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Geographic distribution of cattle and shoats populations and their market supply sheds in Ethiopia



Mohammad Jabbar, Asfaw Negassa and Taye Girdyellaw



Discussion Paper No. 2
Improving Market Opportunities

Geographic distribution of cattle and shoats populations and their market supply sheds in Ethiopia

Mohammad Jabbar, Asfaw Negassa and Taye Gidyelew

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Abbreviations and acronyms

ASAL	Arid and Semi-Arid Lands
AU-IBAR	African Union-Inter-African Bureau for Animal Resources
CASREN	Crop–Animal Systems Research Network
CSA	Central Statistical Authority
DAGRIS	Domestic Animal Genetic Resources Information System
FAO	Food and Agriculture Organization of the United Nations
FEWS	Famine Early Warning System
GIS	Geographic Information System
GLCRSP	Global Livestock Collaborative Research Support Program
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IPMS	Improving Productivity and Market Success
MEDaC	Ministry of Economic Development and Cooperation
RVF	Rift Valley Fever
SCF-UK	Save the Children Fund-UK
SPS-LMM	Sanitary and Phytosanitary Standards & Livestock and Meat Marketing
TLU	Tropical Livestock Unit
UAE	United Arab Emirates
UNDP	United Nations Development Program
USAID	United States Agency for International Development

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Summary

The objective of this paper was to identify and map the geographical distribution of livestock populations, and domestic and export livestock market routes and their respective supply sheds in the main production areas in Ethiopia.

These maps are based on the latest digitized livestock population data from Ethiopia's Central Statistical Authority (CSA) and the International Livestock Research Institute (ILRI). Secondary data from published and unpublished sources and key informant interviews were also used to identify key livestock market routes and map the major urban livestock markets, market routes and supply sheds.

The maps showed that the highest numbers of cattle and shoats are to be found along a north–south transect covering parts of the central highlands of Tigray, Amhara and Oromia regions, and the transect that connects Nazret (Adama) and Dire Dawa. Conversely, very low livestock numbers occur in pastoral areas like Afar, Ogaden, and Boran; this would be normally expected.

Although livestock population density indicates stocking rates, we could not ascertain whether these rates were optimal or non-optimal (in relation to carrying capacity of the different areas) due to lack of data on various factors which influence carrying capacity and stocking rate. These factors include:

- extent of available arable land
- land-use pattern (cropland, pasture, fallow etc.)
- biomass productivity of cropland (especially crop residues) and other land
- combination of system of production (mixed farming, intensive specialized farming, extensive grazing, agro-pastoral or pastoral)
- feeding systems (grazing, harvesting of feeds and stall feeding) and
- combination of animal species being raised.

Generating data on these factors will be helpful for better analysis and targeting of livestock development efforts.

Maps showing the association between human and livestock population densities indicate that there is a positive relationship between the two up to a point. Increased numbers of rural households also lead to increased ownership of livestock for various livelihood purposes. But at much higher population densities, humans and animals start to compete for food and feed hence livestock numbers tend to decrease. This is also accompanied by a change in the combination of animal species kept, with numbers of large animals being reduced in favour of small ones. This phenomenon is described as 'involution' in the context of production systems evolution. This pattern of livestock population dynamics implies that new livestock development strategies must adequately consider differences in ecological conditions and human and livestock population densities when targeting livestock species combinations for feed and health technologies and input and output marketing infrastructure.

The locations of recently-established abattoirs are perhaps based on current main supply hinterlands for exporting quality animals and feed resources. As this industry further expands, supply sources should be diversified and choice of abattoir locations guided by potential new supply sources that are currently not exploited. The maps showing the geographic distribution of breeds of animals will be helpful in that effort.

Market routes for Ethiopian livestock, especially those for live animal exports, are quite variable though domestic routes serving the various formal and informal export routes have some degree of stability. There are also seasonal variations in routes, especially those originating in pastoral areas. As Ethiopia's meat export industry grows stronger, it is likely to significantly influence the future shape of market routes and supply hinterlands as more smallholders get incentives to commercialize livestock production and pull their animals from different supply hinterlands. This will also provide incentives to establish more specialized livestock production enterprises of varying sizes in areas endowed with better feed resources and good market connections. It is thus advisable for the meat export industry, with appropriate support from the Ethiopian government, to take proactive measures in these directions to assist longer term and sustained livestock development in the country.

1 Background and objectives

Export of live animals to the Middle East market, especially Saudi Arabia, has been an important source of foreign exchange for Ethiopia. The share of Ethiopian export to the Middle East market has been declining in recent years while exporting countries like Australia, New Zealand and others have been taking an increasingly larger share of the rapidly expanding market for live animals and meat. The Government of Ethiopia has been developing alternative strategies to promote livestock exports in order to regain its earlier market shares. Alongside promoting live animal export, a major strategy being pursued is to promote meat export as, subject to establishment of a credible health and certification system, it may be easier to meet importers' health and safety requirements for this product. To this end, the government has encouraged the establishment of several meat export abattoirs by the private sector and annual meat exports have already reached 10 thousand tonnes. The government intends to triple this quantity by the year 2010.

Though livestock is a part of different production systems prevailing in the country, different species of livestock may be more concentrated in some regions or *woredas* than others. Such distribution has implications for marketing as animals have to be moved from production areas to principal domestic consumption centres, processing centres and export outlets. Several factors may influence the volume and direction of flow of live animals from the production areas to various destinations: relative costs of transport, geographic and regional differences in feed or forage availabilities, trekking routes, policies, institutions, infrastructure and prices. Knowledge of the spatial distribution of livestock populations and their movements along market routes may be helpful to understand the supply potentials and constraints in given supply hinterlands.

First, it will help in assessing and minimizing the economic impacts of potential disease outbreaks by allowing the tracking of livestock movements. Second, information on livestock movements is also crucial in analysing spatial price differences for various classes of livestock. Such information is useful for minimizing the costs of shipping livestock, making informed decisions on the optimal locations of meat processing facilities for domestic or export markets, and making other logistical decisions that affect the profitability of livestock production and marketing.

However, well-documented maps and descriptions of the geographic distribution of livestock populations and interregional and cross-border livestock trade routes in Ethiopia are rare. This study attempts to fill this gap by producing maps based on Geographic Information Systems (GIS) of the geographical distribution of cattle and shoats' populations, major domestic markets, domestic and export market routes for livestock and their supply sheds in Ethiopia.

2 Sources of data

The latest digitized livestock and human population data from the Central Statistics Authority (CSA) and the International Livestock Research Institute (ILRI) were used to produce maps on geographic distribution of livestock and human population densities. The CSA conducted a census in 2001/02 covering the highlands and sedentary areas in the highland–lowland interface, and a separate limited sample survey in some lowland pastoral areas.¹ Only available and digitized rural data were mapped. Digitized urban data were not available for mapping; however, the urban centres could not be shown as empty or not covered in the maps due to the small geographical areas being covered by most urban centres. However, all densities should be treated as only for rural areas.

For highlands, digitized data were available at the *woreda* level, so average densities of different livestock populations are shown for the *woreda* though it was recognized that there might be variations in livestock population densities among peasant associations within a *woreda*. For lowlands, survey results were available for limited areas, which were extrapolated for the similar larger geographic or administrative units. Thus, the distribution in the maps appears rather uniform for the larger extrapolated areas though in reality there might be differences between smaller administrative units or areas within those larger areas.

The CSA census data were also used for generating maps on urban (consumption) centres and different types of livestock markets. Secondary data from published and unpublished sources and key informant interviews were used to identify livestock market routes.

The data from the Domestic Animal Genetic Resources Information System (DAGRIS), an ILRI project for generating a global animal genetic resources database, were used to map the geographic distributions of selected cattle, goat and sheep breeds in Ethiopia.

1. According to the CSA, there were 41 million cattle, 26 million sheep and 23 million goats in the country in 2003–04. The livestock census conducted by the CSA in 2005–06 in the highlands and sedentary areas of the highland–lowland interface showed populations of 40 million cattle, 20 million sheep and 16 million goats. The numbers are lower because the census excluded the pastoral areas. These latest datasets are yet to be digitized, so they could not be used for mapping in this study. However, it is most likely that the general pattern of livestock population distribution and densities have not changed significantly since 2001–02.

3 Discussion

3.1 Geographic distribution of livestock population

The livestock population densities were computed in two ways: number of animals per square kilometre and number of animals per 1000 human population. When the density was expressed for the composite of cattle and shoats together, numbers of animals were converted into tropical livestock units (TLUs). The estimated densities in Ethiopia per square kilometre are shown in Figures 1 to 5. It was observed that the highest numbers of cattle and shoats were to be found along a north–south transect covering parts of the central highlands of Tigray, Amhara and Oromia regions, and the transect that connects Nazret (Adama) and Dire Dawa. Conversely, very low livestock numbers occurred in pastoral areas like Afar, Ogaden, and Boran; this would be normally expected.

The density per unit land area indicates the current stocking rate of the specific species or composite of all the species considered. We could not ascertain whether these rates as shown in the maps were optimal or non-optimal (in relation to carrying capacity of the different areas) due to lack of data at the *woreda* level on various factors which influence carrying capacity and stocking rate. These factors include:

- nature and extent of available arable land
- land-use pattern (cropland, pasture, fallow etc.)
- biomass productivity of cropland (especially crop residues) and other land
- combination of system of production (mixed farming, intensive specialized farming, extensive grazing, agro-pastoral or pastoral)
- feeding systems (grazing, harvesting of feeds and stall feeding) and
- combination of animal species being raised.¹

The livestock population densities per 1000 human population are given in Figures 6 to 10. It was observed that areas with higher human population densities also had higher livestock densities, especially in some parts of Tigray and the northeastern and southern parts of the country. Some lowland pastoral areas also had moderate to high densities of livestock population per 1000 human population as pastoral herd sizes were larger than in small-scale mixed farming systems. But since the distributions in the lowlands were extrapolated based on limited survey samples, they should be interpreted with caution as the estimated rates may not apply equally throughout the pastoral areas.

The density of livestock per 1000 human population indicates the extent of association between human and livestock population growth, and the nature of evolution of the production systems across the country. The positive relationship between human and livestock densities reflects similar developments elsewhere in the world. The evolution of production systems indicates the following pattern. At the early stages of development of agriculture, both human and livestock population densities increased with population growth and rural expansion. With industrialization and urbanization, fewer people practised agriculture, so farm and herd sizes increased gradually.

1. Whether carrying capacity is an appropriate and useful concept or tool for livestock management for all production systems and situations is being debated by some authors. Anon (undated) gave a summary of discussion and other references.

However, where technical change and general agricultural development was very slow, a stage might have been reached beyond which increased population density led to a decline in livestock numbers (especially large animals) due to competition with human population for land. In such a situation, poorer segments of the population might raise more small stocks, e.g. poultry and small ruminants, relative to cattle (Jabbar and Green 1983). This process has been recently described as ‘involution’ within the context of general evolution of production systems from extensive to intensive systems (Steinfeld et al. 1997). In these cases, a longer time was required for livestock population density per unit human population to increase. Several studies have documented evidence of this phenomenon: Mukherjee (1938) and Vaidyanathan (undated) in India, Jabbar and Green (1983) and Alam (2002) in Bangladesh, Lapar and Jabbar (2003) in five Southeast Asian countries and Mäki-Hokkonen (1996) in different developing regions.

For the present study, data available from 454 *woredas* in the highlands and sedentary or agro-pastoral areas of the highland–lowland interface were used to test the hypothesis about the relationship between human and livestock population densities. In the absence of time series data, cross-sectional data with varying human and livestock population densities may provide insights about the likely evolution of human and livestock population dynamics in specific geographical areas. Because of the non-sedentary nature of pastoral livestock, data from the lowlands were not included in these estimations. The following equations were estimated with the available data:

$$Y_1 = 27.260 + 0.40X_1 - 0.00010X_2 \quad R^2 = 0.592 \text{ Adj}R^2 = 0.591$$

(8.415) (20.317) (–8.696)

$$Y_2 = 32.400 + 0.189X_1 - 0.00059X_2 \quad R^2 = 0.157 \text{ Adj}R^2 = 0.154$$

(7.969) (7.523) (–3.491)

$$Y_3 = 22.322 + 0.304X_1 - 0.000887X_2 \quad R^2 = 0.585 \text{ Adj}R^2 = 0.583$$

(9.110) (20.052) (–8.862)

where

Y_1 = number of cattle per square kilometre

Y_2 = number of shoats per square kilometre

Y_3 = number of TLUs per square kilometre

X_1 = human population per square kilometre

X_2 = square of human population per square kilometre

Scatter plots of data and curves derived from the above quadratic functions are shown in Figures 11 to 13. All the coefficients of the estimated equations are statistically significant at less than 1% level. The results confirm the hypothesis that density of livestock, both specific species and composite of all three species, initially increases and then declines with increasing human population density. A further confirmation of this pattern is that if *woredas* with human population density over 450 per square kilometre are excluded from the equations, a more linear—rather than curvilinear—relationship between animal and human population densities is observed.

The relationship between species composition and human population density was also estimated by running a regression on number of shoats per head of cattle with X_1 and X_2 as independent variables but the association was found to be weak. The simple correlation coefficient between human population density per square kilometre and number of shoats per head of cattle was -0.17 (significant at <0.001). The number of shoats per head of cattle in highland *woredas* with different population density levels excluding a few with extreme values is shown in Table 1. It appears that the number of shoats per head of cattle generally declines as human population density per square kilometre increases, rises sharply up to a point then falls sharply. Within each falling and rising segment, there are wide variations in densities as indicated by high standard deviations. This pattern is perhaps the reason for the weak fit of the quadratic function.

