

Livestock Production System Dynamics, Trends and Drivers of Change in Highlands Areas of Ethiopia: A Review

Hussen Abduku Worku*

Department of Animal and Range Sciences, College of Agricultural Sciences, Bule Hora University, Ethiopia

Abstract

This review was developed to describe the dynamics, trends, and drivers continually changing in Ethiopia's highlands' livestock production systems. Ethiopia endowed with the largest livestock population density among Sub-Saharan African country; however the sector's contribution to the GDP of the region as well as nation was lower. The livestock population trend in the country showed that it was increasing. To classify production systems different method were used; technology level, input type used, and integration of crops and livestock were mainly used. Highland mixed crop-livestock, pastoral and agro-pastoral and urban and peri-urban were the types of livestock production systems practiced. In Ethiopian highlands mixed crop and livestock production system is practiced. Crop cultivation and livestock rearing have an interdependent role in this system, with livestock providing draught power and manure for crop cultivation. Natural pasture and crop residue account the largest share from the total annual feed resource. Conservation of crop residue and improved forage cultivation like Desho grass, Elephant grass and tree lucerne was practiced to mitigate feed shortage. Cropland expansion, land degradation, and improper land management practices, such as the cultivation of marginal and fragile areas, are the main forces affecting change in the highlands. Increased population density, the absence of alternative job possibilities, and traditional production practices have all had a significant negative influence on feed availability. Finally, it is important to consider about land allocation, nutrient value improvements for poor quality roughage, improved forage cultivation, soil and water conservation while trying to increase livestock productivity in the highlands.

Keywords: Driving factor; Feed Resource; Livestock; Mixed Crop-livestock; Ethiopia

Introduction

More than 80% of the livelihood of the population in Ethiopia depends on agriculture [1]. The country has known by largest livestock population density in Africa, with an estimated number of 65.35, 50.50, 39.89, 11.47, and 7.70 for cattle, goat, sheep, equine and camel respectively [1]. According to their composition cattle population number is higher which account 37.36%, goat (28.87%) and sheep (22.81%). Despite the large number of livestock population, diverse livestock genetic resources and conducive environmental condition for livestock rearing, the economic contribution of this sector for the livelihoods of the farmer is still very low [2].

Mixed crop-livestock farming systems make up more than 90% of the nation's agricultural production [3]. The agro-ecological condition of the country is more conducive to cultivate cereal crop and the produced crop residues could be serve as a potential feed resources. In order to improve the livestock productivity and sustainability, crop and livestock production must be integrated [4]. For Ethiopian livestock producers and policy makers, updated information on the availability of livestock feed resources and the driving factor for change is a critical concern [5]. Hence this review paper was developed to point out livestock production system dynamics, trend and driving factors for change in the highlands of Ethiopia.

Socio-Economic Contribution of Livestock Production

Livestock production system has a considerable economic impact for the farmers and also it has the social and cultural values for the rural community [6]. In 2017, the livestock sector generated up to 40% of the GDP from agriculture, over 20% of the GDP overall and 20% of the country's foreign exchange earnings [7]. Globally, it is anticipated that demand for animal products would increase by up to 70% in 2050 due to the world's growing population, rising standard of living, and

urbanization [8]. The created demand increment is a good opportunity for livestock producer to benefit more from the sector in the future.

In highlands areas of the country cattle, sheep, donkeys and horses was the most dominant and economically important livestock species type [9]. In this area livestock production and crop cultivation are complementary to each other; for livestock sector it provide crop residues used as a livestock feed resources and oxen serve as a draft power, which is a vital contribution to the overall farm labor requirement [10].

Generally the purposes of keeping livestock vary with the production systems. In Ethiopia, 33% of livestock keepers' households are headed by women, while 45% of livestock owners are female [11]. Collecting water, cleaning the barns, feeding cows, milking dairy cows, processing milk, selling milk products, looking after calves and sick animals are predominant roles for women; men are mainly responsible for managing pasture land, cultivation of improved forage and feeding the larger animals. Also decision making about breeding and marketing of animals, and taking animals to the veterinary clinic is usually the responsibility of men [12].

