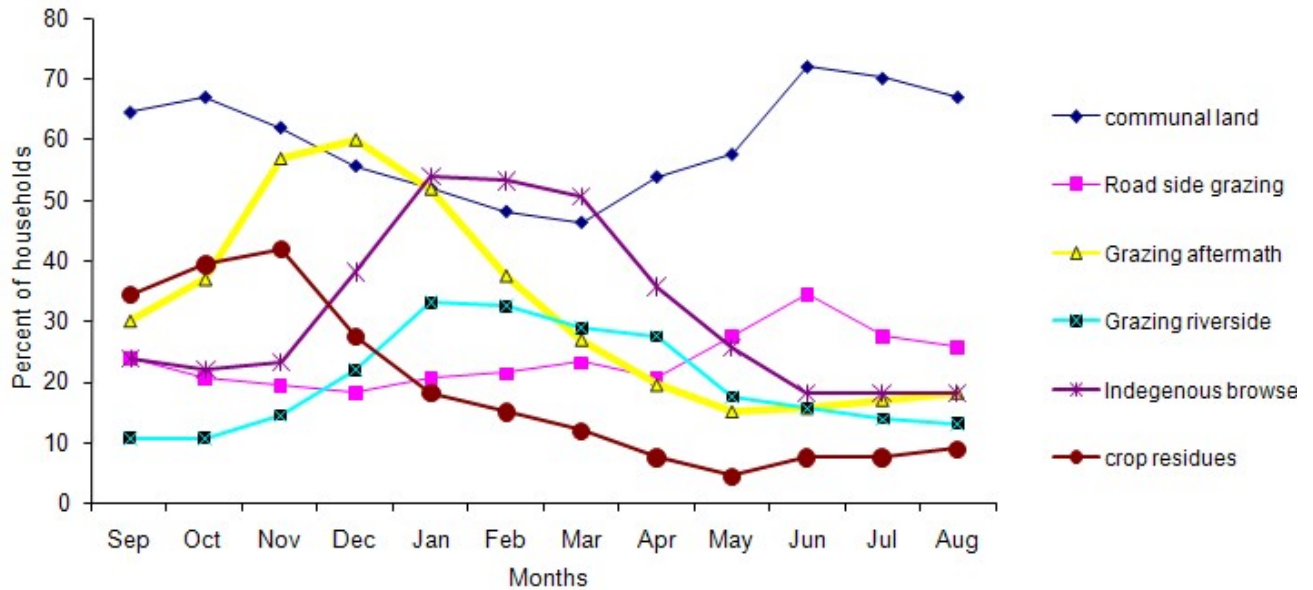


Figure 3. Common grazing sources and their seasonal utilization.

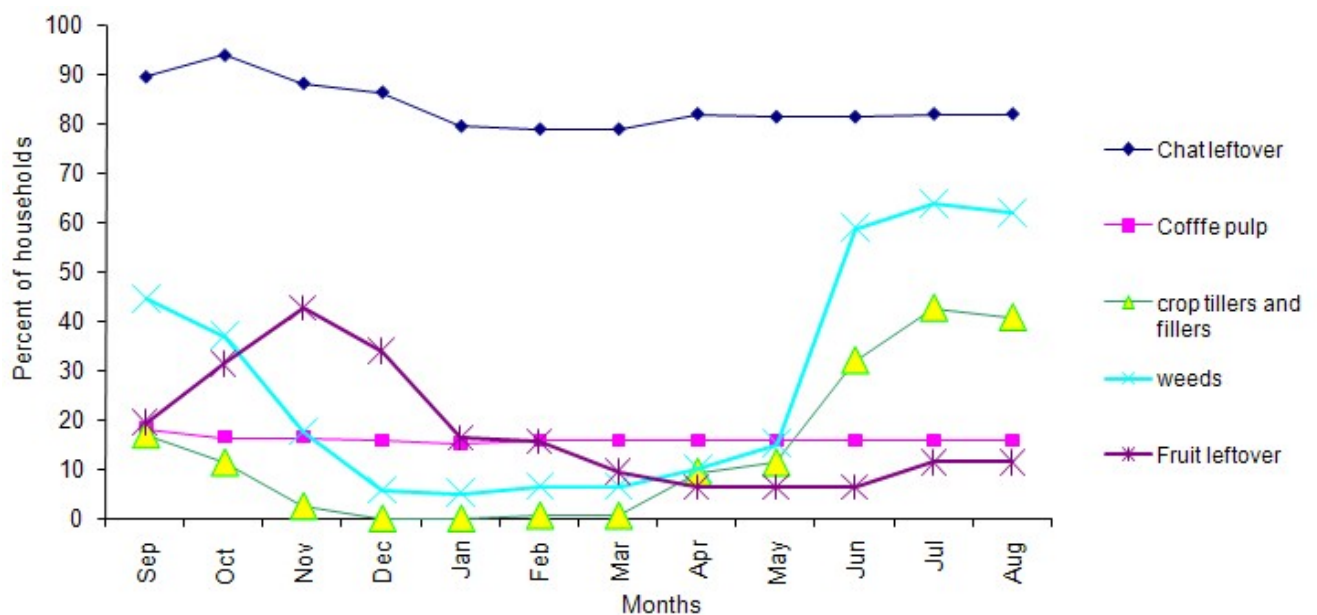


Figure 4. Common non-conventional feed sources and their seasonal utilization.