Table 1. Number of shoats per head of cattle by human population density

Population density per sq km	No. of <i>woredas</i>	Mean number of shoats per head of cattle	Standard deviation
1–25	86	1.2	1.2
26–50	115	1.0	1.2
51–75	103	0.8	0.6
76–100	82	0.7	0.4
101–150	48	0.6	0.4
151–200	9	0.9	1.0
201 or more	8	0.4	0.2
Overall	450	0.9	0.9

Source: CSA census 2001–02.

The main consideration here is that choice of species combination in a given situation depends on a number of factors including feed resources and the use or function of animals. In highland Ethiopia, crop production requires good tillage for which draught animals are essential. So, when herd size may have to be reduced due to feed shortage, farmers may prefer to retain draught animals and give up some of the other types of animals such as dairy cows, replacement heifers and young bulls, and small ruminants. Although the order in which different types of animals are given up or replaced from the herd may depend on the circumstances of the individual household, it appears that large animals are initially replaced with small ones in the face of feed shortages.

These relationships indicate that different strategies may have to be considered to choose or target appropriate species or their combinations for promotion and market-oriented development of livestock through provision of inputs, technology and services. This is because the potential for development may depend greatly on where the evolutionary growth path of a particular geographical area lies. For example, where population and livestock densities are already too high and there is intense competition between man and animals for food and feeds, and natural resources are degrading due to over extraction or use, it will be advisable to promote more small stocks than large animals to reduce pressure on land and feeds. Alternatively, feeds will have to be imported from surplus areas to raise livestock, preferably under stall feeding conditions.

3.2 Geographic distribution of livestock breeds

Systematic characterization of breeds is still incomplete in Ethiopia. Based on detailed phenotypic and genotypic classification, DAGRIS identified five major cattle breeds, nine goat breeds and six sheep breeds. These are:

- Cattle: Boran, Ogaden, Arsi, Horro and Fogera
- Goats: Afar, Abergelle, Hararghe, Central Highlands, Western Highlands, Arsi Bale, Kefa, Long Eared and Weyito Guji
- Sheep: Afar, Dangla, Horro, Menz, Black Headed and Bonga

Most of the other animals are nondescript though they may be classified in future. Data available for the characterized breeds of cattle, goats and sheep have been mapped showing their geographic distributions (Figures 14 to 16). The origins and principal areas of concentration of a specific breed have been shown. Although each of these breeds may be reared sporadically in other parts of the country, those areas have not been identified on the maps due to lack of accurate data.

3.3. Urban centres and markets

Major urban centres of varying sizes representing potential domestic markets for consumption, and secondary markets that deal with livestock exclusively or in combination with other commodities are shown in Figure 17. Appendix A lists the names of the markets. Figure 17 also shows the locations of existing meat-processing abattoirs and those being developed or considered for development in the near future.

3.4 Domestic livestock market routes and their supply sheds

Domestic market routes for livestock in the different regions are shown in Figure 18 along with *woredas* that constitute the catchments for each market route. These catchments are derived from the information on existing primary and secondary markets that principally serve each market route (Appendix B). It should be noted that livestock are mobile and animals from areas shown under one catchment may be actually sold in markets in another nearby catchment. Moreover, areas not defined as a catchment of any market route may supply animals to several markets and market routes, depending on the location of a particular area and its trade connection to adjoining areas. For example, animals from the eastern and southeastern lowlands are supplied to the highland domestic markets and those serving exports to the Gulf regions and Kenya. Moreover, local market routes may originate in a rural area or a primary market located in one administrative domain (*woreda*, zone or region) but serve a destination market (secondary or tertiary) located in another administrative domain. Additionally, a particular destination market may be served by several micro market routes.

In Figure 19, total cattle, sheep and goat populations for each of the principal domestic market catchment are shown. Nazret (Adama), Shashemene, Mekelle and some other large cities are terminal or semi-terminal markets that are supplied by a wide range of areas. Addis Ababa is the

largest domestic terminal market that is supplied by nearly the entire country through several routes. The estimated number of animals actually entering the market—domestic as well as export—depends on the marketing behaviour and off-take rate of the producers. Estimated market off-take rates using the CSA census and other data sources are shown in Table 2.

Table 2. *Cattle and shoats off-take rates by different years and sources of data*

Data source	Sample size	Gross off-take rate (%) ^d			Net off-take rate (%) ^e		
		Cattle	Sheep	Goats	Cattle	Sheep	Goats
ILRI-IFPRI ^a	1,054	16	34	30	8	22	18
CSA census ^b	458,557	16	19	15	7	7	8
GLCRSP ^c	451	11	10	11	9	6	7

a. 1999–200 data, includes highland areas of Amhara, Oromia and Tigray regions.

b. 2001–02 data, excludes pastoral livestock.

c. 2003–05 data, includes Borena pastoral area only.

d. Gross off-take in a year is equal to household sales as a percentage of average household stock during the year and it indicates the volume of sales serving different market outlets or uses — slaughter, export, buy back by producers.

e. Net off-take in a year is equal to sales minus purchase as a percentage of average household stock during the year and it indicates volume of household sales available for non-farm uses.

Source: Negassa and Jabbar (2007).

The data sources used for these estimates are for different years, sample sizes and extents of coverage of physical areas. Only aggregate rates are shown in Table 2; more detailed information for different regions is reported by Negassa and Jabbar (2007). Off-take rates may also vary between individual *woredas*. Thus, the volume of market supply for each catchment shown in Figure 19 may be calculated using an appropriate off-take rate for the relevant geographical area of interest.

3.5 Livestock exports and export routes

Current export market outlets are indicated in Figure 20. Meat is exported mainly by air and live animals through three main routes—via Somalia and Somaliland to the Gulf States, the southern border to Kenya and the northwestern border to Sudan. After the loss of Eritrean ports, export through that route has stopped in recent years though a small amount of cross-border two-way trade may still take place with Eritrea.

Accurate and complete statistics on the volume of official export of live animals and meat are rather difficult to get mainly because separate records of such data are not maintained. The Livestock Marketing Authority recently compiled export statistics from various sources for the period 1998 to 2003. Carefully separated live animal and meat export data from the overall export statistics are summarized in Table 3.

Although the period includes years following the bans by the Middle East market on import of animals from Ethiopia in 1998 and 2000, these figures appear too low to be realistic. Perhaps the recording system is not well organized to capture all official exports. The quantity of official meat export reportedly increased dramatically after 2003. In 2005–06, 163,380 animals (75% of which were cattle) were officially exported to Egypt, Yemen, the United Arab Emirates (UAE)

and Saudi Arabia. In the same period, 8000 t of meat (primarily shoat carcasses) worth USD 18.5 million was exported to Saudi Arabia, UAE and Egypt by air freight (Belachew Hurissa, personal communication).

Table 3. Official annual average quantities of live animal and meat exports from Ethiopia (1998–2003)

Item	Quantity
Live animals (numbers)	
Cattle	12,934
Sheep	13,554
Goats	1247
Meat (t)	
Beef	81
Mutton	27
Goat meat	1560
Total	1668

Source: Unpublished data from the Livestock Marketing Authority.

Historically, the bulk of livestock exports from Ethiopia occurred as informal trade. Estimates on unofficial livestock trade vary widely. For example, MEDaC (1998) estimated unofficial export of 260 thousand cattle and 1.2 million sheep and goats in 1998; Hurissa and Eshetu (2002) and Hurissa and Hargreaves (2003) reported an estimate by the Livestock Marketing Authority showing unofficial export of 325 thousand cattle and 1.15 million sheep and goats, 300 thousand pieces of skins and 150 thousand pieces of hides in 2001. But these studies did not indicate the sources of data for the estimates, nor the export routes and destinations. Estimated informal trade in 2005–06 stood at 328 thousand cattle and 1.1 million shoats.

Pastoral populations in Ethiopia's southeastern lowlands depend heavily for their livelihoods on livestock exports to Somalia, most of which are re-exported to Saudi Arabia and other Gulf states. Out of about 3.5 million predominantly nomadic people in the Somali region of Ethiopia, an estimated 90% derive their livelihoods from pastoralism and other animal-related activities (Ahrens 1998). The region has the largest stock of sheep and goats in Ethiopia.

The Middle Eastern countries, especially Saudi Arabia, have been a traditional export market for Ethiopian livestock. Until 1998, several million sheep and goats were exported every year to Saudi Arabia from ports in Somalia, during a four-month period correlating with the *hajj* activities in Mecca.

This trade proceeded for many years, until an outbreak of Rift Valley fever (RVF) in the Horn of Africa region (Sudan, Kenya, Somalia, Eritrea, Ethiopia and Djibouti) prompted two consecutive bans by Saudi Arabian authorities in 1998 and 2000 with dramatic consequences on the economies of the region. The bans resulted in a drastic decline in exports from Ethiopia and import of consumer goods into Ethiopia. This further led to loss of income and livelihoods by many livestock producers, market actors and traders who depended on livestock export activities for their incomes (Ahrens 1998; Davies and Nunn 1998; FEWS 1998; SCF-UK 1998 and 2002; Leonard 2000; Aklilu 2002; Nin Pratt et al. 2005). When the border between Ethiopia and Somaliland was

closed in 1998, the price of shoats fell relative to that of basic food items on the Ethiopian side of the border though not much had changed around the Berbera port (FEWS 1998).

The government has lost significant amounts of revenue and foreign currency reserves but the effect of unrestrained animal movement on the spread of transboundary diseases remains a major issue. Although the livestock export bans were later partially or fully withdrawn, regaining the earlier market share has proved difficult because of increasingly stringent health, safety, quality and standard requirements by the importing countries.

Most exports of live animals still occur from the eastern and southeastern lowlands, mainly from the Somali region. Most livestock exports from the Somali region pass through ports in Somaliland and Somalia. A report by FEWS (1998) divides the Somali region into a set of livestock market sheds, defined in terms of the assembly markets through which exports occur (Figure 21). Berbera is Somali region's main outlet for livestock exports, which is one day's sail closer to Yemen and Saudi Arabia than the alternative port, Bosasso. Prices paid for animals in the latter port are also lower than in Berbera due to the greater distance from importing markets. Livestock from the southern Somali region historically headed to Mogadishu for shipping but during the civil war they were diverted to Bosasso (FEWS 1998). Most animals sold for export, mainly to Saudi Arabia, are males of the Somali blackhead sheep, followed by male goats, male cattle and young male camels, which are used mainly for meat (Ahrens 1998).

Data on official and 'informal' exports of live animals from the Somaliland ports of Berbera and Bosasso between 1993 and 1997 are shown in Figure 22. Estimates of the number of animals exported vary considerably from about 1.3 million to 3 million head (Shank 1997; Ahrens 1998; FEWS 1998). Ahrens (1998) suggested that between 60% (according to Somaliland sources) and 80% (Ethiopian sources) of the total livestock exported annually through Berbera port were of Ethiopian origin while Little (2001) suggested that 50 to 60% of the 1.4 million small stock exported out of Berbera port originated from eastern Ethiopia. McPeak and Little (2006) quoted Stephen Devereux, a researcher on vulnerable livelihoods in the Somali region of Ethiopia, as reporting that annual livestock turnover in four main markets in the Somali region of Ethiopia amounts to about USD 50 million. Nearly all of these animals cross the border to Somalia informally for export via Somali ports.

The second largest source of cross-border trade of livestock (mainly cattle) occurs through the southeastern Ethiopia/southwestern Somalia/northeastern Kenya triangle. Based on information provided by Shank (1997) and Ahrens (1998), Nin Pratt et al. (2005) estimated that about 28 thousand cattle and 145 thousand sheep and goats crossed the border to Kenya from the Somali region of Ethiopia in the mid 1990s. A Kenya Government estimate showed that the proportion of Kenyan beef output derived from animals coming from cross-border trade has been increasing in recent years and reached about 26% of beef output in 2000 (Table 4). The extent of trade has increased significantly after the neighbouring countries lost the Middle Eastern markets due to import bans.

Between 1997 and 2000, of all the cattle slaughtered in Kenya per year, an average of about 528 thousand head came from across the border. McPeak and Little (2006) estimated that the annual

livestock turnover in Garissa market in northeastern Kenya is about USD 26 million. If half of these animals came from Ethiopia and the other half from Somalia and elsewhere, an estimated 264 thousand cattle were exported unofficially from Ethiopia to Kenya. The market actors and other stakeholders in Kenya felt that cross-border trade in cattle kept the urban consumer price of beef in Kenya low but had a negative impact on the earnings and livelihoods of livestock keepers in the arid and semi-arid lands (ASALs) of Kenya.

Table 4. *Estimated total beef production in Kenya between 1997 and 2000*

Item	Year			
	1997	1998	1999	2000
Total beef output (t)	268,278	270,000	273,450	286,305
Share of total production (%)				
Pastoral herds	49	47	46	46
Dairy herds	29	28	28	28
Cross-border import	22	25	26	26
Total	100	100	100	100

Source: Unpublished data from the Ministry of Agriculture and Rural Development, Government of Kenya, quoted by Jabbar (2002).