***Corresponding author:** Hussen Abduku Worku, Department of Animal and Range Sciences, College of Agricultural Sciences, Bule Hora University, Ethiopia, E-mail: abdukuhusein@gmail.com

Received: 25-Jan-2023, Manuscript No: JFLP-23-87929, **Editor assigned:** 27-Jan-2023, PreQC No: JFLP-23-87929(PQ), **Reviewed:** 10-Feb-2023, QC No: JFLP-23-87929, **Revised:** 15-Feb-2023, Manuscript No: JFLP-23-87929(R), **Published:** 22-Feb-2023, DOI: 10.4172/2332-2608.1000394

Citation: Worku HA (2023) Livestock Production System Dynamics, Trends and Drivers of Change in Highlands Areas of Ethiopia: A Review. J Fisheries Livest Prod 11: 394.

Copyright: © 2023 Worku HA. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Livestock population dynamics

According to Bezabih who reported that, trend of livestock population in Ethiopia showed that it has been increasing time to time [13]. Furthermore the other study report indicates that there was a relatively steady increase in nearly all types of livestock species in Ethiopia as shown in Figure 1 [14]. The amount/rate of livestock number increment varies from region to region, mainly due to disease occurrence and the environmental condition of the area. Between 2000 and 2016, the average stock of livestock, measured in Tropical Livestock Units (TLU) per 100 people, stood at 51 TLU, which is more than double the continental median of 23 TLU [10]. The gross production value average growth rate during the same period was 4.5% also twice the continental median of 2.2% [15]. In the year of 2005/6 the drought affects the livestock sector in the pastoral areas like Borana, Somali and Afar of the country which was reported as a huge loss in livestock wealth [16].

According to CSA (2018) report an estimated number of cattle, sheep, goat, equine and camel in the country in million was 60.39, 31.3, 32.74, 11.32 and 1.42 respectively [17]. While the number of livestock population per head was increased as indicated below in figure 2 [1].

According to CSA (2020) report the livestock population distribution in the country vary across the region; as indicated below in figure 3; Oromia and Amhara regional state take the largest share in cattle population as compared with others [1].

Livestock Production System

It is challenging to make specific conclusions regarding Ethiopia’s livestock production systems practiced; due to the country’s diverse topography, climate, and cultural factors. Various authors classified Ethiopia’s livestock production system by using various criteria. Agro-ecological zone of the area, the level of technology used and production target were dominant method used to categorize the production system [18]. Accordingly highland mixed crop-livestock, lowland pastoral production system and urban and peri-urban were the type of production system practiced [10].

Highland Mixed Crop-livestock Farming System: In highland mixed crop-livestock farming system; this area, which is located over 1,500 metres above sea level, makes up almost 40% of the country’s land area [19]. It is characterised by a mixed farming in which animal production and crop cultivation are carried out concurrently and in synergy [16]. Livestock have critical role as sources of draught power, food, cash income, employment, and poverty reduction in the mixed crop-livestock production system [3]. It accounts for approximately 75% of the production of dairy, 60% of the production of meat, and up to 50% of the production of cereals on a global scale [3].

According to their significance, keeping cattle is largely done for their milk production, draught power, source of income meat production, and manure [4]. In this production system’s livestock production goals include producing milk (for butter making or for