Communal grazing land, roadside grazing, riverside grazing and aftermath grazing are the major types of grazing for sheep and goats. From the interviewed Households (HH), 59.4, 23.5, 19.4 and 32.1% of them utilize communal grazing, roadside grazing, riverside grazing and grazing aftermath, respectively. Although there is difference in utilization across months of the years, communal grazing lands are utilized throughout the year. This is in agreement with the findings of other studies (Abule 2003, Teshome 2006, Tsedeke 2007, Tesfaye 2008), who indicated that natural pasture is the main feed resource for small ruminants and cattle in Ethiopia. The availability and quality of forages are not favorable and uniform in nutrient quality all year round, as a result, for animals that are not supplemented the body gains made during the wet season is totally or partially lost in the dry season (Alemayehu 2003). During the specific period of the year (mid December to March) indigenous browses are the main sources of feed in the study area, especially for goats, while concentrates feeds are not common. The utilization of indigenous browses by goats is also reported in Alaba district of southern Ethiopia (Yeshitila 2007). The utilization of these indigenous browses as feed sources may be due their high protein content so that they can keep animals in better body condition.

The animals graze along the riverside during the dry season and short rainy seasons while intensity of its utilization then declines until October (Figure 3). This is may be due to the utilization of communal grazing lands in wet months. During the rainy seasons, farmers do not cut browses to feed small ruminants. The cut-and-carry is much common during the dry season. Grazing aftermath is an important source of sheep and goat feed from the start of the dry season to the start of the short rainy season after which their importance declines. Indigenous browses are important sources of animal feed from October to May when other sources of feeds are becoming fibrous and poor in quality.

In Goma, there is a wide spread utilization of non-conventional feed resources such as chat left over, home left-over, fruit left over, *Enset* (*Ensete ventricosum*) and banana parts, weeds and crop tillers and fillers (Figure 4). From the interviewed households, 83.5% fed their animals (particularly castrated) with chat and home left-over. According to the participants of group discussion, after being utilized by family members, chat is not dropped; rather it is collected and put for small ruminants. So its utilization by animals was throughout the year for most of the households.

Weeds and crop tillers of maize and sorghum are also other common feed sources for sheep and goats. This is in agreement with other reports that indicated that farmers use crop fillers and tiller during the wet season in Alaba of SNNPR (Tsedeke 2007, Yeshitila 2007). When the farmers move to crop field for weeding they take their animals with them and feed them. However, these feeds are limited to rainy seasons although small number of farmers have access to irrigation and then weed their crop during other times of the year too.

Grazing lands are communally owned while some households have small private grazing paddocks/enclosure locally called *kallo* between their cropping fields. While working on their cropland they keep their animal with them in these small grazing areas.

In the current study area, sheep and goats spend most of their time being sheltered in the house. On the average, they spent only 6 hours grazing/browsing during the day time. They are under close supervision through out the day and in all seasons of the year to prevent them from damaging crop cultivation and to protect them from predators. In the highlands where sheep are dominant, there is short grazing time; small ruminants are protected from cropland (coffee cultivation and fruit plantation) and from predators especially leopard and hyena. In the lowlands areas, where goats are dominating and grazing lands are relatively larger, they are also protected to avoid damaging of

cropland and to protect them from wild animals such as leopard, hyena and monkey. Monkeys were a threat for kids/lambs; according to key informants, they take out the eye of kids/lambs first, and then kill them to predate. There is no significant ($p<0.05$) variation across the three areas classified to small ruminant density with regard to allocation for grazing or browsing by sheep and goats; however, according to results of the group discussions, there is a difference in time allocated for the two species with more restriction to goats than sheep .

>From the interviewed households, 53.8% of them herd sheep alone, 12.5 % goat alone, 22.5% sheep and goats together and 11.2% keep small ruminants with large ruminants while grazing. The tendency of keeping small ruminants with large ruminant is lower; this is because of their feeding behavior. According to the result of the group discussion, farmers prefer feeding goats alone instead of grazing/browsing them with sheep. This may be due to the fact that the goats have the ability to browsing many plant species within short period and less time is required to fill their gut than sheep.

In wet seasons, when the major feed resource is the communal grazing, 79.4% of the households use herded grazing system so that sheep and goats do not go into crop fields as herders are closely following. In this time of the year, road-side grazing and private grazing are often used though the size of the land is very small. About 13% of the household use both herd grazing and tethered grazing (*i.e.* herded grazing then tether or vice versa). Tethering and cut and carry methods were practiced in wet season.