It is generally observed that the volume of trade flow from Ethiopia through the Kenya border varies widely between years and seasons due to differences in rainfall pattern and associated pastoral grazing pattern. Consequently, there may be occasional reverse movement of livestock from northern Kenya to Ethiopia. There are anecdotal reports of Kenyan livestock movement to southern Ethiopia in response to higher demand. It is unclear if this apparent inflow to Ethiopia is in response to higher prices in the domestic market or due to demand for better quality sheep by export abattoirs for meat export.

More recently, cross-border trade of only cattle has been taking place through the northwestern border with Sudan. Exports have been taking place through five important outlets or posts located along the Sudan–Amhara border. These are: Metema Yohannes, Shinfa-Tiha, Berkete Nur, Abrehajira and Abdurafi export points. Official export takes place through the Metema Yohannes quarantine post and the other points are used only for unofficial trade. Mainly bulls and steers from North Gondar lowlands and other nearby areas are exported, eventually reaching large urban markets in Sudan including Khartoum. Importers buy cattle in bulk and take them for slaughter in slaughterhouses and processing plants in Khartoum or re-export them through Port Sudan to Egypt or elsewhere.

During a recent rapid appraisal on the nature of export along this border, it was found that in 2005, about 4600 cattle were exported officially through the Metema Yohannes post to Sudan and in the first nine months of 2006, about 19 thousand cattle were exported officially through the same post (unpublished data from the Metema Yohannes Quarantine Service Centre). Moreover, results of key informant interviews at export points along the Amhara–Sudan border showed that in 2005 about 4600 head of cattle had been exported unofficially, rising to about 28 thousand in the first nine months of the following year. This means that about 60% of all animals passing through this border were exported unofficially (Elias et al. 2007). The key informants who provided information for the rapid appraisal indicated that total official export in 2006 would reach 31 thousand and unofficial export about 47 thousand animals. They also projected that in 2007 official and unofficial exports, respectively, might rise to about 40 thousand and 60 thousand animals.

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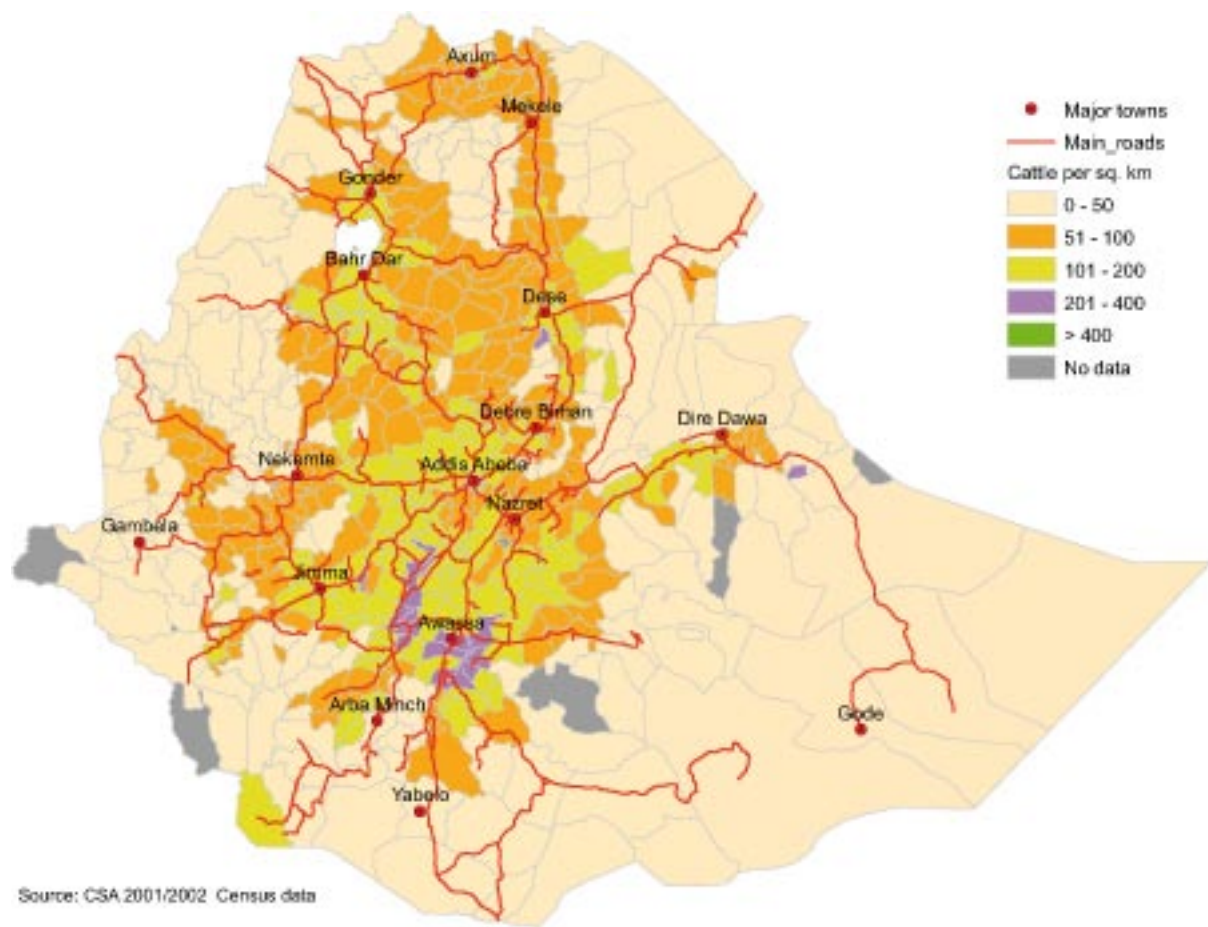


Figure 1. Cattle population density in Ethiopia (number per square kilometre).

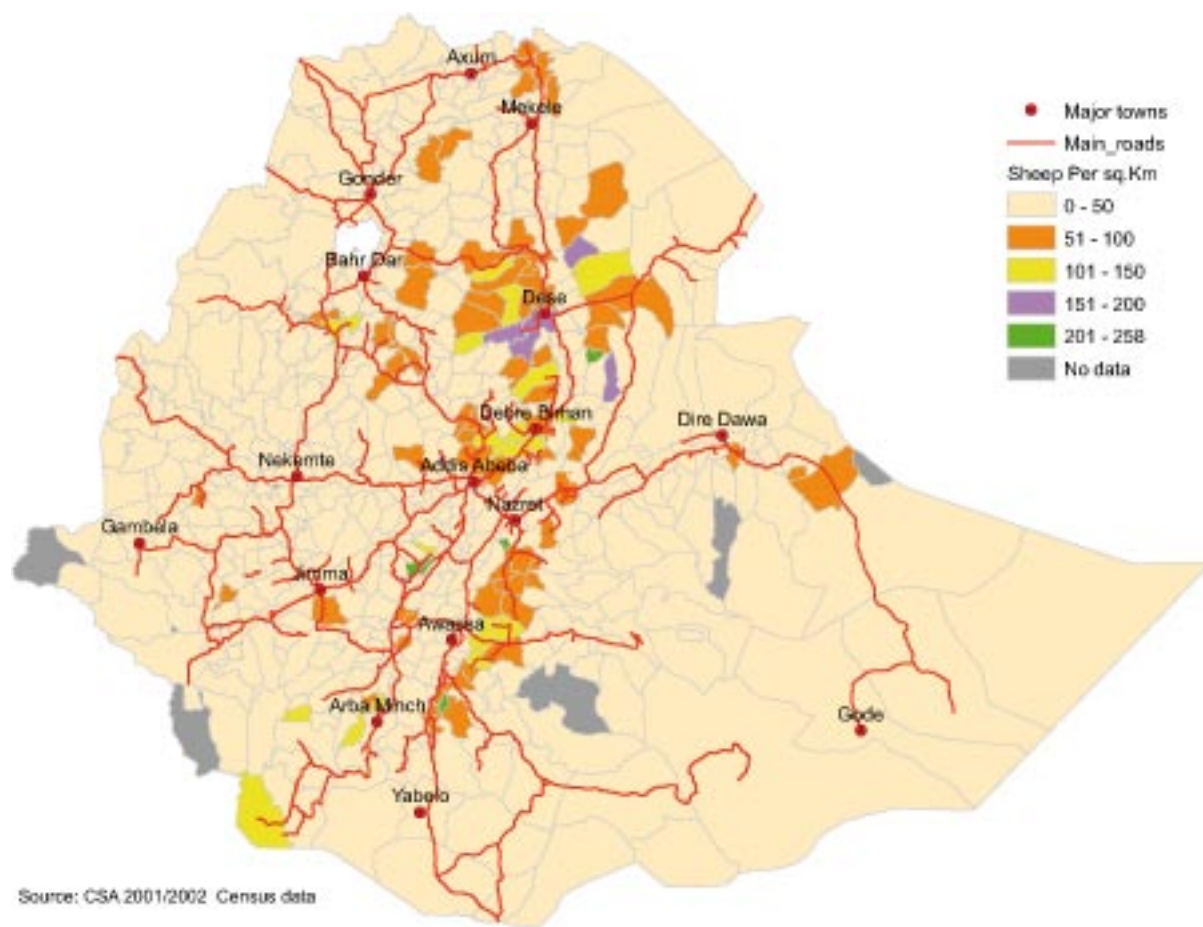


Figure 2. Sheep population density in Ethiopia (number per square kilometre).

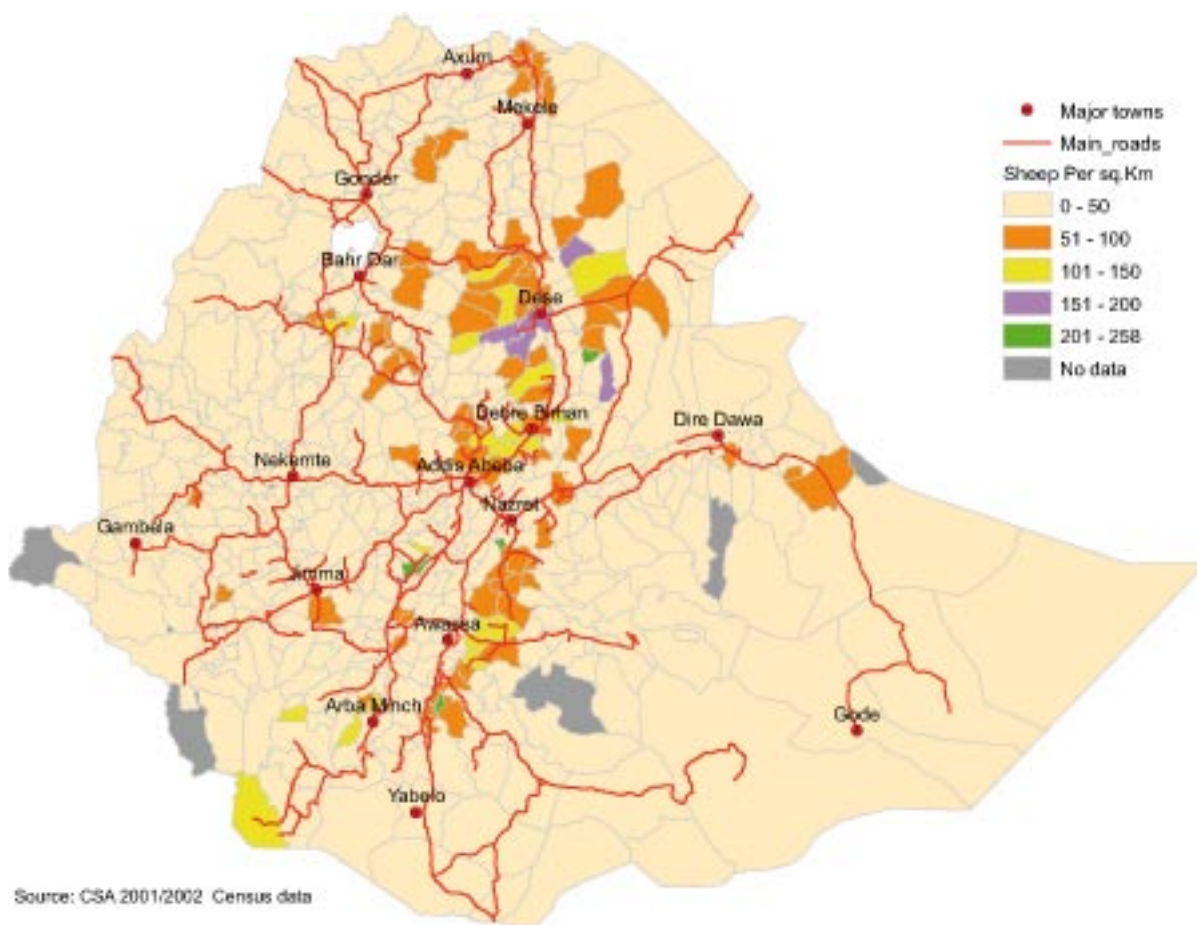


Figure 3. Goat population density in Ethiopia (number per square kilometre).