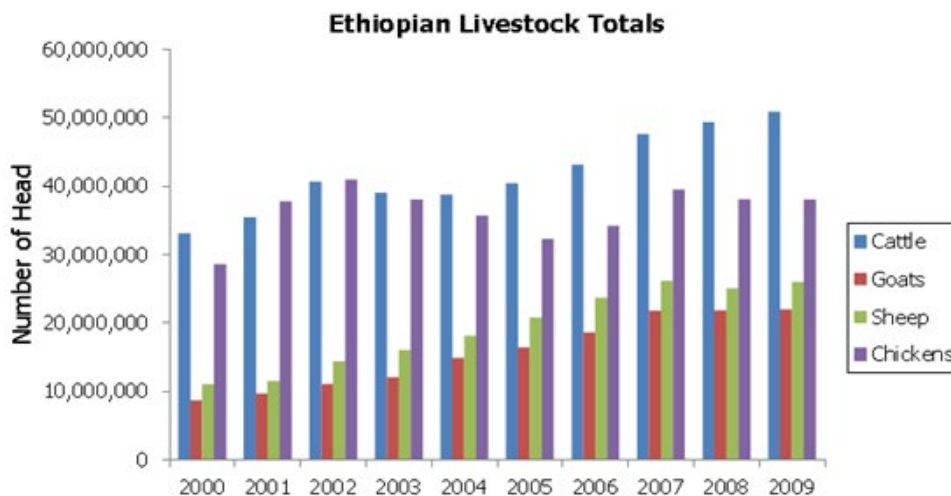


Figure 1: Livestock Population Trend (2000-2009) in Ethiopia.

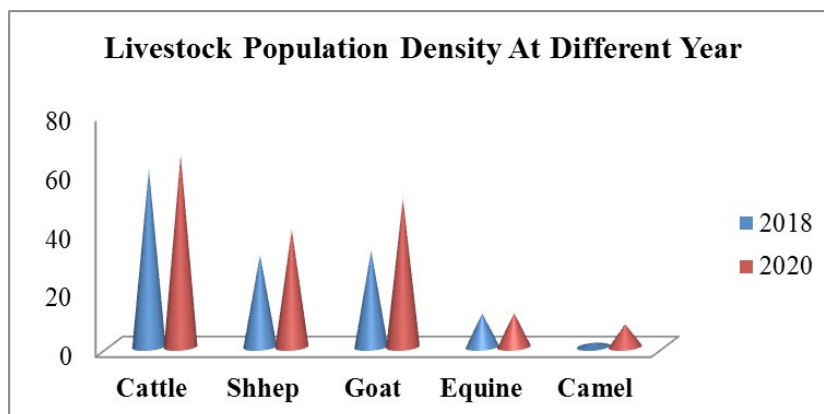


Figure 2: Livestock Population density in 2018 and 2020.

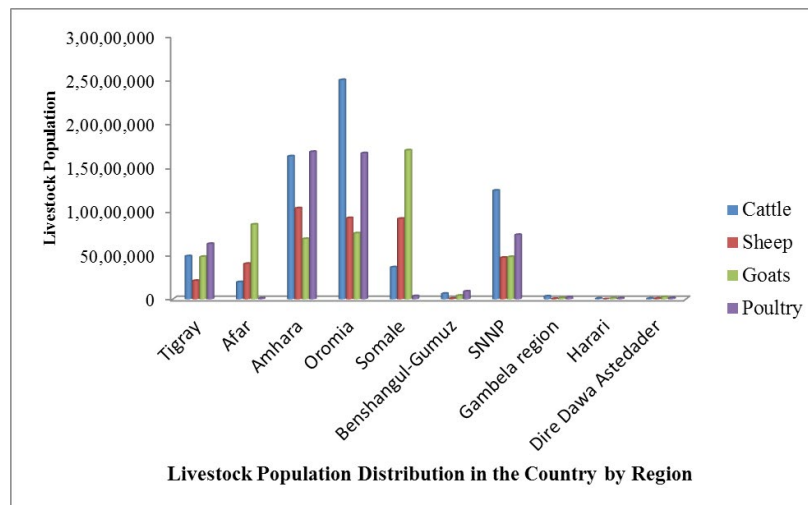


Figure 3: Livestock Population in Ethiopia.

sale), surplus females and male animals for sale, and retaining oxen to give draught power and [20]. While manure collected from livestock is used for crop land fertility improvement. Also, livestock production is benefited by using crop residues as animal feed resources.

Agricultural activity practiced in this production system is predominantly smallholder mixed farming and crop cultivation is main source of income [4]. Livestock rearing and crop production have much interaction, but the degrees of integration vary considerably [21]. Labour demand and availability vary with season and agro ecology of the area. In general labour was an important resource that determines the production and productivity of agricultural practices in the highlands of the country. It agrees with Bezabih (2015) report; family labour, hired labour and social organizations are the major source of labour for smallholder farmers [13]. Moreover labour shortage was critical during seeding and crop harvesting in the central highland of Ethiopia which account 38.40 % and 25.75 % respectively [22]. The author justified as, the two seasons namely seeding and harvesting are the critical time which require extra labour, seeding takes place within short time, not more than ten days and all farmers became busy at that time.

