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Research Article

Assessment of Livestock Production System in Selected Districts of East and Horro Guduru Wellega Zones, Oromia, Ethiopia

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Abstract

Ethiopia has a large livestock population, however, the resources are not well exploited. The study was conducted to assess and prioritize livestock production constraints. The study employed purposive sampling techniques. The zones, districts, and villages were selected as proximate to roads, livestock resources, and stability. Primary and secondary data were collected during the study periods using checklists separate for groups. The collected data was analyzed using descriptive statistics and systems thinking approaches. The survey revealed that livestock production is the main livelihood in all districts cattle, shoat, poultry, honeybees, equines, and fish were kept in the subsistence-oriented. No, any livestock species are reared for a single purpose. For example, bulls produced for drought and cows for dairy then fetched to the market after being culled from production for beef purposes. Animal products had high demand except fish consumption habits and marketing were unsatisfactory. According to survey results, milk yield was 2.33 and 7.33 L/day/head, and carcass yield was 122.33 and 131.33 kg/head for indigenous and cross cattle breeds, respectively. No cross sheep (13 kg/head) and goat (11.67 kg/head) breeds were reared in the study area. About 2kg/head and 3kg/head carcasses were produced from indigenous and cross-breed chicken. Regarding egg production, about 74 and 194 eggs/head/year from indigenous and cross-breed chicken. The results revealed that honey yield was harvested at 9, 16, and 19.5 kg/hive/year from traditional, transition, and modern, respectively. Natural pastures, crop residues, browses, and concentrate (rare) are animal feed resources availed in all the study districts. Silage making, urea block molasses, ration formulation from the locally available diet, and haymaking were not practiced in the study area. The major feeding systems in the study areas were revealed as free grazing for ruminants, scavengers for chicken and fish, and flora-visiting for honeybees. Enough climate change is a global threat to livestock production respondents in the study area were less concerned about the issue. Lack of insufficient animal feeds, veterinary service, lack of improved breeds, and inadequate markets were the major problems for livestock production. In conclusion, livestock production in study areas was subsistence-oriented and challenged fully. Therefore, establishing strong extensions to demonstrate improved forage, formulating a diet from locally available ingredients, conserving surplus feed, providing animal health services, designing compressive animal breed improvement programs, and availing put proximate will enhance livestock productivity.

Keywords: *Constraints; Disease; Feed; Livestock; Wellega*

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Introduction

Ethiopia's livestock population is the largest in Africa. The sector contributes to the agricultural GDP (45%), the overall GDP (19%) and foreign exchange earnings 16-19% and 30% of the labor force [29,32]. It also provides income, quality food, fuel, draught power, building materials, fertilizer, household livelihood, food security, and nutrition [4]. However, the resources are not well exploited [30] and productivity remains low due to various factors [51]. The major production constraints are the lack of adequate feed, the prevalence of different diseases, the lack of veterinary service, the lack of improved breed, and the lack of market-oriented production [30,39].

Commercializing smallholder livestock production is not new in Ethiopia [13]. However, transforming from household consumption to a market-oriented livestock production system remains unresolved [10,13,28]. The animals are supplied to the market from highly dispersed and non-homogeneous. Unresponsive business communication among livestock value chain actors has fundamental problems across the chain [28,38,51].

Designing a proper breeding strategy, improved feeding, health service, product safety, product promotion, excellent relationships among industry actors and conducive management conditions should be a path to market success [10]. As a result, the Food System and Resilience Program (FSRP) has been established to improve the resilience of food systems and increase preparedness against food insecurity in selected districts of FSRP targeted in Ethiopia. Accordingly, East and Horro Guduru Wellega zones are among the selected zones in Oromia addressed by the program. The Ethiopian government has been making significant efforts to transform the agricultural sector through the Agricultural Growth Program (AGP) in recent years and now the FSRP project reinforces the findings. To come up with concrete results before conducting agricultural research and development interventions, design and conduct analysis of livestock production systems and their constraints are very important for boosting production and productivity. So, the study was conducted to identify and prioritize livestock production constraints in the target areas through a participatory approach using information generated from key informants, focus group discussions, secondary data, and personal observations.

Research Methodology

Description of the Study Area

The study was conducted in the East Wellega and Horro Guduru Wellega zones of western Oromia in 2023. East Wellega zone has 17 rural districts and town administration while Horro Guduru Wellega zone has 12 rural districts and one administration. Of the total districts six and four districts were supported by the FSRP project from East and Horro Guduru Wellega zones, respectively. Three districts were selected purposively from the Horro Guduru zone Horro district and Gobu Seyo and Diga districts from East Wellega.

Sites and Focuses Group Discussion (FGD) Selection Methods

The study employed multistage sampling techniques. In the first stage, two zones were selected purposively based on livestock availability and mandate area. In the second stage, the zones stratified into three agroecologies (highland, midland, and lowland) based on commodities farming systems. In the third stage, one district was selected from each agro-ecology using simple random techniques. The villages were selected purposively based on accessibility to roads, livestock production, and stability. Finally, about six FGDs each about 10-12 members per village were organized considering gender balances.

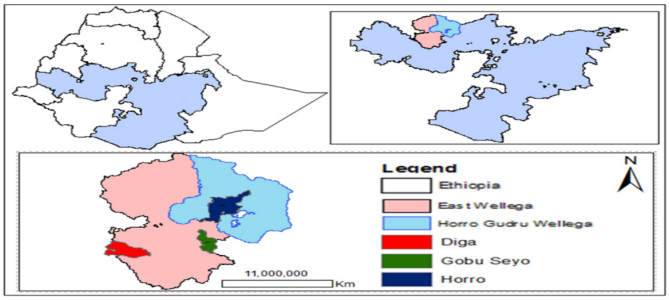

Figure 1: Map of the study districts.

Data Sources and Collection Techniques

The qualitative and quantitative data types were collected from primary and secondary sources. The primary data were collected from smallholder farmers, Development Agents (Das), and experts using Peasant Research Appraisal (PRA) tools. The most participatory tools adopted for this study included: FGD and Key Informant Interviews (KII). Data was collected using prepared checklists that cover whole livestock production system themes. The secondary data was collected from different published and unpublished sources.

Methods of Data Analysis

The collected data was analyzed using different quantitative and qualitative techniques such as percentages, means, rankings, and graphing were applied for this data analysis. Besides, systems thinking approaches were also applied for the analysis.