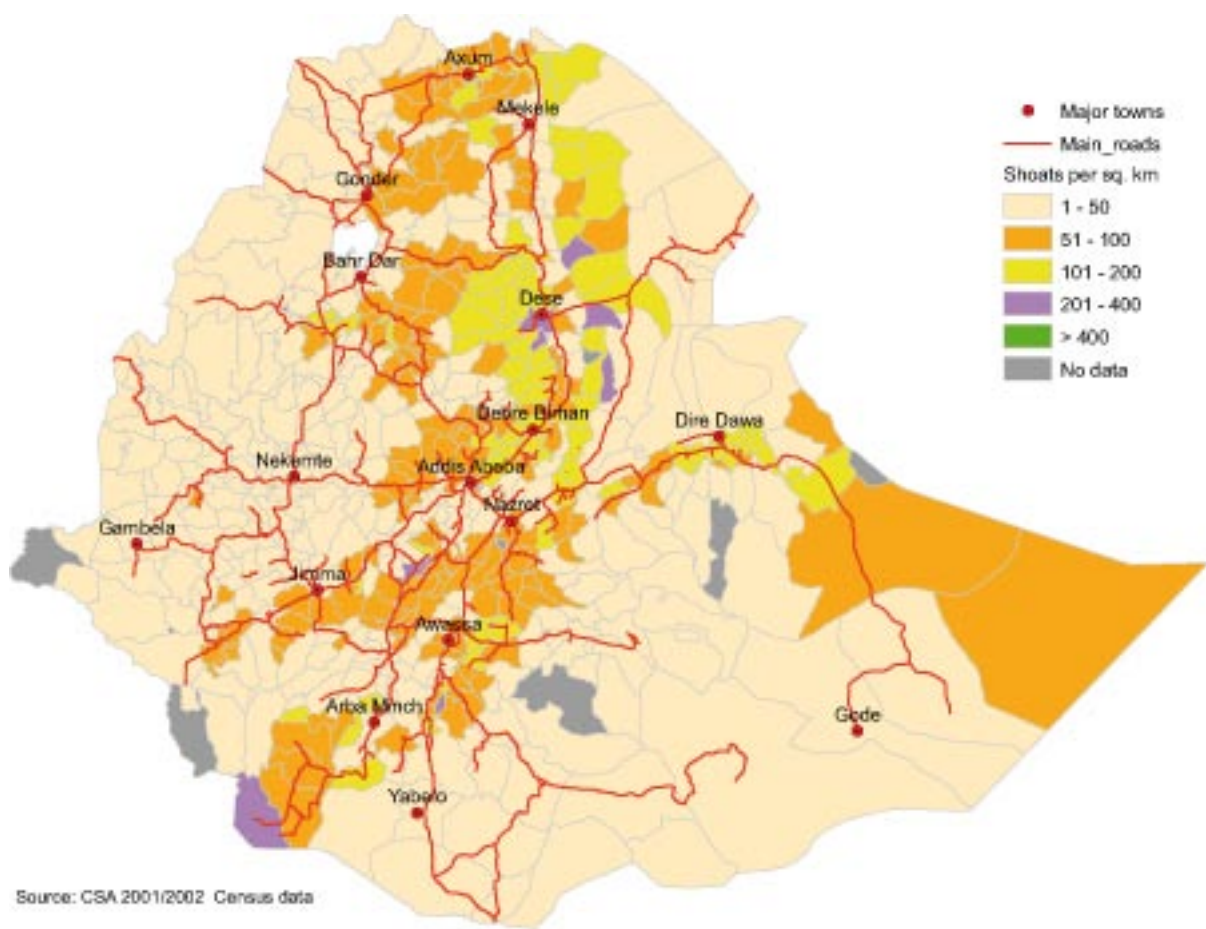


Figure 4. *Shoat population density in Ethiopia (number per square kilometre).*

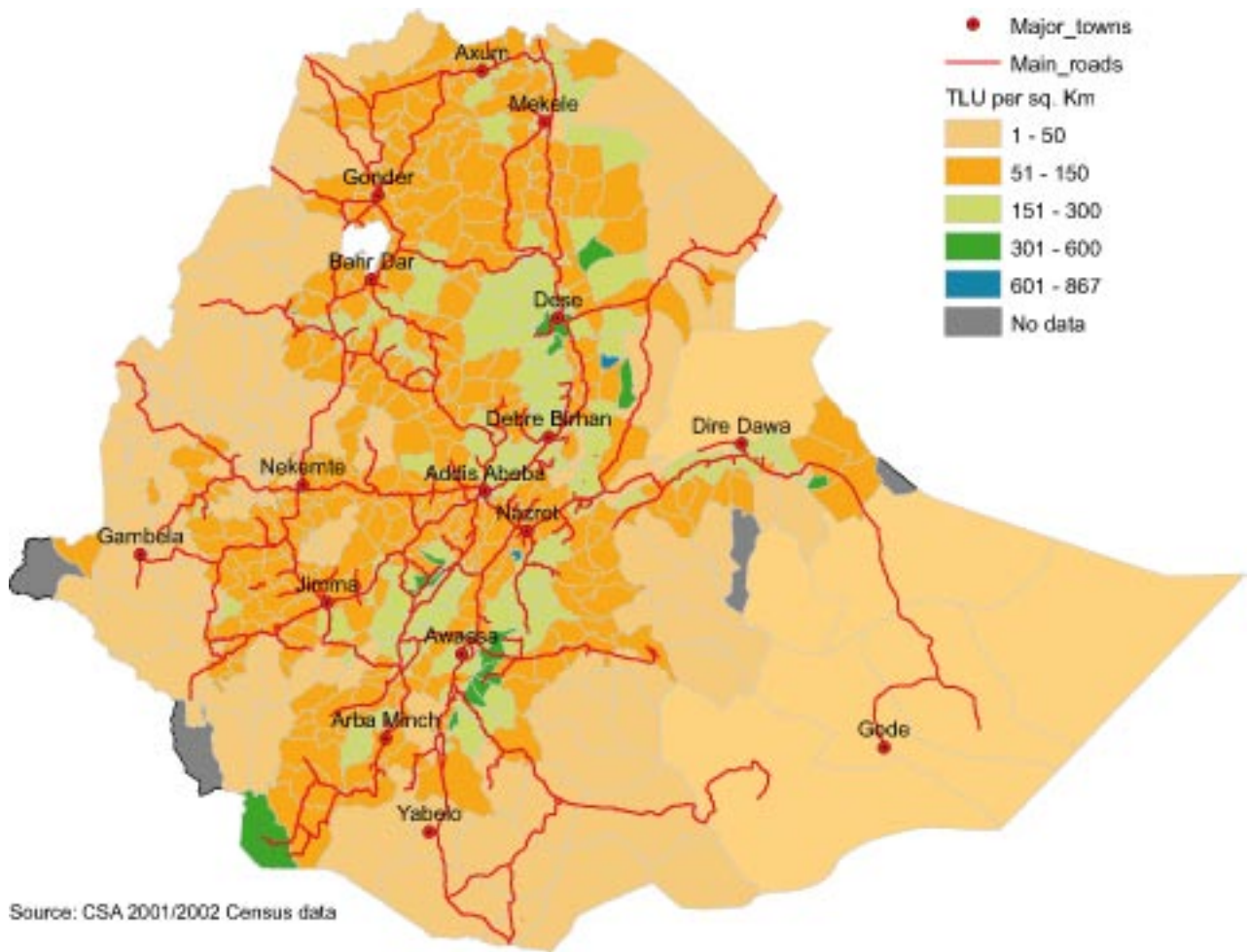


Figure 5. Cattle and shoats population density in Ethiopia (TLU per square kilometre).

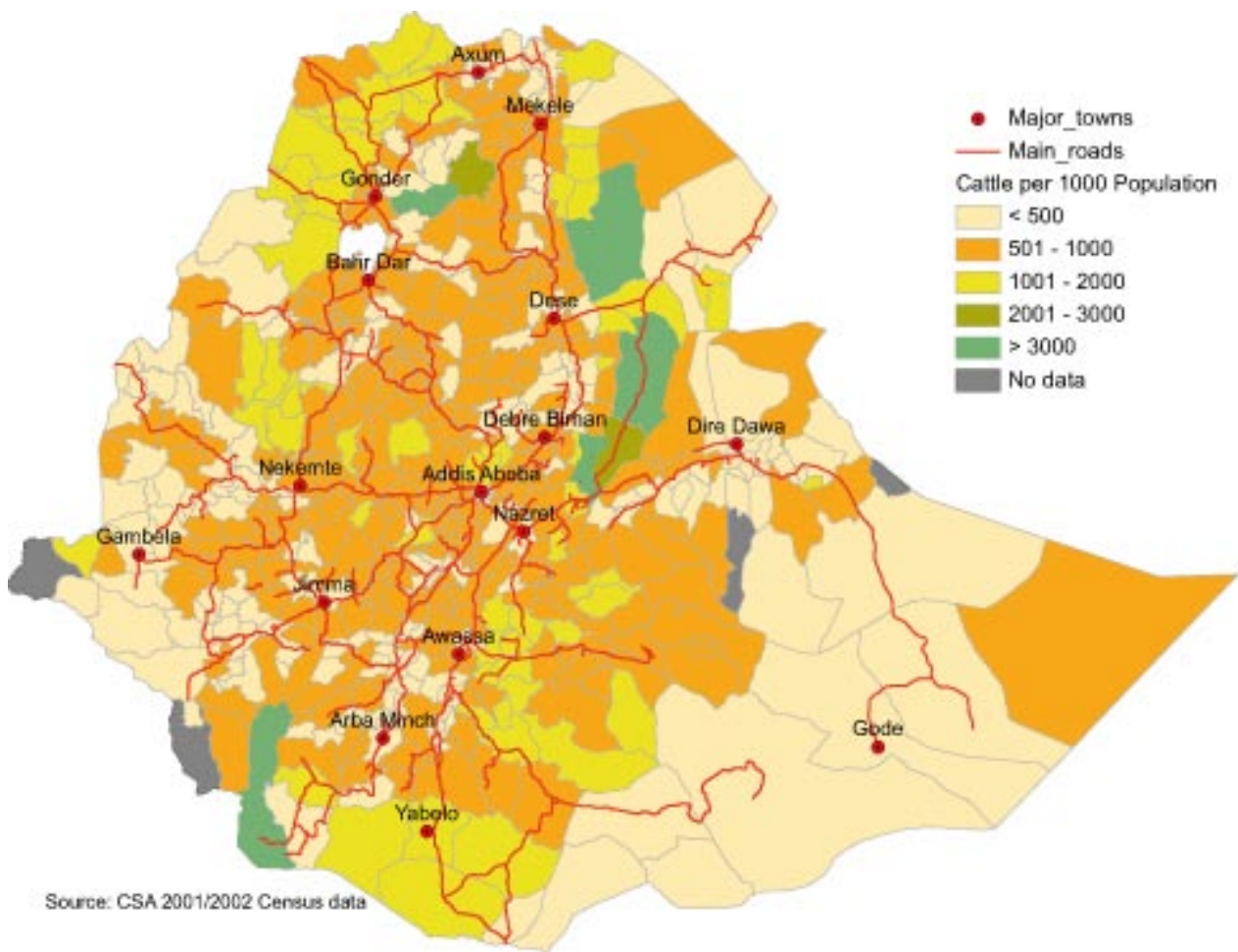


Figure 6. Cattle density in Ethiopia (number per 1000 human population).

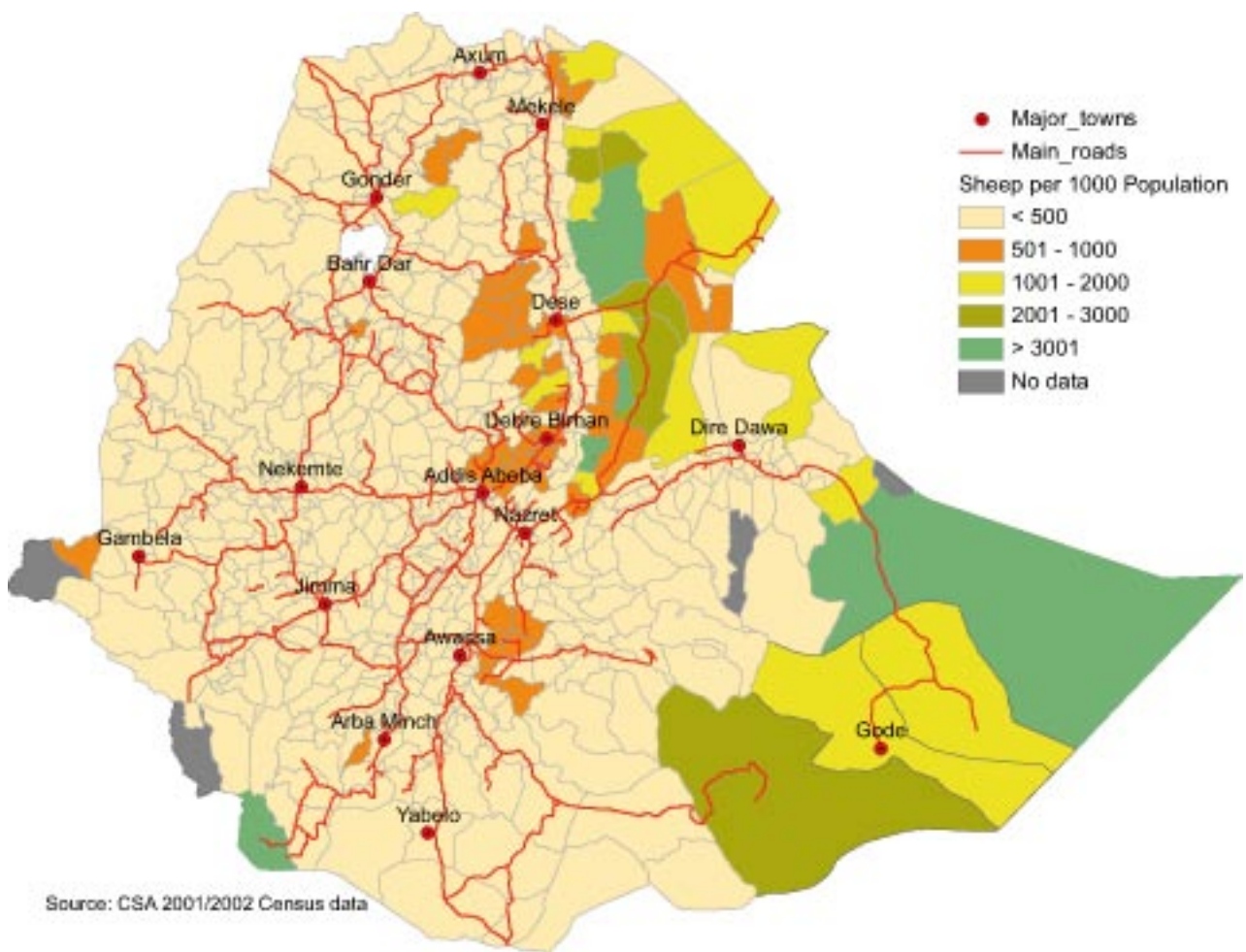


Figure 7. Sheep density in Ethiopia (number per 1000 human population).