Lowland Pastoral Production System: Ethiopia is a country in which mobile pastoralism is dominant in the arid and semi-arid areas in the eastern, north-eastern and south-eastern parts of the country [23]. The lowlands of Ethiopia with an altitude of less than 1,500 meters above sea level cover 50-60% of the total land area, and support 12% of the human population. Among the total livestock number of the country 20% of cattle, 25% of sheep, 73% of goats and 100% of camels are found in the lowland pastoral areas and the area is suitable for livestock production [24].

Livestock are the principal source of subsistence providing milk and cash income to cover family expenses to purchase food items and other essential household requirements (mostly consumer goods) and industrial products such as clothing [25]. Livestock holding per household are higher than highland mixed crop-livestock production system in general. It varies from place to place; mainly based on range land availability, breed type and adaptation potential [26]. Milking cows' calves and sick animals are kept around the homesteads, while other animals freely graze in rangelands far from home [10].

The major constraints limiting livestock productivity in this

production system includes: feed shortage, recurring drought, and rangeland encroachment by undesirable plant species such as *Acacia drepanolobium* like in Borana and *Prosopis juliflora* in Afar, expansion of crop land conversion of grazing pasture land in to cultivation land [10]. Seasonal shortage of rainfall has been an impact on feed availability which forces the pastoralist to market their animal at available market cost.

Urban and Peri-urban Production System: Urban and peri-urban livestock production can play a great role in the livelihood improvement of urban and peri-urban peoples which provide milk and milk product, meat and fuel [1]. It is practiced in areas where the population density is higher. This system has been more practiced to meet the fast growing demand for milk and milk products around urban and peri-urban areas [1]. In and around the major urban centers dairying is becoming increasingly important [11]. The production system can be practiced at medium and larger scale in the country to produce milk for consumers. In general dairy production system can be classified into commercial and subsistence based on the breed type, the amount of capital invested and technology [11].

Driving Factors for Change in Highlands Areas of Ethiopia

Crop Land Expansion and Population Pressure: Mixed crop-livestock farming system is characterized by the traditional smallholders and they follow subsistence farming. High population density resulted in fragmentation of agricultural lands. As a result, the land holding per household are declining significantly over time [20].

Ethiopia's population growth rate is 2.6%, and 40.3% of the population is between 0 and 14 years of age [27]. In highlands of the country there is a greatest human population pressure where reported as a result of this land holdings are extremely small and communal grazing lands almost all converted to private land [28].

Moreover the study carried out by Bezabih [13] in northern highland of Ethiopia which revealed with the generalization that the crop land expansion seriously affected grazing land size negatively, grazing lands are steadily shrinking by being converted to arable lands and grazing areas are restricted to areas that have little value or farming [29]. Increasing population density coupled with lack of alternative employment opportunities and traditional practices have posed a tremendous impact on the livestock feed resources in the highlands [30].

Land Degradation: Ethiopia is one of the countries in sub-Saharan Africa which is seriously affected by land degradation [3]. Land degradation and associated decline in the productive potential of agricultural lands are threatening economic and social well-being of the present and future generations [31]. It is more common in mixed crop-livestock farming system due to frequent cultivation without fallowing, free grazing and deforestation and mainly a function of heavy reliance by a rapidly growing population on unsustainable subsistence agricultural practices [27]. As a result, the growing livestock population is compelled to graze on grazing ground that is becoming increasingly degraded, which results in animals that are poorly fed and have low productivity. Manmade land degradation that was observed in the highland includes production on steep slopes and fragile soils with inadequate investment in soil conservation or vegetation cover, declining use of fallow, limited recycling of dung and crop residues to the soil, limited application of external source of plant nutrient, deforestation and overgrazing [32].

Feed shortage and inappropriate land use management: Generally feed shortage is the main constraint limiting livestock productivity in the country; there were seasonal fluctuations in feed availability both in quantity and quality [10]. Poor grassland management practice result in low productivity. In mixed crop-livestock production system there was a serious feed shortage problem in the highlands areas of the country [16]. The feed shortage is common during the dry season of the year. Grazing management systems and sources of livestock feed are often changing quite rapidly [10].