Result and Discussion

Livestock Production Systems and Their Purposes

Livestock production is the main means of livelihood for the population in the area. In all districts cattle, shoat, poultry, bee, equines, and fish production have been carried out. Diga district had the highest population of all livestock types followed by Horro and Gobu seyo districts (Figure 2). This might be due to the relatively larger grazing land availability. The production system is dominated by extensive, rare semi-intensive, and no-intensive production systems. Merely semi-intensive fattening, cross-breed dairy cows, and cross-breed poultry production were practiced. However, there was high potential and opportunity to export animal products from Wellega provinces to the Sudan market [28]. Even though a few farmers had one or two dairy crossbreeds (HF), the production system was not skewed from the traditional one. Sometimes, they have been supplemented at night and morning unless the cows mob within other herds. Hence, the productivity was below expected due to low management (feeding, health, housing, watering) given to animals. Because, the feeding system, health, housing, and water play a vital role in boosting livestock [46]. The bulls were reared

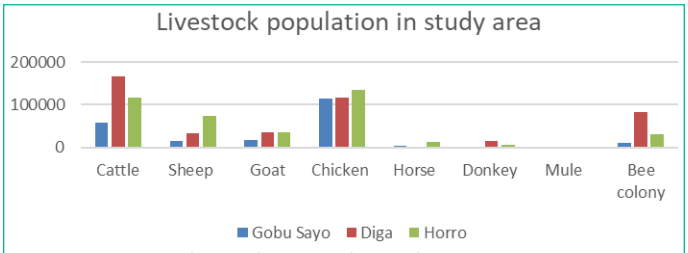

Figure 2: Livestock population in the study area.

for drought purposes and sold for beef purposes after serving for 2-4 years. Farmers care for bulls more than cows due to drought need energy and candidates for fattening after the drought is finished. This result is supported by Nega et al. (2002) who reported that farmers give priority to supplement their animals in order of importance. The discussants raised that if the bull had been emaciated and lost high weight during drought it might not easily respond to feedlot. This result is supported by Nega et al. (2002) who reported compensatory growth needs a long time, high-quality ration, high cost, and treatment. Cows and heifers were produced for milk production, calves, and income sources. After being culled from production old cows are used for beef particularly for *"qircaa"*. This result is similar to Semeneh et al. (2014) who reported that slaughtering cows in rural Ethiopia as sharing called "*qircaa*" is a common practice during cultural ceremony festivals.

The population of shoat in the study areas was summarized in Fig.2. The major purpose of small ruminant production was immediate income generation used for child education, input purchase, family expenses, clothing purchasing, health treatment, and social life expenses. This sale of early-growth rams and bucks is a critical problem for rural small ruminant breeding improvement, subsequent negative selection, and increased inbreeding. The result was in line with Duguma et al. (2020) who reported that the availability of breeding rams/bucks in sufficient numbers is indeed important for breeding improvement programs. Hence, FSRP should design community-based breeding programs, and establish ranching and open nucleus breeding systems for availing breeding rams or bucks. The survey result revealed that slaughtering animals for family consumption is limited at festivals and special celebrations. The result was in line with Mummed & Webb [40] who reported that Ethiopians consumed about 8 kg of meat per capita annually.

The equine (horse, donkey, and mule) population were also presented in Fig. 2. These animals were produced primarily for pack and draft animals followed by income generation (sold, rent, and chart) and other like prestige/social value, and Joke. The result was in line with Asmare and Yayeh (2017) who reported equines used for different roles in the farm family's daily chores due to their sturdy nature and manageable behavior. Horse production in the Horro district is used for prestige or social value & entertainment (joke) during the annual holiday/festival, weeding, mourning ceremony, and other celebrations. This information is highly supported by Kebede (2020); Baynes-Rock and Teressa (2021) who reported that horses and horsemen play a significant socio-cultural and economic role in Awi zone, such as in annual religious celebrations, mourning ceremonies, escorting guests, wedding ceremony, sports competition, loading and transportation, and handicraft production. There is no socio-cultural event that is undertaken in the highland areas without the involvement of the horsemen. However, donkeys were used only for packing and drafting and mules were used additional for transportation.

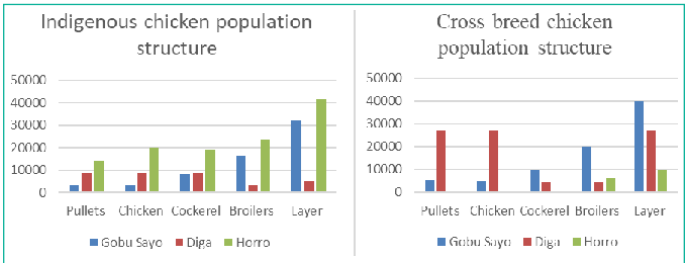

Figure 3: Chicken population structure in the study area.

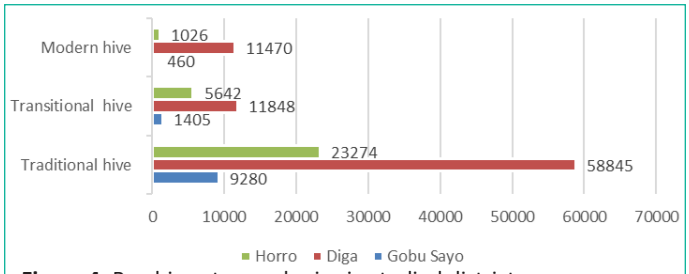

Figure 4: Bee hives-type colonies in studied districts.
Source: Survey result (2023).

Poultry production is presented in Fig. 3. Poultry was produced for egg, income generation, and family meat consumption. Mostly egg and live chickens were produced for market rather than family consumption. This result was supported by Sime [44] who reported that Ethiopian poultry farming methods are typically subsistence systems. Layer chicken was overwhelming the population. This indicates that eggs are in high demand in the areas. The chicken was owned by children and women they used for immediate cash needs like child education and weekly cloth cleaning soup and food items for families.

The apiculture production is presented in Figure. 4. The commodity has been getting high attention from government initiatives and NGOs in the last five years for honey, income generation, and wax production. Wax was an unmarketable product in the Horro and Gobu Seyo districts. However, recently youth in the Diga district have started wax processing. In current price, the cost of a kg of wax is higher than honey. Similarly, Eshete & Eshetie [19] reported that one kg of beeswax is worth more than one kg of honey. In the Horro and Gobu Seyo districts, wax was delivered by the district livestock office from where it was processed. The farmers did not know how waxes were processed. Hence, a large amount of crude beeswax is wasted in the beekeeper's backyard and `*Tej*` making houses [19,49]. They were surprised to hear that any trained men could produce wax from old foundations at their homes. Therefore, the old foundation was harvested from the hive and dumped under the hive because the farmers were destroying the old foundation to minimize honey darkness.