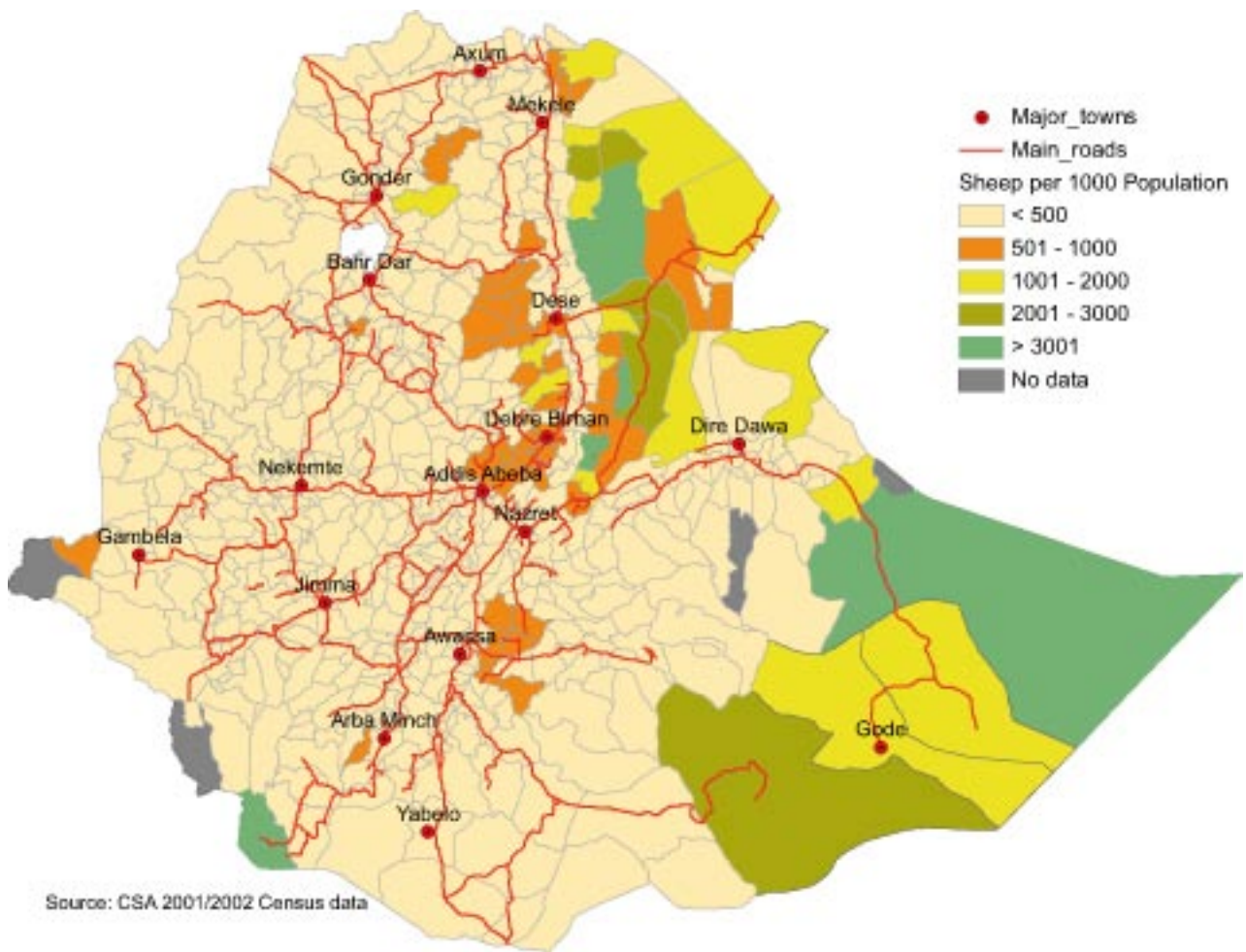


Figure 8. Goat density in Ethiopia (number per 1000 human population).

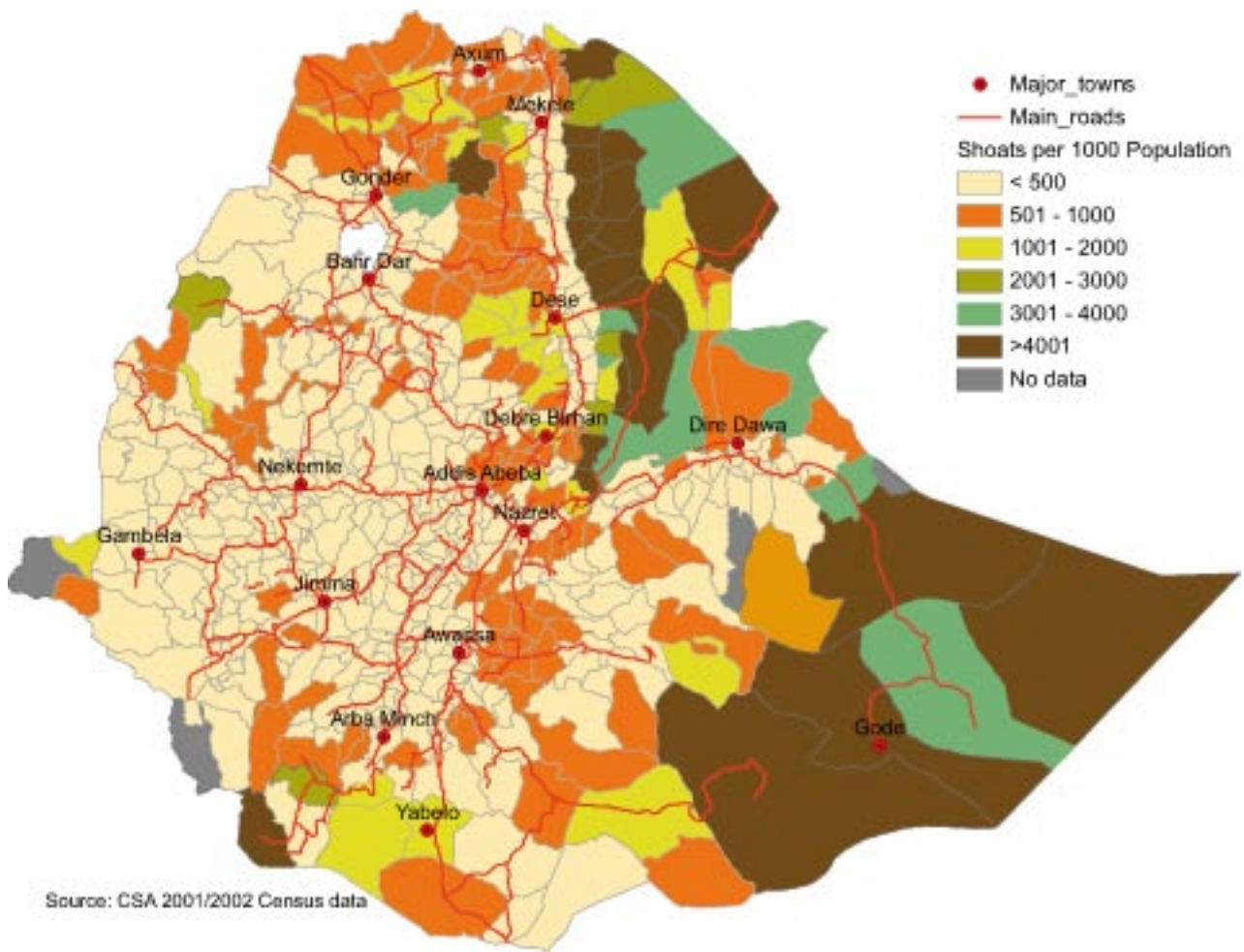


Figure 9. Shoats density in Ethiopia (number per 1000 human population).

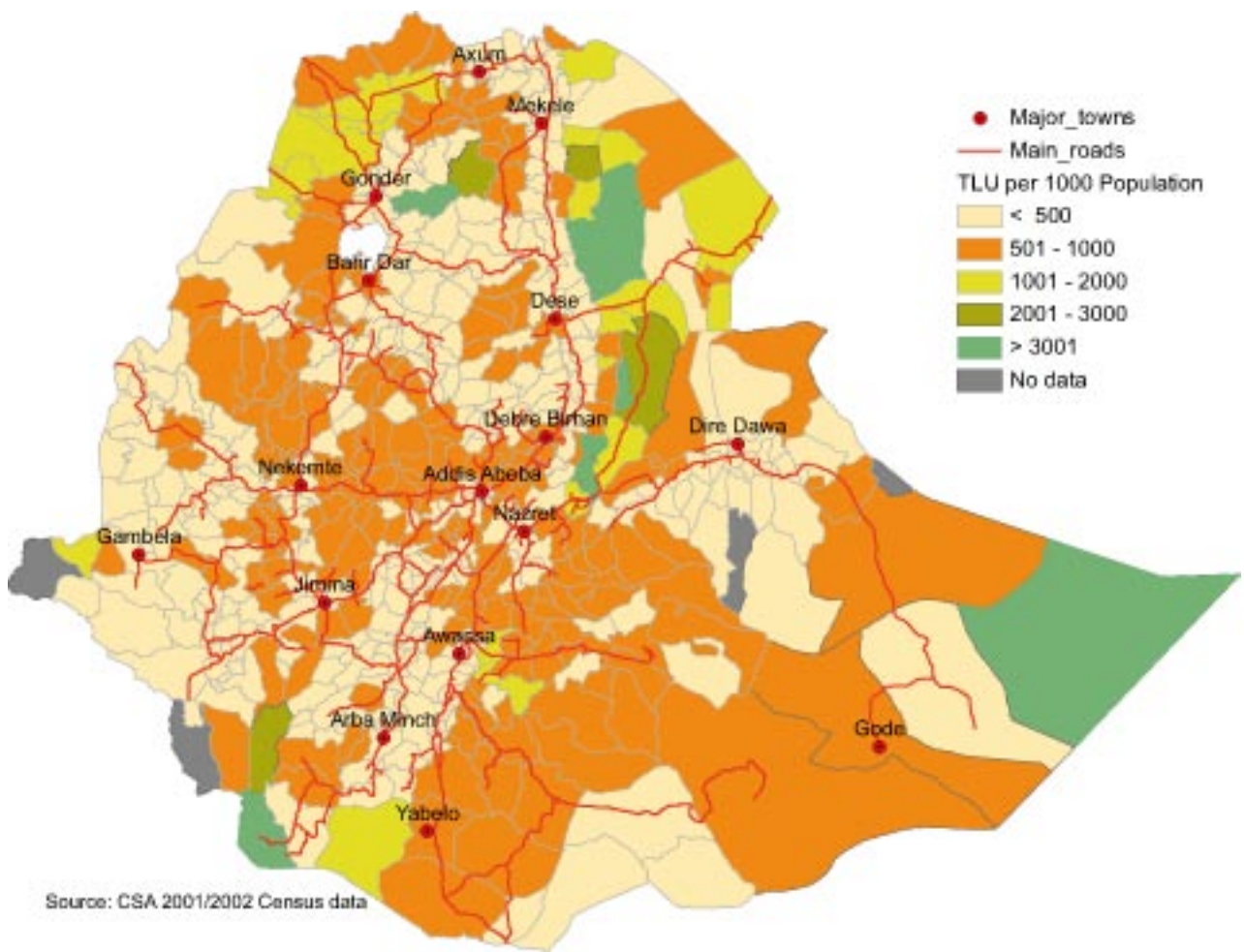


Figure 10. Cattle and shoats density in Ethiopia (TLU per 1000 human population).