Due to overgrazing the available pasture land feed resources become low in nutritional content, which is a serious problem which can causes low intake rates resulting in low levels of overall productivity [33]. Due to the pasture land shortage valley bottoms, fallow land and road side grazing became as an important source of livestock feed [29]. Traditional production system coupled with free grazing affect the livestock productivity and grassland ecosystem seriously [34]. Hence due to poor management practices of the farmers and attention given so far for the sector were lower results for the grassland productivity declining [29].

Livestock feed resources and feeding strategy

According to CSA (2020) report, in the country variety of feed resources types were used [1]. It includes natural pasture, crop residue, hay, agro-industrial by-products, and improved forage, and vegetable and fruit wastes. In mixed crop-livestock system natural pasture constitutes the main source of feed which covers around 65.48 percent of the livestock feed in dry matter intake [35]. Crop residue has an estimated global level of 1.14 billion tons of DM and a local level of 30 million tons [36]. On farms crop production can be the major source of crop residue, which were in plentiful supply from December to March then steadily declined from April to November [37].

In mixed crop-livestock farming, crop residues are the most abundant source of feed which contribute up to 30–80% of the total feed DM available [38]. Depending on the crops cultivated there, a variety of crop residues were provided [39]. Crop residue account approximately 55% of the entire feed supply, which was made up of both on-farm production and outside purchases [37]. Crop residues produced includes maize stover, barley straws, teff (*Eragrostis tef*), finger millet, haulms (fava bean and field pea), and noug or Guizotia Abyssinica chaff [9]. Free grazing was dominant feeding strategy [3]. The other strategy used to feed their animal was tethering, semi-grazing, and zero-grazing [4].

Generally the availability of feed resource throughout the year can varies. During feed scarcity the farmers use different coping mechanism to overcome the problem. From September through November, the contribution of fallow land and natural grazing land increases [37]. Purchasing roughages, renting grazing pasture and conserving crop residues were the coping mechanisms used to feed the animal amid a feed shortage [3]. The other crucial method of alleviating the feed scarcity during the dry season is farm-based production of improved forage around the home [40]. The farmers cultivate improved forage for various purposes; to feed sick and dairy animals, to use as a source of income, soil and water conservation, fencing, and wind break [10]. Now a day's improved forage type cultivated in the highland of the country includes Rhodes grass (*Chloris Gayana*), tree lucerne (*Cytisus proliferus*), Desho grass (*Pennisetum pedicellatum*), Elephant grass (*Pennisetum purpureum*), Sesbania, and Leucaena [4].

Livestock production constraints

The top-ranked constraint that affect livestock production and productivity in the highlands was feed shortage with poor nutritional quality, grazing land shrinkage associated with population growth and urbanization, seasonal variations in rainfall and weak extension services [39]. In Ethiopia's highlands, the feed balance is typically negative [2]. Only 60–80% of the DM needed annually for livestock maintenance in Ethiopia's highlands is covered by the feeds presently available [9]. Foot and Mouth Disease (FMD), Contagious Bovine Pleuro Pneumonia (CBPP) and Brucellosis were the most commonly identified endemic disease type that affects cattle [1]. Moreover the disease like Peste des Petits Ruminants (PPR) and sheep and goat pox are the viral disease that affects sheep and goat.

In Ethiopian the breed of livestock species are entirely composed of indigenous [10]. The survey report estimates for different species showed that 97.8%, 1.9%, and 0.3% of cattle are indigenous, hybrid, and exotic breeds, respectively. According to CSA report the estimates for sheep are 99.6% and 0.3% for local breeds and hybrids, respectively; for poultry 81.7%, 10.9%, and 7.4% are indigenous, hybrids and exotic, respectively. Nearly all goats (99.9%) are indigenous breeds [1]. It indicates that the product and productivity expected from this type of breed of the animal also lower due to their poor productivity and reproductive performance as compared with improved breed's types of the animals.