According to farmer's perceptions and secondary data, honey, and wax production were increased due to the distribution of modern hives, the establishment of hives in many farmers' backyards, awareness creation, commencement of colony marketing (recent scenario), engagement of youth and female unions on beekeeping via the aid of government and NGO. In many cases, honey could be harvested twice a year during October to November (main harvesting season) and April to May (minor harvesting season). Accordingly, the farmers had been harvesting honey of about 9, 16, and 19.5 kg/hive/year from traditional, transition, and modern, respectively. Beyene et al. [14] reported about 21.02, 12.51, and 5.65 kg/hive/harvesting from modern, transitional, and traditional beehives, respectively in the rift valley area of Ethiopia.

In the study districts fish production was not commonly practiced except few villages around Gibe River in Gobu Seyo; and Finchaa Lake Horro districts. However, the survey result revealed that there was no fish rearing, because, the district had no suitable water resources and artificial ponds. Hence, fish consumption and marketing were rare. However, the district had a high opportunity to market the product at Nekamte the capital town of western Oromia opposite Gobu Seyo district. For the Gobu Seyo district, Gibe River was an opportunity for fish rearing, however, less market availability for marketing. The

Table 1: Honey and wax production in the study areas.

District	Hive types	Honey output cycle	Season		Kg/ hive/year	Wax output cycle	Season		Kg/ hive/	Total kg/hive /year
			Major	Minor			Major	Minor	year	
Gobu Seyo	Traditional	2	Oct-Nov.	Apr.-May	5	2	Apr-May	Oct-Nov.	4.5	9.5
	Transitional	2	Oct-Nov.	Apr.-May	12	2	Apr-May	Oct-Nov.	4	15
	Modern	2	Oct-Nov.	Apr.-May	16.5	2	Apr-May	Oct-Nov.	5	21.5
Diga	Traditional	2	Oct- Nov.	Mar.-Apr.	5	2	Mar-Apr.	Oct- Nov.	4	9
	Transitional	2	Oct- Nov.	Mar-Apr.	13	2	Mar-Apr.	Oct- Nov.	3	16
	Modern	2	Oct- Nov.	Mar-Apr.	17	2	Mar-Apr.	Oct- Nov.	2	19
Horro	Traditional	2	Oct-Dec.	May-Jun.	5	2	May-Jun.	Oct-Dec.	4	8.5
	Transitional	2	Oct-Dec.	May-Jun.	9	2	May-Jun.	Oct-Dec.	5	14
	Modern	2	Oct-Dec.	May-Jun.	15	2	May-Jun.	Oct-Dec.	3	18

Source: Survey result (2023).

district had many rivers *Like Bisdoma, Katamo, Kilole, Anchu, Guluma, Lemmu, Dhoqonu, Gibe, Aqabo*, etc. Some individuals became aware and started fishing. However, they did not get market demand. Horro district had high potential for fish production like *Amartii, Finchaa & Nashee Lake* are availability. The production was practiced in individuals and groups. However, low market availability, lack of hunting knowledge, and lack of types of equipment for gearing were raised as challenges of fish farming. The youth and females in the nearest area had cooperatives on fishing for income generation and house meat consumption. To improve the income from fish farming the fishermen have been practicing using the net and hock.

Livestock Productive and Reproductive Performances

The productive and reproductive performance of different livestock species is presented in Table 2. The age at first calving, calving interval, daily milk yield, lactation length, weaning age, and longevity were summarized for indigenous, cross, and exotic cattle. According to the result, the age at first calving was four years for indigenous while three years for cross cattle. This report is longer than Jalata et al. [25] who reported 3.42 years to reach the age of first calving in the research station. This difference was observed due to management conditions at the farmers' level and at the station. According to respondents 100% blood level of exotic dairy cattle is uncommonly produced by farmers. The weaning length was reported from all districts between 6

Table 2: Reproductive performances of different livestock species.

Traits	Cattle									Traits	Chicken								
	Indigenous			Cross			Exotic				Indigenous			Cross			Exotic		
	GS	D	H	GS	D	H	GS	D	H		GS	D	H	GS	D	H	GS	D	H
Age at first calving (years)	4	4	4	3	3	3	3			Age at first laying (months)	7	5	6	`6	4	5	5	3	4
Calving interval (years)	1.6	2	2	1.2	1.6	2	1.2			Egg per clutch/broodiness	12	12	12	30	40	40	70	70	80
Daily milk (Liters)	2	3	2	6	10	6	6			Broodiness Length (days/ week)	10	14	14	5	5	5	-	-	-
Lactation Length (months)	8	8	6	10	8	8	10			Length of broodiness to laying (week)	3	6	24	1	4	15	1	3	10
Calf weaning age (Months)	8	7	6	10	7	8	10			Egg laying per year (No)	60	60	50	75	80	90	150	170	150
Longevity/Survivability (year	13	10	12	14	10	10	14			Male age at market (months)	7	7	6	6	6	5	5	5	3
Carcass yield (kg/head)	127	113	127	132	127	135				Female age at market (months)	7	7	7	6	6	5	5	5	3
										Longevity/Survivability (years)	7	3		5	2		3	1.5	2
										Carcass yield (kg/head)	2	2	2						
Traits	Sheep									Traits	Goat								
	Indigenous			Cross			Exotic				Indigenous			Cross			Exotic		
	GS	D	H	GS	D	H	GS	D	H		GS	D	H	GS	D	H	GS	D	H
Birth type (single, twin, triple)	1	2	2	-	-	-	-	-	-	Birth type (single, twin, triple)	2	2	2	-	-	-	-	-	-
Age at first lambing (Year)	1	1.4	1.2	-	-	-	-	-	-	Age at first kidding (months)	10	15	12	-	-	-	-	-	-
Lambing interval (months)	8	11	8	-	-	-	-	-	-	Kidding interval (months)	7	7	7	-	-	-	-	-	-
Lamb Weaning age (months)	4	5	5	-	-	-	-	-	-	Kid Weaning age (months)	3.6	4	4	-	-	-	-	-	-
Female lamb age at market (months)	8	11	5	-	-	-	-	-	-	Female kid age at market (months)	7	6	5	-	-	-	-	-	-
Male lamb age at market (months)	8	10	5	-	-	-	-	-	-	Male kid age at market	7	6	5	-	-	-	-	-	-
Longevity/Survivability (years)	9	8	9	-	-	-	-	-	-	Longevity/Survivability	9	7	15	-	-	-	-	-	-
Carcass yield (kg/head)	13	13	12.5							Carcass yield (kg/head)	12	13	10						