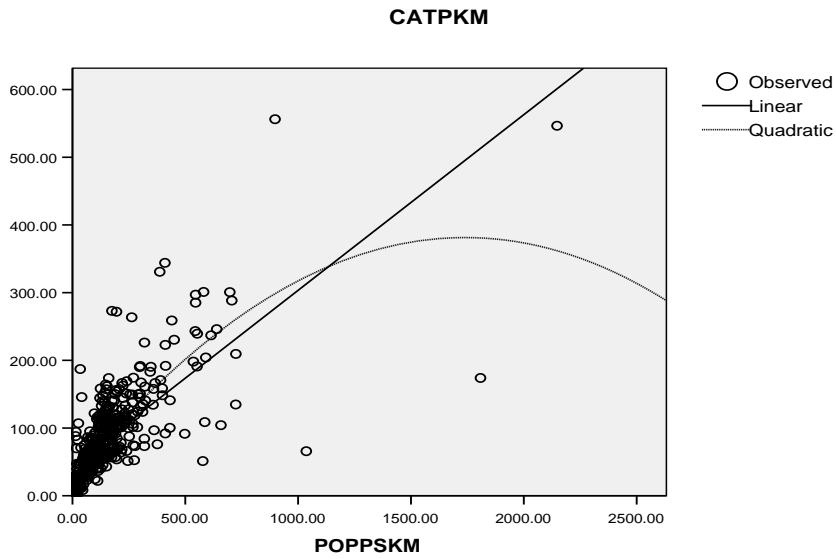


Figure 11. Relationship between cattle and human population densities.

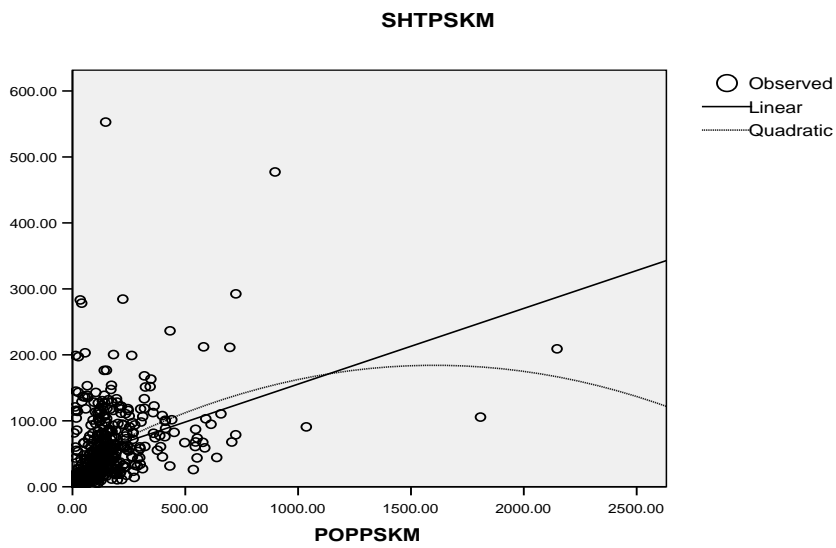


Figure 12. Relationship between shoats and human population densities.

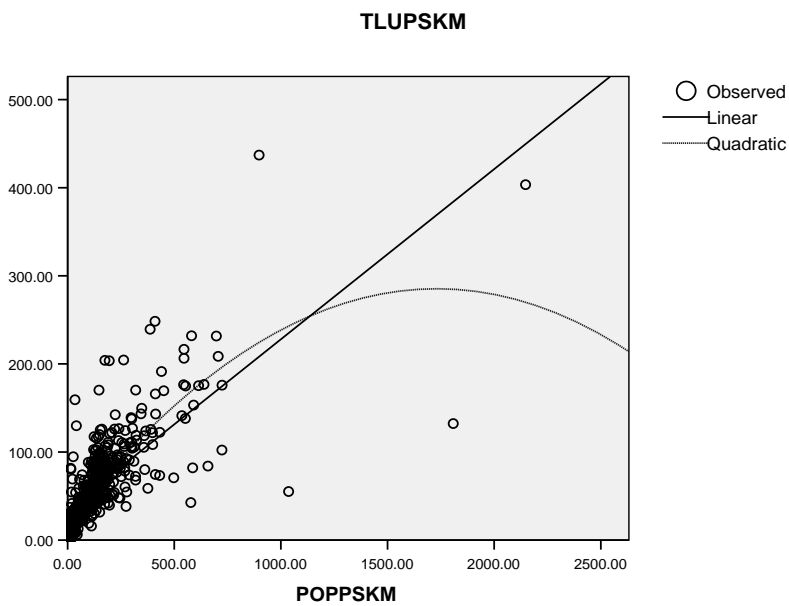


Figure 13. Relationship between cattle and shoats, and human population densities.

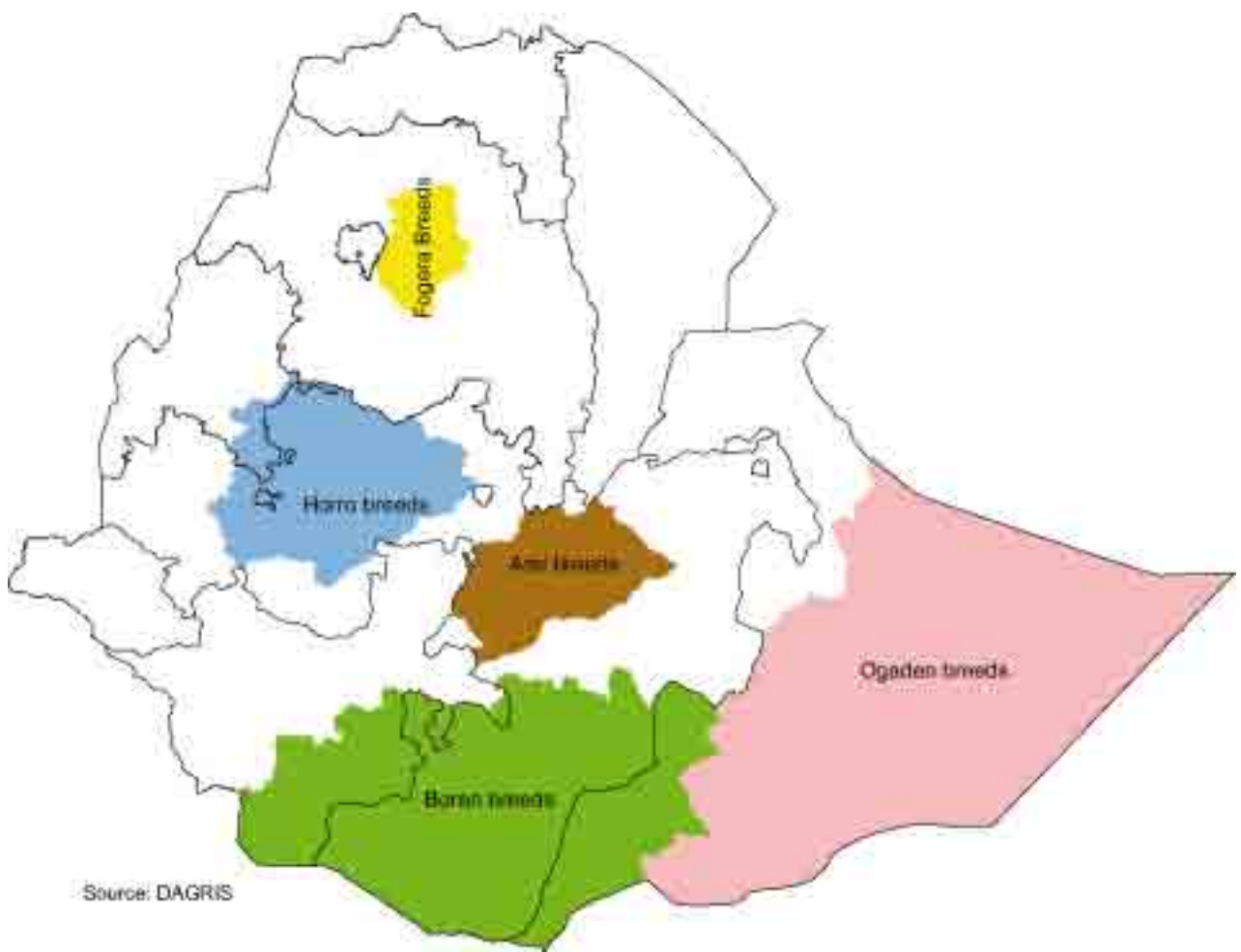


Figure 14. Geographic distribution of cattle breeds in Ethiopia.