In the dry seasons, the majority of the households (54.4%) tether their animals while 25.6% of the households use cut and carry methods and only few of them herd (12.5%) their flock. Although the intensity and the purpose differs, similar practices were also reported in different studies (Getahun 2008, Tesfaye 2008).

Small ruminant production problems and opportunities

Constraints and opportunities of small ruminant production and marketing

Feed and grazing land shortage is the most limiting constraint (74.4%) in small ruminant production in the study area (Table 2).

Table 2. Major constraints of small ruminant production as reported by the sampled households by small ruminant density groups (%)

Problems	Group			Overall
	Sheep dominant	Goat dominant	Mixed flock	
Feed/ land Shortage	72.5	90	62.5	74.4
Lack of Input	62.5	90	70	71.3
Predators	70	80	52.5	68.1
Disease & Parasites	52.5	90	47.5	60.6
Lack of Credit	48.8	90	60	61.9
Marketing Problems	8.75	82.5	25	31.3
Labor Shortage	30	32.5	17.5	27.5
Drought	3.75	27.5	5	10
Water Shortage	2.5	20	5	7.5

Feed shortage in both seasons (dry and wet) limits productivity of small ruminants and it was further worsened by the lack of awareness and practice of feed conservation techniques. Moreover, forage development has been given less attention. There is a significant difference among small ruminant density groups with production constraint with pronounced problem in sheep dominant sites (highland and mid altitudes) than other sites. This is because more land is covered by perennial crops than left for grazing.

Water shortage and drought were reported as production problem by 20 and 27.5% of the households, respectively in goat dominant sites. This may be due to goat dominant areas receives relatively smaller rainfall and has shorter rainy seasons than their counterparts. Yet water shortage is not a critical problem that hinders small ruminant production in the area and this may be due to better rainfall distribution and the existence of many rivers. Only 7.5 and 10% of the households, respectively has reported water shortage and drought as constraints.

Diseases and parasites hamper small ruminant production by causing high mortalities especially among suckling animals. From interviewed households, 60.6% indicated diseases and parasites to be among the major constraints for small ruminant production in the area. Almost all interviewed households lost one or more small ruminants during the last 12 months for that reason.

The loss of small ruminants by predators is a common phenomenon in the study area and on average 68.1% of the interviewed households indicated this problem as a constraint for small ruminant production. Problems of input supply, credit services and appropriate extension services constitute 71.3, 61.9 and 21.3% of the constraints mentioned by the interviewed households

Opportunity of small ruminant production

Goma is one of the districts in Oromia that is known for coffee production. However, the productivity and the price of coffee has been highly variable due to erratic nature of the rainfall and lowered price and volume of coffee exported which has direct impact on farmer livelihood. So, farmers face income shortage during times of coffee failure. The integration of small ruminant production is important as they can be intermediate cash sources during coffee failure time. Moreover, their high turnover rate, easy to be managed by children and women are advantages that worth mention for their integration with crop production.

Goma is also highly endowed with natural forests and various annual and perennial plants that can be potential feed resources for small ruminant. The vegetation is endowed with spicy herbs that give demandable aesthetic property of the meat which may be valued for export markets. Moreover, the area receives enough amount of rainfall that can be used to develop various types of improved grasses, legumes and browses through different production strategies. Landless youth and farmers, retired people and other members of society can be engaged in fattening activities that could benefit as result of high market demand and higher prices for meat and live animal sell.

High demand of the small ruminants in the local market as a result of population increase, urbanization, and increase in income (even within a district) can be considered as an opportunity for the small ruminant producers. It is evident that there was high consumption of meat during crop (coffee) harvest and less volume of animal were taken out of Goma.

The need for young males is also opportunity for the producers. Nowadays, many abattoirs flourish in the country; so agents and assemblers purchase small ruminant even at farm gate.

Conclusions

- In Goma, where coffee and chat are the major cash sources for farmers, small ruminant are mainly kept for cash generation and saving in case of coffee failure. In general, sheep are the dominant and most preferred species than goats by farmers and it was observed that most farmers who has larger perennial crop land do not choose to have small ruminants especially goats.
- Feed development projects should be planned and implemented as the rainfall pattern and soil fertility enable most annual and perennial forage crops plantation effective (Adaptation to disease and pest needs to be studied as for high and low temperature response). Moreover, integration of improved forage species by different strategies (Which are the most appropriate strategies for the area and explain why you chose them) should also be area of intervention and then the issue of feed quality can be resolved.
- Diseases and parasites which are the major constraints in small ruminant production should be studied in depth and microbial (etioloical) causes should be identified; Epidemiology should also be clearly indicated and appropriate development interventions should be planned.
- Fattening is the emerging opportunity for land owning and landless farmers and other urban and peri-urban communities. However, there are limited efforts in providing profitable feeding packages and so future research needs to focus in generation and dissemination of appropriate technologies for the farmers.

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