Note: *GS: Gobu Seyo district, D: Dida district, H: Horro district;* **Source:** Survey result (2023).

to 10 months. Even though cross-breed production has been a recent history in their livestock production; farm infrastructure has a positive and significant effect on dairy herd longevity, age of first calving, milk yield, and other productive and reproductive performances [41]. Indigenous cattle can survive up to 15 years. Farmers were offered good management for crossbreeds. Hence, under the farmer's condition age of survivability was nearly similar because the animals that had good management had higher survivability. According to secondary data and information from key informants' carcass and milk yields are higher for crossbreeds than Indigenous cattle. The higher carcass yield was reported in Horro districts (135kg/head) followed by Gobu Seyo (132kg/head) for cross cattle. For instance, indigenous cattle produced equal carcass yield in the Horro and Gobu Seyo districts (127kg/head). An equal milk yield was reported from three districts (3 L/day/cows) from Indigenous and 13 L/day/cows from crossbreeds. The result revealed that there were no cross and exotic breeds of small ruminants. The birth type of Horro sheep in the Gobu Seyo district was single (75%), twin (17.5%), and triple (7.5%). This indicated that the majority of sheep have a single birth type. In Diga, district ewes had been giving lamb in single (30%), twin (62.5%), and triple (7.5%) while single (32.5%), twin (60%), and triple (7.5%) had been given in Horro district. The mainstream ewes in the Diga and Horro districts were given twin lambs. This result deviated from Bekana et al. [11] who reported that Horro sheep birth type 66.82% single and 33.18 % twins. This difference might be due to the precision of data between the survey and actual data. The age at first lambing was 12, 14, and 16 months in the Gobu Seyo, Diga, and Horro districts, respectively. The lambing interval was similar for the Gobu Seyo and Horro districts (8 months) and longer for the Diga District about 11 months. The farmers responded that early weaning age (4 months) and late similar age of weaning were 5 months in Diga and Horro districts. The result was comparable with Ayele & Urge [7] who reported a mean of 11 to 16 months of age at first lambing and 7 to 10 month lambing intervals for different Ethiopian sheep breeds.

Both male and female Horro sheep reached to market earlier than other districts at 5 months followed by Gobu Seyo at 8 months. Carcass yield from Horro sheep in all districts was 13 kg/head. The result was comparable to Ayele & Urge [7] who reported 7 - 18 kg/head hot carcass weight from different Ethiopian indigenous sheep and Tefera et al. [45] for the Washera breed. The sheep's longevity was based on management providing for ewes and the opportunity to give productivity up to 10 years.

According to farmers' responses, the birth type of Goat in the Gobu Seyo district was single (27.5%), twin (65%), and triple (7.5%), respectively. This indicated that the majority of the Goats in the district had been given a twin birth type. In the Diga district doe had been giving kids in single (22.5%), twin (70%), triple (7.5%), and in the Horro district; single (42.5%), twin (52.5%), and triple (5%). In general, the doe in all districts were giving twin kids. The age at first kidding was revealed as 10, 15, and 12 months in Gobu Seyo, Diga, and Horro districts, respectively. The kidding interval was similar in all districts about 7 months. The discussants responded that kid weaning age is 4 months in all districts. Male and female kid goats reach market weight in Horro district earlier than other districts at 5 months followed by Diga district at 6 months. This result was supported by Getaneh et al. [21] who reported review literature from Ethiopian Indigenous goats reproductive performances ranged from 6.61 to 14.83 months, 11.82 to 28.46 months, 5.47 to 12.07 months, 1.00 to 2.15 kids, and 4.72 to 10.2 years for pubertal age of females, age at first kidding, kidding interval, litter size at birth, and does' average productive life, respectively.

The highest goat carcass yield was reported from Diga district (13kg/head) followed by Gobu Seyo (12kg/head) and Horro (10kg/head). This result indicated that the Diga district is more favorable ecologic for Goats than others. The longevity/productive life is affected by genetics, breed, health condition, and management given for doe [21], and in the case of the current survey results revealed that does can be productive for up to 15 years. This result was much longer than Hulunim [24] who reported 10.2 years for Bati, Borana, and short-eared Somali goats, and Getaneh et al. [21] reported 7.4 years for non-descript local goat breeds in north Ethiopia. The difference might be due to the breed, management, and health conditions.

The product and productivity of cross and exotic chickens were better than indigenous ones. The survey results revealed that the age of first laying was taken 5-7 months for Indigenous and 3-5 months for cross-breed chickens. The number of eggs per year for indigenous chicken was reported as 50-75, 80 -150 for crosses, and 150-170 for exotic breeds. The highest number of eggs per chicken per year from the cross was in the Diga and Gobu Seyo districts (216 eggs/hen/year) and the lowest was reported in the Horro district 150 eggs/hen/year [31]. Reported similar results, about 6-12 and 5 months of age of first laying and 30- 60 and 150- 250 egg/head/years from indigenous and cross chickens, respectively. The male and female were reached for market similarly in 6-7, 5-6, and 3-5 months for indigenous, cross, and exotic chicken breeds, respectively. The carcass yield was 2 kg/head. According to Mekonnen et al. [34] about 0.95kg at Goba and 0.89kg in Agarfa districts and Halima [23] reported 1.05 to 1.52 kg. This result indicated that the Horro chicken had a higher carcass yield than other Ethiopian indigenous chicken breeds which is a great opportunity for designing further genetic improvement programs.

Livestock Feed and Feeding Systems

Feed resources: Different feed resources for different livestock species are presented in Tables 3 & 4. Inadequate quantity and quality of feed are critical for livestock production and productivity in Ethiopia (Gashaw & Defar, 2017). Grazing of natural pastures, crop residues, browses, and concentrate (rare) are animal feed resources availed in all the study districts. Similarly, the report was revealed by Derbie et al. [16] from the Wollo zone, Ashenafi and Solomon [3] from Southwest Oromia, and Gurmessa et al. [22] from Western Ethiopia. However, all feed resources are used only for specific seasons. The natural pasture was used during the wet (May to December) and crop residues, browsers and concentrate during the dry (December to May). Free grazing was commonly practiced in all districts. Some improved animal feed like Rhodes, Elephant, Oat, Desho, Panicum, Bracharia grass and Alfalfa, Cowpea, Dolichose lablab, Vetch, and Pigeon pea were a few availed in some farmer training centers (FTC). However, the discussants revealed that allocating land for improved fodder production was rare due to seed shortage, land scarcity, and awareness. The current result was strengthened by Ayele et al. [6] who reported that smallholders did not adopt various improved forage production in Ethiopia.