(a) Afar breed



(b) Ogaden breed



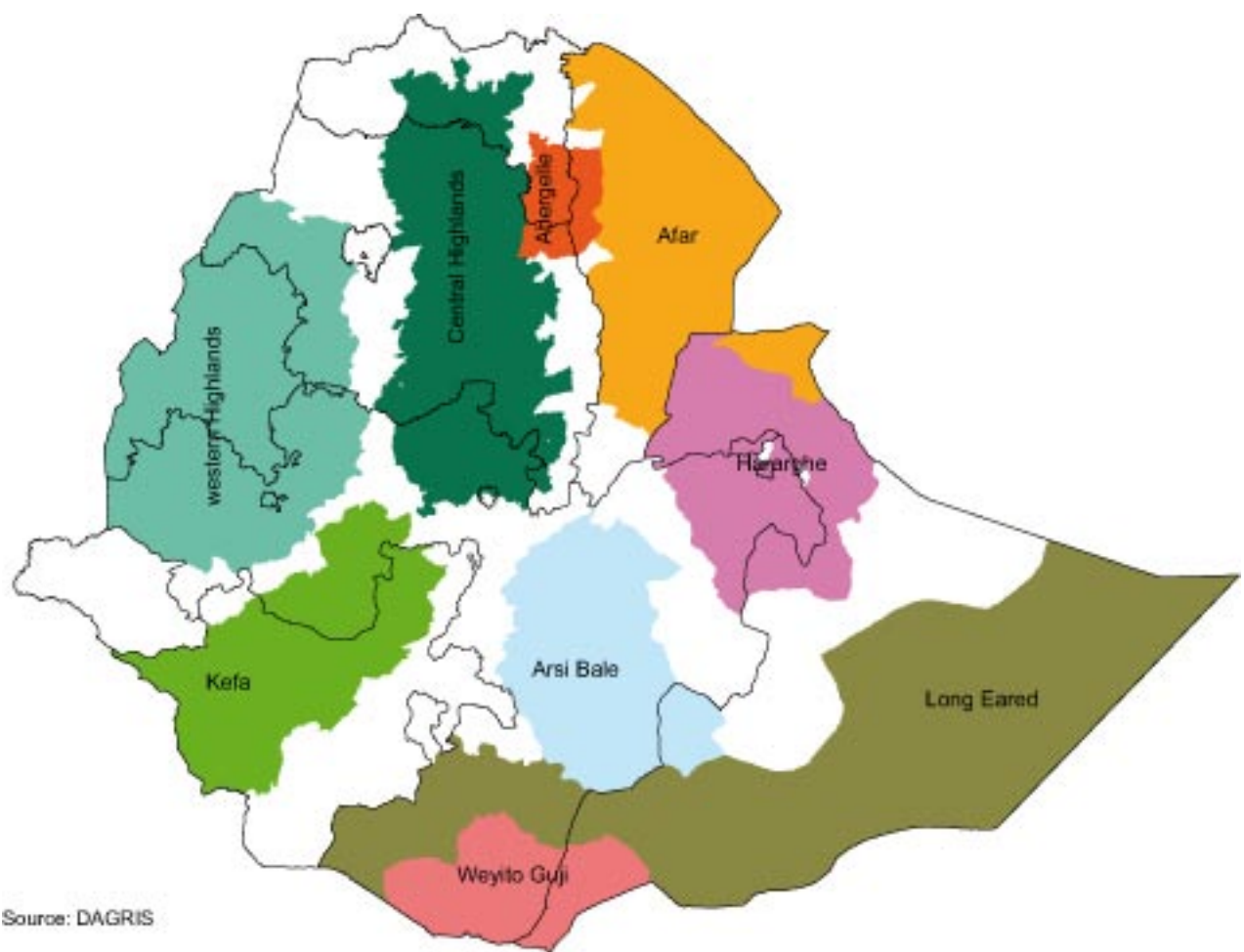
(c) Arsi breed



(d) Horro breed



(e) Boran breed



Source: DAGRIS

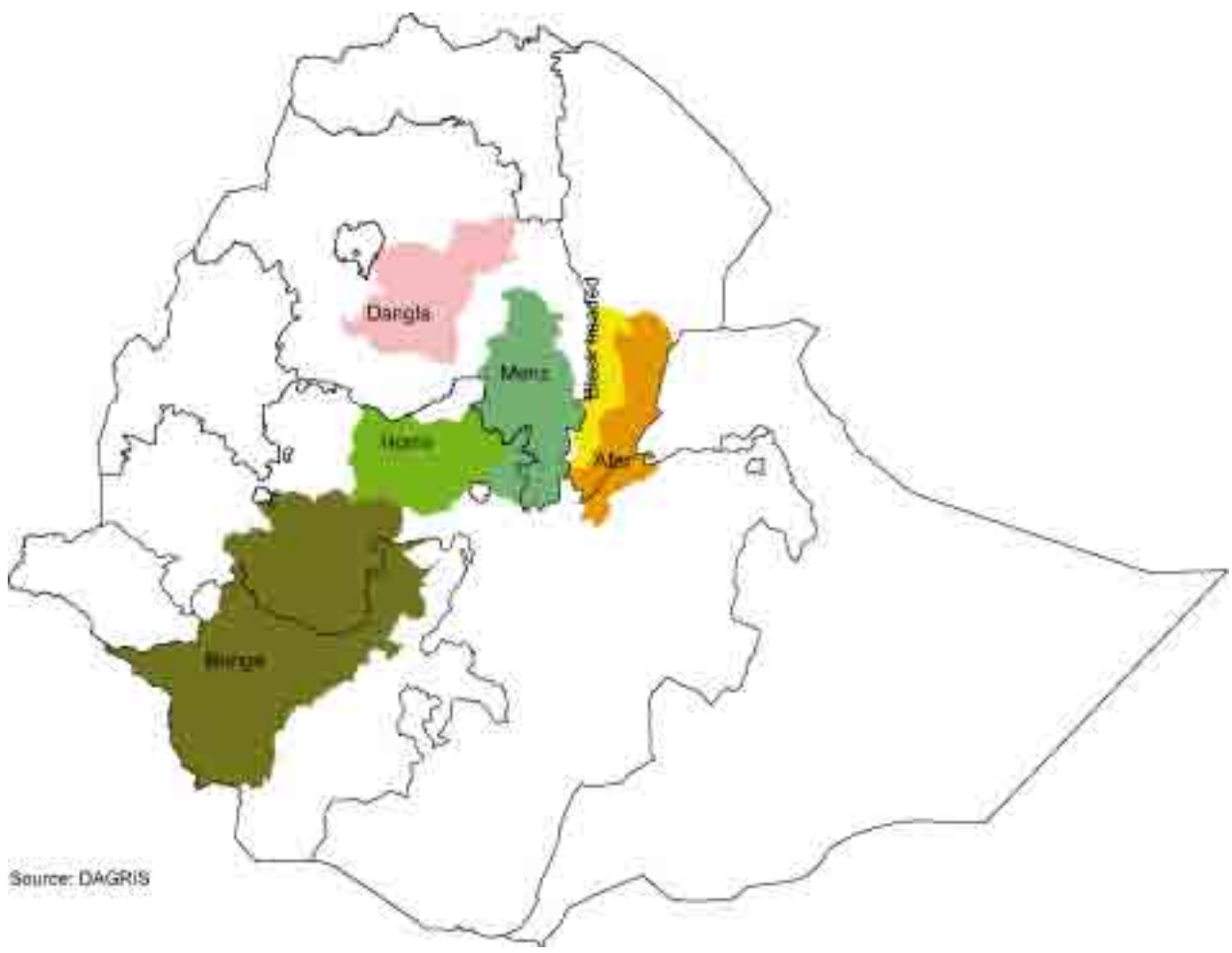
Figure 15. Geographic distribution of goat breeds in Ethiopia.



(a) Abergelle breed



(b) Afar breed



Source: DAGRIS

Figure 16. Geographic distribution of sheep breeds in Ethiopia.



(a) Horro breed



(b) Dangla breed



(c) Menz breed

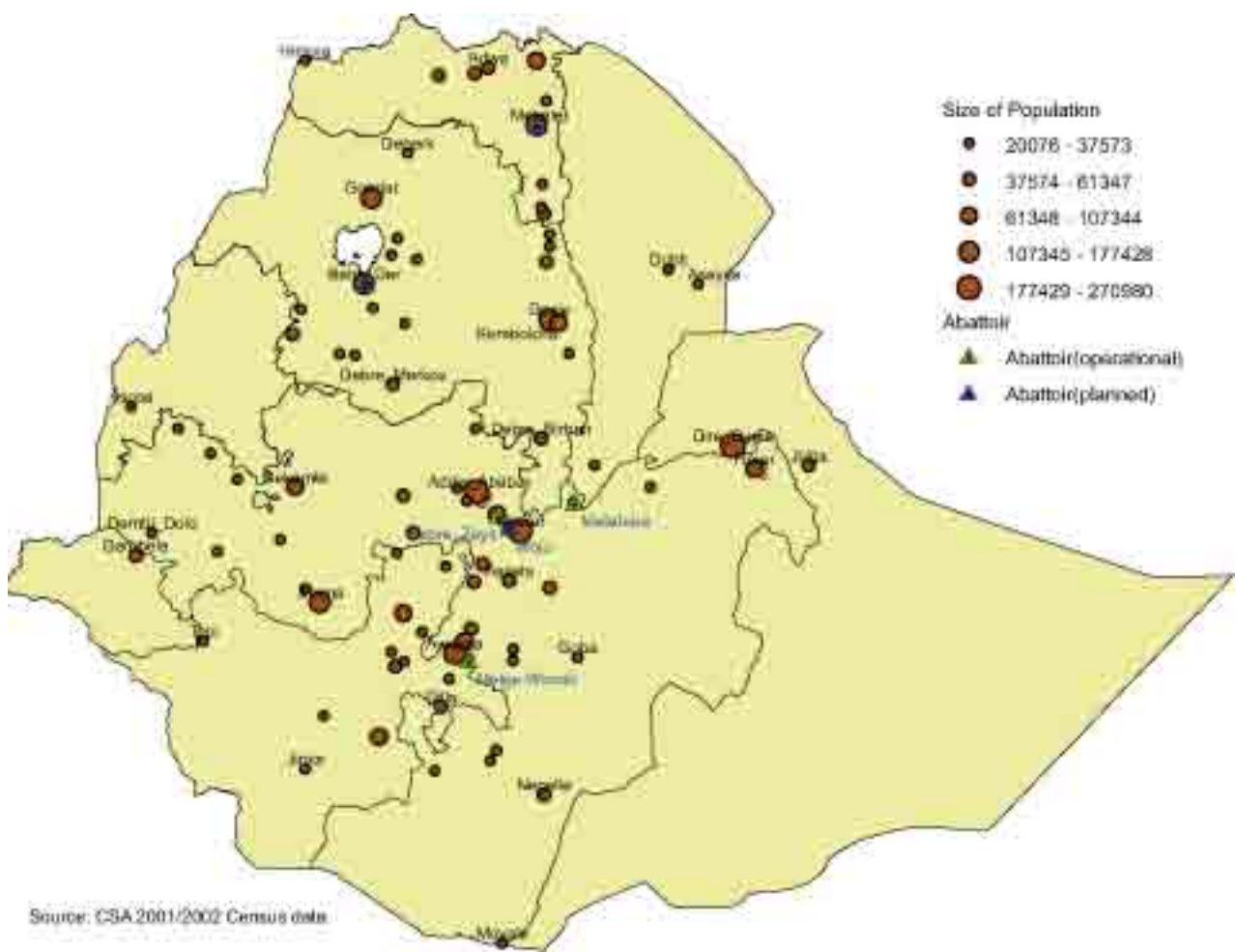


Figure 17. Human population of major urban centres and markets in Ethiopia.

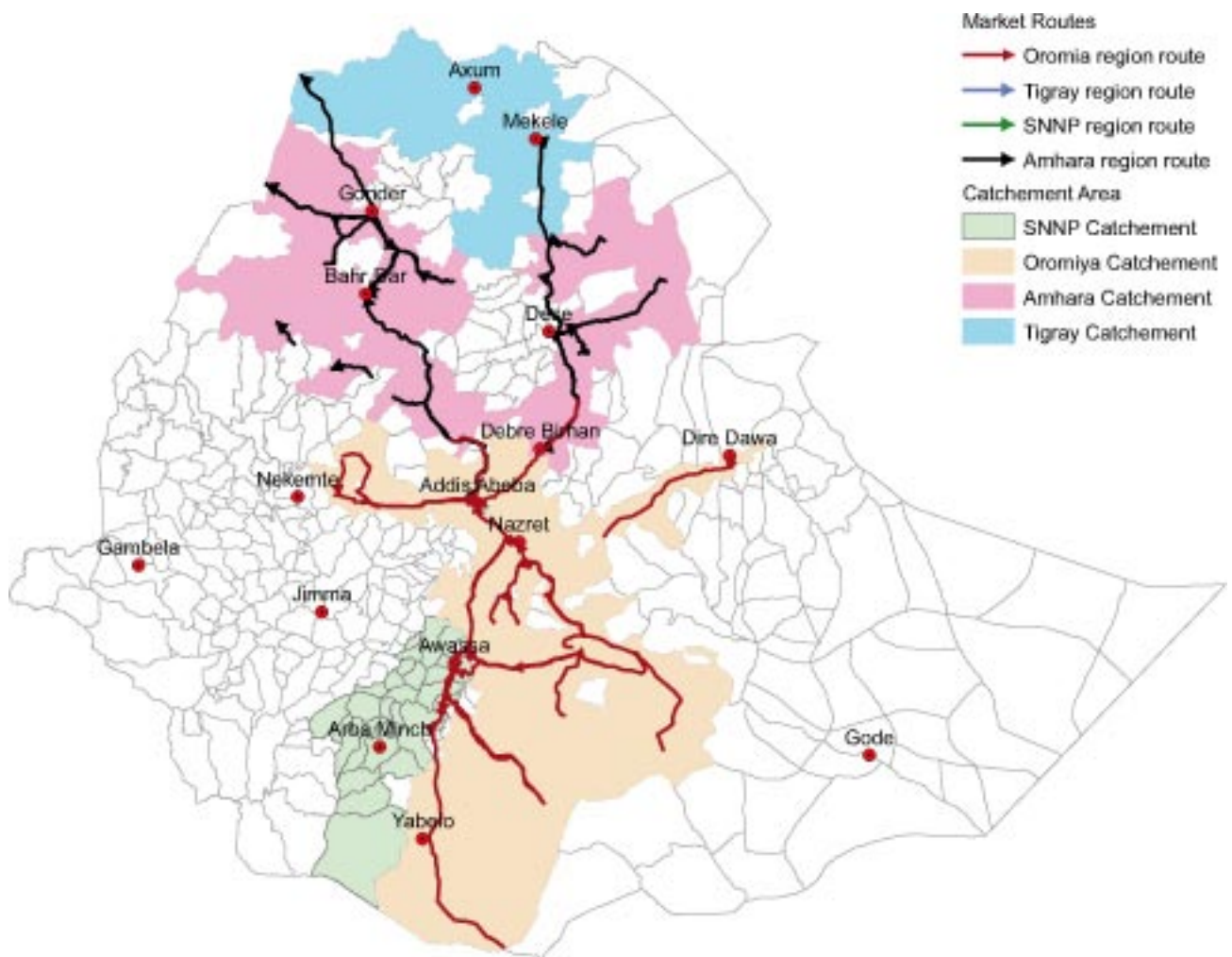


Figure 18. Domestic livestock market routes in Ethiopia.

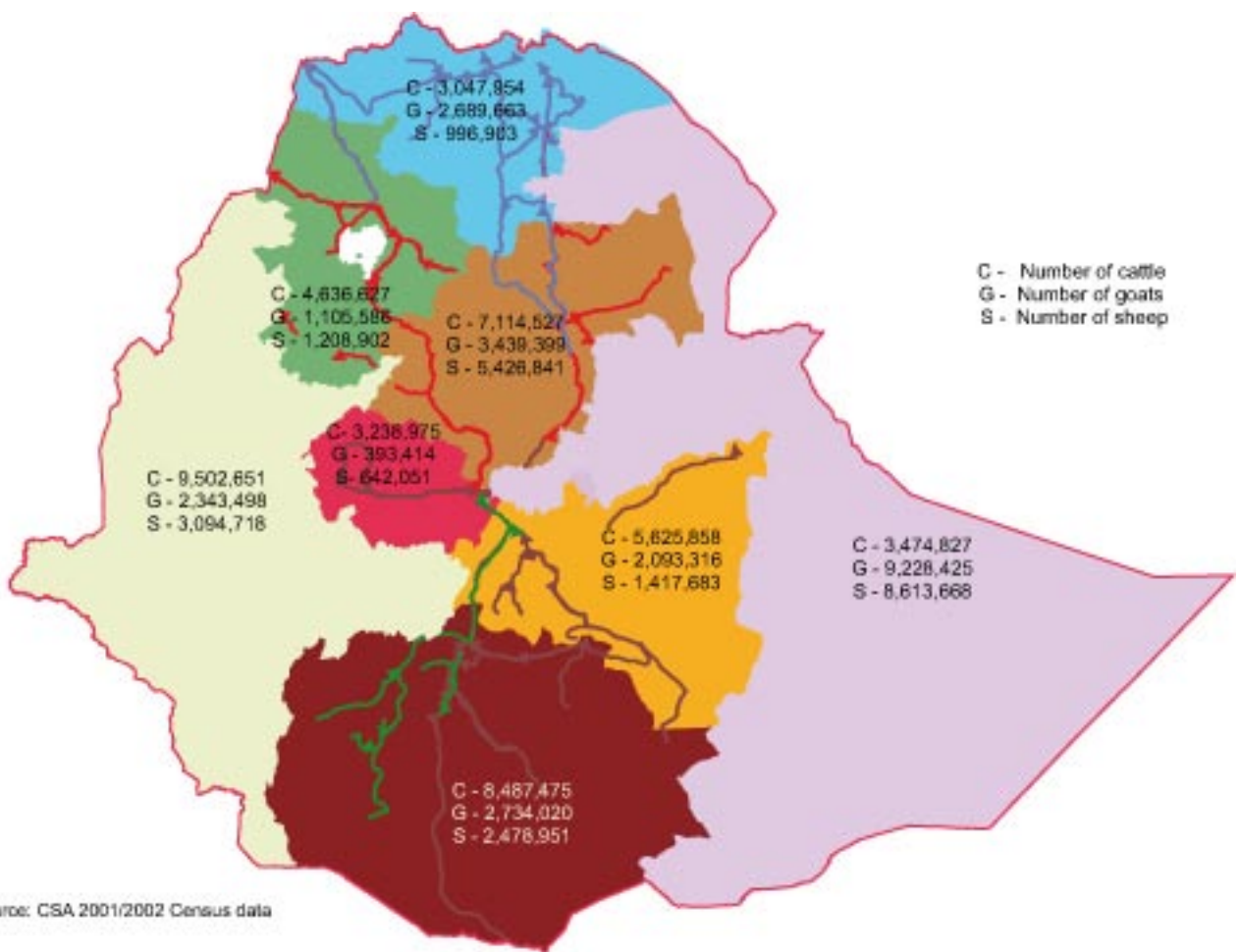


Figure 19. Domestic livestock market routes and livestock population in selected supply sheds in Ethiopia.