Summary

In Ethiopia livestock production system are broadly classified as highland mixed crop-livestock production system, lowland pastoral and urban and peri-urban production system. The trend of livestock population at the country level it increases. In Highland mixed crop-livestock farming system is characterized as, the integration of crop cultivation and livestock rearing is higher, oxen used as draught power, crop residues are used as a feed source during dry season. Natural pasture, crop residues to some extent improved forage and agricultural by-product were the type of livestock feed resource in the highlands of the country. Expansion of crop land, land degradation and feed shortage and human population pressures are the driving factors for change.

Therefore, the review result indicated that the need for an urgent look up of the current livestock feed resource availability status to improve the livelihoods of the farmers. Widely cultivation of improved forage, improving the nutritive value of available crop residue, over-sown suitable legume forages species, proper feed conservation and strong extension services helps to improve livestock productivity.

References

1. CSA (2020) Agricultural Sample Survey 2019/20 (2012 E.C.). Volume II report on livestock and livestock characteristics (private peasant holdings). Central Statistical Agency (CSA): Addis Ababa, Ethiopia.
2. Solomn G, Abule E, Yayneshet T, Zeleke M, Yoseph M, et al. (2017) Feed resources in the highlands of Ethiopia: A value chain assessment and intervention options. *ILRI* 1–36.
3. Duguma B, Janssens GPJ (2021) Assessment of Livestock Feed Resources and Coping Strategies with Dry Season Feed Scarcity in Mixed Crop-Livestock Farming Systems Around the Gilgel Gibe Catchment, South West Ethiopia. *Sustain* 13.
4. Adinew D, Abegaze B, Kassahun D (2020) Assessment of feed resources feeding systems and milk production potential of dairy cattle in Misha district of Ethiopia. *Ethiop J Appl Sci Technol* 11: 15–26.
5. Chufa A, Tadele Y, Hidosa D (2022) Assessment on Livestock Feed Resources and Utilization Practices in Derashe Special District, Southern-Western Ethiopia: Status, Challenges and Opportunities. *J Vet Med* 5: 14.
6. Melaku T (2011) Oxidization versus Tractorization: Options and Constraints for Ethiopian Framing System. *Int J Sustainable Agric* 3: 11–20.
7. World Bank (2017) International Development Association: Project Appraisal Document on a Proposed Credit in the Amount of SDR 121.1 Million (US\$ 170 Million Equivalent) to the Federal Democratic Republic of Ethiopia for a Livestock and Fisheries Sector Development Project (Project Appraisal Document No. PAD2396). Washington DC.
8. FAO (2014) OECD, Food and Agriculture Organization of the United States, Agricultural Outlook 2014, OECD Publishing FAO.
9. Belay G, Negesse T (2019) Livestock Feed Dry Matter Availability and Utilization in Burie Zuria District, North Western Ethiopia. *Trop Subtrop Agroecosystems* 22: 55–70.
10. Management Entity (2021) Ethiopia's Livestock Systems: Overview and Areas of Inquiry. Gainesville, FL, USA: Feed the Future Innovation Lab for Livestock Systems.
11. Azage T (2004) Urban livestock production and gender in Addis Ababa. *ILRI (International Livestock Research Institute)*. Addis Ababa, Ethiopia. *Urban Agric Mag* 12:3.
12. Balehey S, Tesfay G, Balehegn M (2018) Traditional gender inequalities limit pastoral women's opportunities for adaptation to climate change: Evidence from the Afar pastoralists of Ethiopia. *Pastoralism* 8.
13. Emama B, Mohammed H, Mohammed S (2015) A situational analysis of agricultural production and marketing, and natural resource management systems in the Ethiopian highlands. *ILRI*, Addis Ababa, Ethiopia.
14. Environmental Policy Review (EPR) (2011) Livestock Production Systems and their Environmental Implications in Ethiopia.
15. Food and Agricultural Organization (FAO) (2019) FAOSTAT database.