In this study survey scavenger was the main feeding system with some supplement of grains (cereals) and house leftovers because grains are scarce even for family consumption. Discus-

Table 3: Cattle and shoat feed resources in study areas.

Season	Gobu Seyo		Diga		Horro	
	Feed sources	Rank	Feed sources	Rank	Feed sources	Rank
Wet	Natural pasture	1	Natural pasture	1	Natural pasture	1
	Crop thinning & weed	2	Crop thinning & weed	2	Established pasture	2
	Established forage	3	Established forage	3	Improved forage	3
	Crop residues	4	Improve forage	4	Fallow land	
	Browsers	5	Crop residues	5	Crop residues	4
	Others	6	Others	6	Others	5
	Concentrate	7	Concentrate	7	Concentrate	6
	Established pasture	8				
Dry	Crop residues	1	Crop residues	1	Crop residues	1
	Crop aftermath	2	Hay	2	Hay	2
	Hay	3	Crop aftermath	3	Improve forage	3
	Browser	4	Browser	4	Browsers	4
	Fallow land	5	Fallow land	5	Crop aftermath	5
	Improve feed	6	Improve feed	6	Fallow land	6
	Concentrate	7	Concentrate	7	Concentrate	7

Others: *house leftover + salt + soil and leaf as minerals source.*

Table 4: Poultry feed resources.

Season	Gobu Seyo		Diga		Horro	
	Feed resources	Rank	Feed resources	Rank	Feed resources	Rank
Wet	Scavenger	1	Scavenger	1	Scavenger	1
	Cereal grain	2	Cereal grain	2	Cereal grain	2
	House leftover	3	House leftover	3	House leftover	3
	Vegetables	4	Vegetables	4	Vegetables	4
Dry	Scavenger	1	Scavenger	1	Scavenger	1
	Cereal grain	2	Cereal grain	2	Cereal grain	2
	House left over	3	House left over	3	House left over	3

Source: Survey result (2023).

Table 5: Common feeding system in the study areas by season.

Livestock types	Gobu Seyo		Diga		Horro	
	Wet season	Dry season	Wet season	Dry season	Wet season	Dry season
Cattle	Free grazing	Free grazing	Free grazing	Free grazing	Free grazing	Free grazing
Sheep	Free grazing	Free grazing & browsers	Free grazing	Free grazing & browsers	Free grazing	Free grazing & browsers
Goat	Free grazing & browsers	Browsers	Free grazing & browsers	Browsers	Free grazing & browsers	Browsers
Poultry	Scavenger, supplementary feeding	Scavenger	Scavenger, supplementary feeding	Scavenger	Scavenger, supplementary feeding	Scavenger
Bee	Visiting	Visiting, supplementary	Visiting	Visiting	Visiting, supplementary	Visiting
Fish	Scavenger	Scavenger	Scavenger	Scavenger	Scavenger	Scavenger
Equine	Free grazing	Free grazing	Free grazing	Free grazing	Free grazing & supplement	Free grazing & supplement

Source: Survey result (2023).

sants were raised that chickens foraging omitted grain during the dry season particularly, where crops are threshed and backyard crop field production. This result was in line with Abera et al. [1] who reported that almost all of the chickens were scavengers in smallholder farmers in the Gembella region.

Animal feeding system: Common feeding systems in the study areas by season are presented in Table 5. The current result revealed that free graze feeding systems is common for cattle and equine in all districts through the years. Small ruminants are browsers of succulent leaves during the dry season in addition to grazing. Scavenger is a common feeding system in poultry and fish production in the study area. Supplementary feeding of industrial products, cereal grain, house leftovers, and vegetables was an occasion for poultry. No supplementary feeding was practiced for fish and honeybees. Hence, the productivity was very low. Western Oromia had a good diversity of natural resources that flowered in different seasons. Hence, bee visiting was the major feeding system in apicultural production which was double important for honey production and crop pollination.

Grazing lands: Availability of grazing is very important for animal feed resources. Communal grazing lands have been important for livestock forage in the western Oromia. However, several communal and private grazing lands have been severely degraded due to crop expansion, and free and uncontrolled grazing systems. Similarly, Ebro et al. [17] reported that grazing lands are used as a major livestock feed resource in Ethiopia, but, it's diminishing from time to time because of crop expansion and heavy grazing pressure on the remaining grazing lands [50]. The current scenario of the government's agenda for wheat production has been extremely computed with communal grazing lands. The result is supported by Mekuria et al. [35] who reported that devastating grazing land for wheat production consequences, lack of animal feed, reduced crop-livestock integration, and reduced natural vegetation coverage.

Animal feed conservation methods: Seasonal variations of available feed, both in quantity and quality are suffering in Ethiopia [27]**.** Conservation of surplus animal feed is essential in livestock production [37]. Discussants responded that animal feeds were preserved as crop residues, aftermath collection, and area enclosing. But, no silage-making had been practicing the community level. This result was supported by Balehegn et al. [8] reported smallholder farmers rarely make silages, even though, repeated recommendations were provided. This happened because awareness and adoption of forage conservation practices at the farmer's level are low [5]. For instance, grazing land was enclosed for calves, and unhealthy animals mostly in backyards refused to harvest. However, the quality of the feeds

is diminished by prolonged maturity. Discussants in all districts raised the straw that had been conserved for drought animals, barley straw for cows and calves, maize straw for all cattle, and crop aftermath for sheep, calves, and horses.

Water resources availability for livestock: Fresh and clean water is crucial for improving animal performance (Diriba et al., 2024). Rivers, streams, springs, manmade lakes and ponds are year-round water sources for all livestock species in all studied districts. There is no water harvesting practice from flood/home roofs for watering their animals. Cattle, sheep, and horses were drink water two times a day during the dry season and once a day during the wet season. Whereas, goats, donkeys, and mules were once a day during the dry season and occasionally during the wet season. Poultry needs ad libitum water across the year.

Livestock Technologies Available

Modern technologies and digitization can allow livestock producers to optimize their operations [28]. For instance, used for creating more efficient production systems, reducing environmental impacts, achieving food self-sufficiency, and lowering production costs [9]. Discussants in all districts responded that no more livestock technologies were used currently. More production and product processing have been conducted in traditional ways. However, in recent situations distribution of improved forage, chicken (cross breeds and day-old chick), and the use of AI and estrus synchronization were the few livestock technologies available in urban and pre-urban areas. Animal feed constraint was a major cause of decreased animal productivity. However, the distribution of improved animal feed in the rural area was limited. Furthermore, livestock technologies were not addressed among farmer's training centers in all villages. In the future, the concerned body should be working on the scale-up of improved forage, preservation and treatment of crop residues feed processing is essential.

In contrast global livestock farming technological companies are developing sensors to monitor real-time milk production, meat production, honey reap, egg quality, feed quality and treatments, feed formulation, fish hunting, health, and pregnancy diagnostics [42]. Hence, our livestock production system should be restructured and supported by different technologies to compute the productivity globally comparable with the population [51]. The discussants and key informants have requested livestock technologies support from research centers institutes, universities, NGOs, and other concerned bodies on different commodities. For example, cattle: practical training on AI, delivering equipment, bull survives, animal feed formulation, fed chopper, feed processing plant, and delivering improved cross-breeds. Bee production: training on management, personally protected equipment, hive, smoker, and casting mold. On sheep and goat health treatment, feed formulation and improve rams/buck and on poultry availing day old chicken, health treatment, concentrate feed, training on all poultry management. Fish catching materials and processing training.

Livestock Fattening Practices

Livestock fattening has been a long-standing practice in the study areas, which is mainly geared towards meeting the demand and typically increases during festive seasons. According to the survey results fattening was took a long period due to being practiced traditionally. The fattening program had been targeting New Year, Eastern, Charismas, and Ed Al-Arafat. The most preferred age for fattening was 5-8 years for bulls, 2-5 years for shoat both intact and castrated. If any bulls had not started plowing before four years, then farmers had been used for two to four years for drought. Fattening bulls before plowing (less than four years) was not experienced in all studied districts.

During the fattening period, special caution was provided for these animals via tying in a clean house, feeding cut and carrying pasture individuals, giving house leftovers, providing clean water, timely health treatments, and salt supplementations. Feeding industrial by-products during fattening was uncommon in both zones. The lack of supplementing industrial byproducts prolonged the fattening period and affected Horro cattle and sheep meat quality, because, the feed they offered was not met for surplice production. These cases limit animals and their product from terminal and export markets claimed as short shelf life. Merera et al. (2013) reported that short shelf life/dark cutting carcass occurred due to pre-slaughter handling. Thus, improving the feed and nutrition aspects of the small and large ruminant value chains should be one of the core intervention areas for the FSRP project to exploit red meat marketing and consumption.

Regarding sheep and goats less than two years entering for fattening takes time and the animals have no demand in the local market. Survey results revealed that Horro sheep and cattle age preferred for fattening and finishing was not preferred at terminal markets, particularly for high-end domestic hotels, catering institutions, and export markets. This practice might be similar to other parts of Ethiopia, because, Yami et al. (2018) reported that Ethiopia was dependent on meat imports. This happened due to the inability to produce high-quality carcasses (Mummed and Webb, 2015). Animals were sent to market without considering their meat quality (Ehui et al., 2000) [52]. However, different authors have controversial perceptions on the theme Akililu et al. (2005); Abebe et al. (2010); Legese and Fadiga (2014), and Yami et al. (2018) reported carcasses from highland animals in Ethiopia quickly darkened and had a short shelf-life and concluded that the animals are not meat for high ended domestic (HED) hotels and export markets. In contrast, Merera et al. (2013) and Birhanu et al. (2019) reported dark cutting and short shelf-life carcasses are not related to the origin of animals rather than others pre-slaughter handling and genotypes. Hence, the scenarios need deep investigation and designing a proper breeding strategy, premium price for quality animals, awareness creation on preparing ration formulation from locally available feed for specific species, health service, product safety, excellent relationships among industry actors, and conducive management conditions.

Livestock Health and Vaccination

Common livestock diseases and vaccination calendars are presented in Table 6. Livestock diseases are a priority problem for livestock keepers throughout Ethiopia [12]. The survey results revealed that Anthrax, blackleg, pasteurellosis, and FMD were the common diseases for cattle, PPR, pasteurellosis, and shoat pox for small ruminants, NCD and foul typhoid for poultry and African Horse sickness was the major disease equine across the study districts. The result was supported by Gizaw et al. (2021) who worked on the importance of livestock diseases in the highlands of Ethiopia. The prevalence of these diseases reduces individual, regional and international income and jeopardizes food security. Inadequate drugs and vaccine availability, inconsistent supply of drugs, high price of drugs, poor quality, and illegal smuggling trade of drugs were raised as major prob-

Table 6: Livestock common diseases and vaccination calendar.

District	Livestock	Major Diseases	Vaccinations	Seasons of vaccinations
Gobu Seyo	Cattle	Anthrax, blackleg & pasteurellosis	Anthrax, blackleg & pasteurellosis vaccines	Before & after rain season set
	Shoat	PPR, pasteurellosis and shoat pox	PPR, pasteurellosis and shoat pox vaccines	
	Poultry	NCD & Foul typhoid	NCD and Foul typhoid vaccines	
	Equine	AHS & ulcerative colitis	AHS and UC vaccines	September
Diga	Cattle	✓ Anthrax, blackleg, pasteurellosis LSD & CBPP	✓ Anthrax, blackleg, pasteurellosis, LSD & CBPP vaccines	✓ Feb.-Mar., Jul.-Aug., and Oct. to Dec. based on disease
	Shoat	✓ Anthrax, PPR, pasteurellosis and CCPP	✓ Anthrax, PPR, pasteurellosis & CCPP vaccines	✓ Before rain season set
	Poultry	✓ NCD, Foul typhoid	✓ NCD and Foul typhoid vaccines	✓ As new emerged & Dec.-Mar.
	Equine	✓ Anthrax & African horse	✓ Anthrax & AHS vaccines	✓ February & March
Horro	Cattle	✓ Anthrax, blackleg, FMD, Rabies, pasteurellosis, Tuberculosis, Brucellosis, LSD & CBPP	✓ Anthrax, blackleg, FMD, Rabies, pasteurellosis, Tuberculosis, Brucellosis, LSD & CBPP vaccines	✓ April-August
	Shoat	✓ CCPP, shoat pox & Brucellosis	✓ shoat pox vaccine	✓ June-August
	Poultry	✓ NCD, Foul typhoid, cholera, foul box, Gumboro & coccidiosis (parasite)	✓ NCD, Foul typhoid, F. box, cholera, Gumboro & parasite vaccines	✓ As new case emerged and Dec.-Mar.
	Equine	✓ African horse sickness	✓ AHs vaccines	✓ June-August

Key: *LSD= Lumpy and skin disease, NCD=Newcastle disease, AHS= African horse sickness, FMD= Foot and Mouth disease, CCPP= Contiguous Caprine plurone pneumonia, CBPP= Contiguous Bovine plurone pneumonia, PPR= Peste des petits ruminants*
Source: Survey result (2023).

lems of animal health in the study area. Similar results were reported by different authors on the constraints of animal health in Ethiopia [12,33,43,46,53]. The good thing from the discussant's group revealed that no disease outbreak had occurred in the last five years. This result indicated that the area is conducive to diversity of livestock production. However, the chronic problems were affecting the livelihoods of livestock keepers and jeopardizing food security at the local and national levels. Hence, designing and implementing a compressive sustainable animal disease control and prevention strategy will be pertinent for problems in the study area.