16. Desta S (2006) Pastoralism and Development in Ethiopia. *EEA* 9: 12–19.
17. CSA (2018) Agricultural Sample Survey: Volume II Report on Livestock and Livestock Characteristics (Private Peasant Holdings). CSA, Addis Ababa, Ethiopia.
18. Tonamo A (2015) A review on cattle husbandry practices in Ethiopia. *IJLP*, Ethiopia.
19. NEPAD-CAADP (2005) Investment Project Profile "Live Animal and Meat Export" Preliminary Options Outline, Ethiopia 3.
20. IBC (2012) Ethiopia: Third Country Report On the State of Plant Genetic Resources for Food and Agriculture Addis Ababa, Ethiopia.
21. Amede T, Kirkby R (2004) Guidelines for Integration of Legume Cover Crops in to the Farming Systems of East African Highlands. Academic science publishers 608.
22. Abduku H (2017) Farming System and Traditional Grassland Management Practices: The Case of Kofele District, Western Arsi Zone, Ethiopia. MSc thesis presented at Hawassa University, Ethiopia.
23. Amaha K (2006) Characterization of range land resources and dynamics of the pastoral production system in the Somali region of eastern Ethiopia. PhD thesis, University of the Free State, Bloemfontein, South Africa 232.
24. Alemayehu M (2007) Opportunities and Challenges of Livelihood Strategy. In: Proceeding of the 15th Conference of Ethiopian Society of Animal Production. Addis Ababa, Ethiopia 1-15.
25. Bruke Y, Tafesse M (2000) Pastoralism and Agro pastoralism: past and present. In: Pastoralism and Agro-pastoralism which way forward? Proceedings of the 8th Annual Conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia.
26. Behnke R, HM Osman (2012) The Contribution of Livestock to the Sudanese Economy. IGAD LPI Working Paper 01–12. Great Wolford, UK: Odessa Centre, IGAD Livestock Policy Initiative.
27. World Bank (2021) World Bank Open Data.
28. Lemma M (2016) Assessment of Feed Resource Availability and Quality in Kedida Gamela District, of Southern Ethiopia. MSc. Thesis presented in Hawassa University College of Agriculture, Hawassa, Ethiopia.
29. Alemayehu M (2004) Rangelands Biodiversity: Concepts, Approaches, and the Way Forward. Addis Ababa, Ethiopia.
30. Mengistu S, Nurfeta A, Tolera A, Bezabih M, Adie A, et al. (2021) Livestock Production Challenges and Improved Forage Production Efforts in the Damot Gale District of Wolaita Zone, Ethiopia. *Advances in Agriculture*.
31. Berhanu K, Suryabhagavan KV (2014) Multi temporal remote sensing of landscape dynamics and pattern change in Dire district, Southern Ethiopia. *Int J Biom* 8: 189–194.
32. Gedefaw M, Soromessa T (2015) Land degradation and its impact in the highlands of Ethiopia: Case study in Kutaber district, South Wollo, Ethiopia.
33. Tolera A, Yami A, Mengistu S, Alemu D, Geleti D, et al. (2012) Livestock Feed Resources in Ethiopia, Challenges, Opportunities and the Need for Transformation 1-15.
34. Augustine A, Tarawali S, Wright I (2011) Rangeland-based livestock production. *ILRI*.
35. CSA (2014) Agricultural sample survey. Volume II report on livestock and livestock characteristics.
36. Tolera A, Yami A, Alemu D (2012) Livestock feed resources in Ethiopia, challenges, opportunities and the need for transformation. *Ethiopian animal feed industry Association*, Addis Ababa 132.
37. Tahir MB, Wossen AM, Mersso BT (2018) Evaluation of Livestock Feed Balance under Mixed Crop-Livestock Production System in the Central Highlands of Ethiopia. *Agriculture and Food Security* 7: 1–17.
38. Africa RISING (2014) Africa Research in Sustainable Intensification for the Next Generation, Ethiopian Highlands Project Technical report, 1 April 2014-30 September, 2014, 14.
39. Feyisa T, Tolera A, Nurfeta A, Balehegn M, Yigrem S, et al. (2022) Assessment of fodder resources in Ethiopia: Biomass production and nutritional value. *J Agron* 114: 8–25.
40. Ahmed H, Ebro A, Mohammed K, Treydte AC (2010) Livestock feed resources utilization and management as influenced by altitude in the Central Highlands of Ethiopia. *Livestock Res Rural Develop* 22: 229.