Deworming and spraying of livestock: Livestock deworming and spraying colander are presented in Table 7. Parasites decrease production through decreased weight gain. Particularly, internal parasitic like fasciolosis, hydatidosis, and C. bovis were the major causes of poor animal condition, loss of body weight, carcass condemnation, organ condemnation, and financial loss in Ethiopia [26,46]. According to information from key informants and secondary data deworming in all districts was conducted before and after the rainy seasons. However, sparing was conducted throughout the year following the emergency of external parasite infestations.

Livestock product processing: Even though, Ethiopia has a huge diversity of livestock resources productivity is low and stored/processed as traditional floodways' [15]. According to data from discussants, animal slaughtering has been processed in conventional ways. In the rural area, all animals were slaughtered in the backyard without any post and ant-mortem inspection by professionals, because, no abattoir service at the village level. Similarly, the key informant responded that abattoirs at the district level couldn't give full service to clients. These results are similar to a report of Amistu et al. [2] who reported that more butchers were slaughtering in the backyard without inspection by professionals. Sudden deaths of animals in rural areas were shared (*Qircaa*) by all neighbors without knowing the causes of death. The farmers preserved meat by mincing and hanging it in the kitchen to minimize moisture, and salt and a hot hopper were used to diminish microbial growth.

Table 7: Livestock deworming and spraying colander.

Livestock types	Deworming Calendar	Spraying calendar
Cattle	Before and after the rainy season	Throughout the year
Sheep	Before and after the rainy season	Throughout the year
Goat	Before and after the rainy season	Throughout the year
Poultry	Before and after the rainy season	There is no spraying for poultry
Equine	Before and after the rainy season	Throughout the year

Milk was processed using traditional ways. Do not mix hot milk with the previous one, clean the milking storage, and put it in the kitchen during winter, and in water during the summer season. In urban and pre-urban milk is distilled and pastured in refrigerators where access to electricity is availed. However, most discussants had no electric access since the survey was conducted in a rural area. The egg was preserved in cereal grain, net equipment, and *tef* straw. Honey was preserved only in sealed storages. Because, honey can absorb odor and moisture when it is exposed to air. No hide and skin processes were practiced in the study area, however, no market availability for hide and skin in East and Horro Guduru Welloga.

Climate Change on Livestock Production

Climate change is a major threat to the sustainability of the livestock system globally. Because, the impact on the quality of feed crop and forage, water availability, animal and milk production, livestock diseases, animal reproduction, and biodiversity were high (Melissa et al., 2017; Ali et al., 2020, Cheng et al., 2022). Consequently, adaptation and mitigation of detrimental effects of extreme climates have played a major role in combating the climatic impact on livestock (Sejian et al., 2015). The survey result revealed that the discussants in villages were less knowledgeable about how climate change affects their animals. However, the awareness of discussants on climate change was different among villages and districts. Even, farmers had different perceptions of climate change in one district. For example, in Diga district, a discussant from *Arjo Qonan Bula* village, Horro district Gitlo village, Gobu Seyo district Gambela Tare and Agolaften villages were raised as climate change affects their animals

Table 8: Production constraints in the study areas.

Districts	Major constraints	Cattle	Sheep	Goat	Poultry	Bee	Equines	Fish
Gobu Seyo	Inadequate Feed	2	3	3	2	4	2	-
	Animal Health Service	1	2	1	1	2	1	3
	Lack of improved breed	3	1	2	3	-	-	-
	Market access	4	4	4	4	-	-	-
	Credit access	7	5	-	-	-	-	-
	Water Access	8	-	-	-	-	-	1
	Land scares	5	-	-	-	-	3	-
	Technology limit	6	-	5	-	-	-	4
	Climate change	9				6		
	Chemicals	-	-	-	-	1	-	-
	Predators	-	6	-	6	5	4	-
	Equip-ment's	-	-	-	5	3	5	2
Diga	Inadequate Feed	1	3	1	1	5	2	-
	Animal Health Service	2	1	-	2	3	1	-
	Lack of improved breed	6	2	2	4	-	-	-
	Market access	3	4	3	3	-	-	2
	Credit access	4	5	4	6	-	-	-
	Water Access	8	6	5		-	-	1
	Land scares	7	7	6	7	-	3	-
	Technology limit	5	8	7	8	-	-	-
	Climate change	9	-	-	5	-	-	--
	Chemicals	-	-	-	-	1	-	-
	Predators	-	-	-	-	4	4	-
	Equip-ment's	-	-		-	2		-
Horro	Inadequate Feed	1	2	1	3	5	3	-
	Animal Health Service	2	1	2	1	2	1	4
	Lack of improved Breed	3	3	3	2	-	-	-
	Market access	5	5	4	5	-	-	3
	Credit access	6	4	5	-	-	-	-
	Water Access	7	-	-	-	-	-	1
	Land scares	4	6	6	-	-	4	-
	Technology limit	8	-		6	-	-	-
	Climate change	9	-	7	-		-	-
	Chemicals	-	-	-	-	1	-	-
	Predators	-	-	-	4	3	2	2
	Equip-ment's	-	-	-	7	4	5	5

Source: Survey result (2023).

in medium via the emergence of new diseases, slow growth of animals, feed and water scares, reproductive fallers, thinly of hide and skin. In contrast, the discussants from Diga district, Jirata village, and Horro district Dayo Bariso village were denied as climate change affects their animals and no hear about it, the era is conducive for their animals. The key informants from all districts had similar perceptions of climate change. The discussants revealed that climate change has been a medium worry for the animals in their respective districts. However, their low measurements were taken on adaptation and mitigation strategies in study areas. They raised the theme is current topics in animal production and heard the topic from natural resources experts who took the measurements like plating the tree and bound construction. Effective adaptation to climate variability and climate change is dependent on access to climate information for the coming seasons and years, to enable communities to make decisions for now and the future (Sejian et al., 2015). The direct impact of climate change is drought, flood, thermal stress, mortality, reduced productivity, and shortage of water and feed while the indirect one is animal productivity, quality forages, pest distribution, and increased production cost.

Major Livestock Production Constraints

The major livestock production constraints in the studied areas are presented in Table 8. According to survey results, in Gobu Seyo district animal health service was the major constraint for cattle, goats, and equines followed by inadequate feed. The absence of veterinary clinics and limited drug supply, the high price of drugs and services, and the shortage of skilled men were revealed as factors contributing to the severity of animal diseases. Farmers mostly rely on locally prepared herbal medicines to treat different livestock species due to the increased cost of drugs. This result was supported by Gizaw et al. [43] who reported that diseases adversely affect livestock production and exports. Shortage of quantity and quality diets, improved forage, and an extremely increasing cost of the industrial by-products. Similarly, Mengistu et al. Kalsa & Dey [27,36] reported that feed shortages are the topmost livestock production constraint in Ethiopia. No improved sheep breed was reared in all districts the result was supported by Tiruneh et al., [48] who reported that almost all sheep in Ethiopia's indigenous breed belong to the low-productive. A key informant responded that 15-20 years ago Sustainable Land Management (SLM) project delivered about 200 Bonga sheep in the Gobu Seyo district. However, the animal was not adopted to the area. This indicated that the breed was not acclimated to management conditions and environments. Hence, starting a small ruminant community-based breeding program in the Gobu Seyo district is essential rather than importing from others which resulted in economic loss, genetic dilution, etc. According to discussants, the use of herbicides and pesticides was the major confrontation for apiculture production followed by diseases parasites, and types of equipment. Lack of sustainability water availability is a major fish production in followed catching and shipping equipment and diseases.

In the Diga district, inadequate feed is ranked as the first constraint for cattle, goat, and poultry production. Discussants ranked animal health as the second major problem in the district for cattle, and poultry production. Uncontrolled usage of herbicides and pesticides for crop production was raised as major apiculture production. the result was supported by Wakgari & Yigezu [49] who reported that honeybees face agrochemical problems in their natural environment during pollen, nectar, and

water or moisture collection. Shortage of bee types of equipment like bee hive, bee Val, fumigator, casting mold, fork, honey extractor, and other personal protective equipment. Similarly, Teesega [47] reported a lack of beekeeping equipment, chemical poisoning, shortage of bee forage, drought, knowledge, and skill gap as the problem in northern Ethiopia. Water availability is ranked as a major problem fish production study area. Because, water provides stability, and predictability, and supports food supplies for fish. Market access is raised as the second constraint of fish production. Even though the potential production is there in the study area market access and consumption habits are low. The survey results in Horro district revealed that inadequate feed was ranked by respondents as a major constraint for cattle and goats, animal health service for sheep, poultry, and equine, and chemicals for apiculture and water availability is fish production. For cattle, goat, and apiculture production animal health service is raised as the second constraint in Horro district. For poultry production lack of improved breeds, cost, and took a long time to get day-old chicken is the second poultry production. Predators like birds, ants, badgers, lizards, etc for apiculture and hyenas for equines is responded as the second production in Horro district.

Conclusions and Recommendations

Livestock production systems in the study areas were dominated by extensive. The low productivity was due to a shortage of animal feed, disease, crossbreeds, poor skill & knowledge of farmers and poor management. The majority of livestock rearing in the areas are Horro breeding type which was produced for different purposes like milk, drought, meat, egg, pack & draft, honey, income sources, breeding, wealth status, joke, and as fertilizer. The contribution of livestock in the areas was not exploited well due to the distance from the central terminal market, the lack of unstructured ranching and breeding strategies. Horro sheep and cattle were segregated the brand's traits (color & body size). The apiculture production in the areas is below potential especially wax production in the areas not known. In the study areas, there are potential opportunities for rivers for fishery production, improved forage varieties, and sources of technology (research centers and universities). The reproductive performance of cross &/or exotic cattle was better than indigenous cattle based on feed, housing, health, genotype, and other conditions. The birth type of shoat was single, twin, and triple in all the study areas. Livestock fattening in the areas takes a long period because of poor management, rare supplementary diet, traditional practices, etc. The majority of diseases in the areas were anthrax, blackleg, LSD, CBPP, CCPP, NCD, foul typhoid, shoat pox, cholera, African horses, etc. The common feeding systems in the areas were free grazing, browsers, scavengers, and supplementary feeding from different sources with low quality. Improved forage technologies in the areas were limited due to seed shortage, land scarcity, and lack of awareness. Climate change in the study areas has affected livestock productivity directly as well as indirectly. In these areas feed shortage, disease, shortage of breeds, market problems, water shortage in lowlands, land scarcity, etc. identified as main constraints in cattle production. Feed shortage, diseases, lack of improved breeds, and lack of terminal market in the area are recognized as major constraints in shoat production. Diseases, feed shortages, poor marketing systems, shortage of improved breeds, and predators were identified as the main constraints in poultry production. Chemical application, diseases, feed shortage, modern hives, and other constraints identified under bee production. Under fish production, lack of awareness of improved technology, water shortage in highlands, market linkage, and lack of improved technology are identified while disease and feed shortage are reported as main constraints under equines production. In all studied districts the awareness of the impact of climate change on livestock production and productivity is insufficient.

Based on the findings the following suggestion has been forwarded;

1. Multiplication and distribution of improved forage at the farmer level.

2. Strong extension services on feed formulation for all livestock based on species and production stage from locally available materials, uses and handling agrochemicals, and efficient input delivery for farmers are vitally important.

3. Establish a feed processing and mixing plant in the target area of zones.

4. Re-enforcing and scaling up of Horro sheep community-based breeding program, and designing appropriate and sound genetic improvement for the Horro cattle.

5. Initiation of exciting community ranches in strategic areas for small and large ruminants.

6. Forming community-based bull and AI service stations in strategic locations.

7. Sustainable delivers day-old chicken.

8. Training on disease control and surveillance.

9. Capacity building of farmers on bee wax production and preparing foundation sheets

10. Assess the adoption of modern bee hives at the farmer's level

11. Availing apiculture production equipment as well as personal protecting types of equipment

12. Availing fish production equipment, awareness of consumption, and market linkage

13. Capacitate stakeholders on climate adaptation and mitigation strategies

Author Statements

Conflict of Interest

There is no conflict of interest between authors.

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Author's Contribution

Birmaduma Gadisa: collect, analyze data, and draft the manuscript

Kifle Degafa: Collect data, supervised the project, and edited the manuscript

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