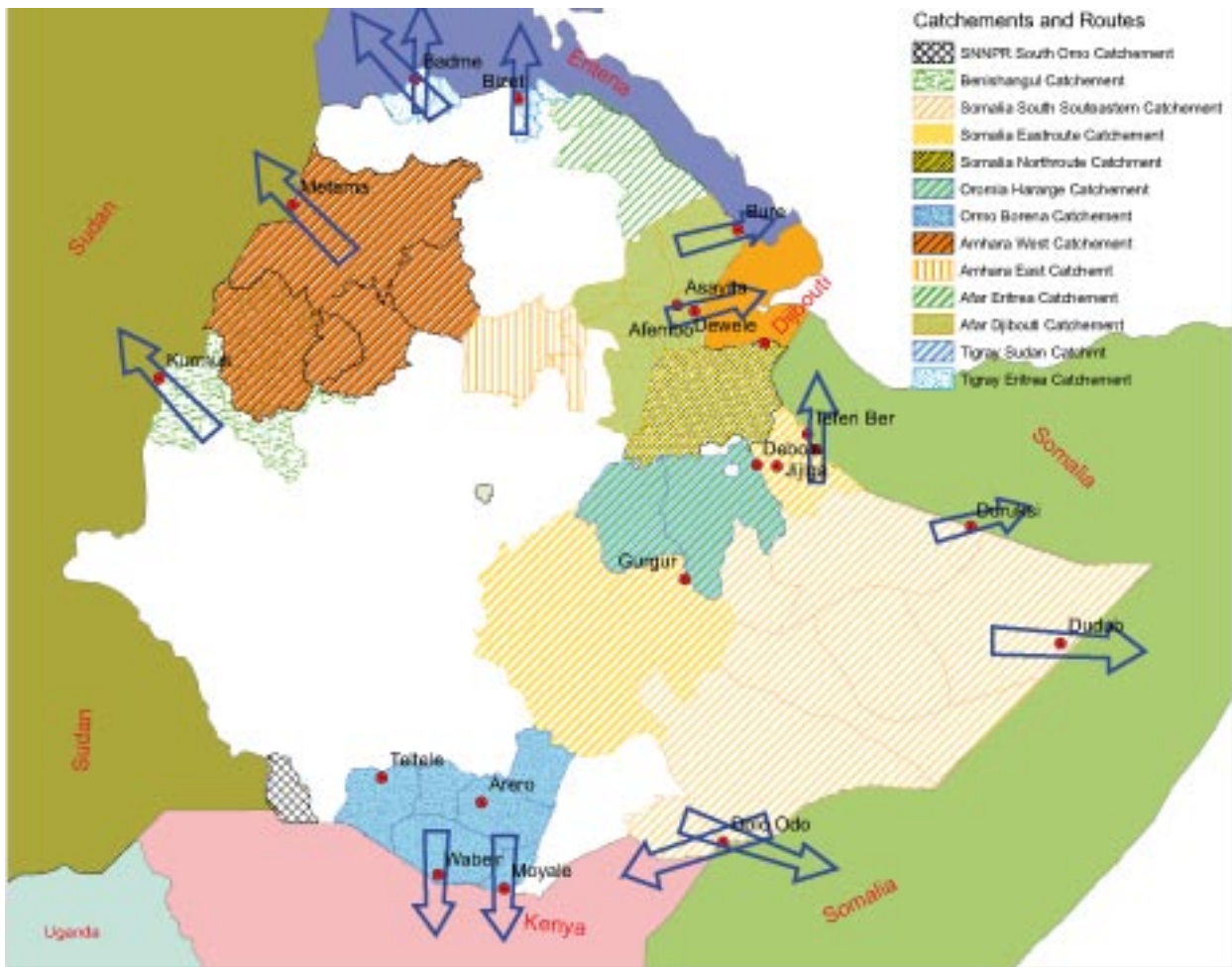


Figure 20. Livestock export routes in Ethiopia.

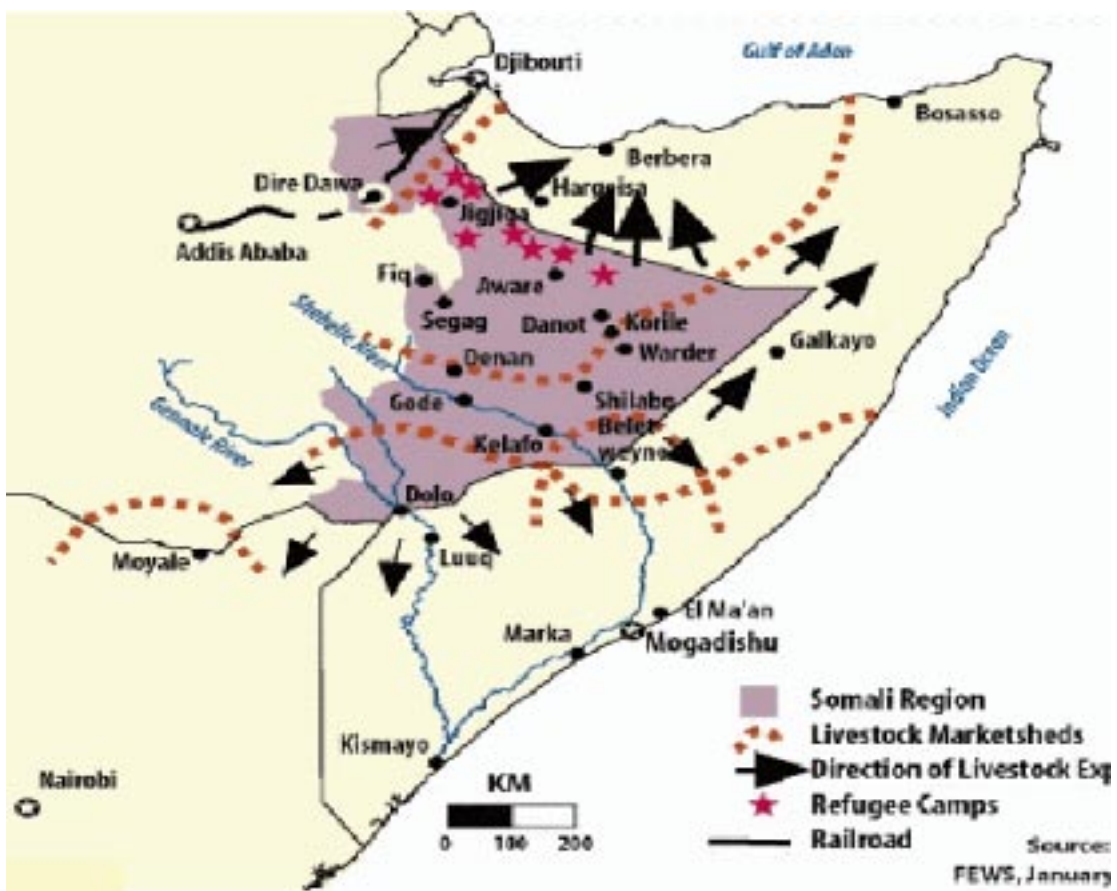
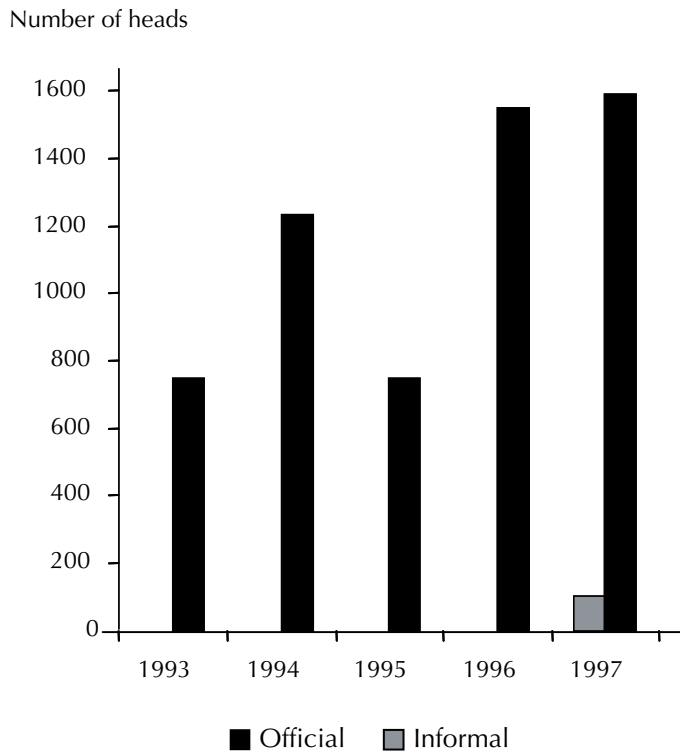


Figure 21. Supply shed for Ethiopian Somali region livestock export.



Source: Ahrens (1998).

Figure 22. *Official and 'informal' exports of livestock through Berbera and Bosasso ports in Somaliland (including those from Ethiopia).*

Appendix A. Markets monitored for retail prices of commodities

Kilil	Code	Zone	Code	Woreda	Code	Town		
Tigray	01	N. Eastern Tigray	01	Tahitay Koraro	04	Endaselasse		
				Aseged Tsembila	06	Endabaguna		
		Central Tigray	02	Lalay Maychew	05	Axum		
		E. Tigray	03	Adawa	04	Adwa		
Afar	02	1	01	Ganta Afeshum	04	Adigrat		
				Wukro	06	Wukro		
		3	04	Mekele	09	Mekele		
				Endamehoni	05	Maychew		
		Amhara	03	5	01	Asayita	01	Asayita
						Dubti	02	Dubti
				N. Gondar	03	Awash Fentale	02	Awash 7 Kilo
						Amibara	01	Melka Werer
				S.gondar	05	Dawe	02	Dawe
						Gondar	19	Gondar
02	Dembia				12	Chuahit		
	Estie				09	Estie (Mekane Yesus)		
	Debre Tabor	11						
	Woldia	17	Woldia					
Oromia	04	N. Wollo	03	Kobo	08	Kobo		
				Dessie	24	Dessie		
		S. Wollo	04	Kombolcha	23	Kombolcha		
				Dessie	24	Dessie		
		N. Shewa	05	Kewet	21	Shewa Robit		
				Debre Birhan	34	Debre Berhan		
		E. Gojam	06	Debre Markos	17	Debre Markos		
				Hulet Eju Enesie	02	Mota		
		W. Gojam	07	Bahir Dar	18	Bahir Dar		
				Dembecha	04	Dembecha		
		Wag Himera	08	Sekota	05	Sekota		
				Dahana	06	Amdework		
		Awi	09	Dangala	01	Dangala		
				Guangua	05	Chagni		
Oromia	04	Oromia	10	Batti	02	Batti		
				Chifie Golana	02	Kemisie		
		W. Welega	01	Dawrahemado	06	Gimbi		
				Gimbi	06	Gimbi		
		E. Welega	02	Seyo	23	Dembidolo		
				Gutowayu	15	Nekemte		
		Illubabur	03	Jamma Horo	07	Shambu		
				Mettu	16	Mettu		
		Jimma	04	Bedele	06	Bedele		
				Kersa	05	Jimma		
		W. Shewa	05	Goma	07	Agaro		
				Ambo	03	Ambo		
		N. Shewa	06	Woliso Ena Goro	22	Woliso		
				Girar Jarso	07	Fichie		
		E. Shewa	07	Hidabu Abote	03	Ejerie		
				Adama	03	Nazret (Adama)		
		Arssi	08	Shashemene	12	Shashemene		
				Tiyo	21	Asela		
W. Hararghe	09	Tena	18	Diksis				
		Chiro	06	Asebe Teferi				
E. Hararghe	10	Kuni	12	Bedesa				
		Gorogutu	13	Boroda				
Bale	11	Haromaya	09	Alemaya				
		Sinna Ena Dinsho	11	Robe				
Borena	12	Adaba	03	Adaba				
		Liben	09	Negele				
Somali	05	Shinlie	01	Hagere Mariam	06	Hagere Mariam		
				Shinlie	03	Shinilie		
		Liben	09	Erer	04			
				Jijiga	03	Jijiga		
				Kebri Beyah	05	Hartishek		
				Moyale	03	Moyale		
	Dolo Odo	02	Dolo					

Kilil	Code	Zone	Code	Woreda	Code	Town	
Benishangul Gumuz	06	Metekel	02	Pawie Liyu	06	Mender 7	
		Asossa	03	Dangur	01	Mambuk	
				Asossa	03	Asossa	
				Bambasi	05	Bambasi	
Kemashe	04	04	Kemashi	03	Kemashi		
			Agelo Meti	04	Agelo Meti		
SNNPR	07	Gurage	01	Mesekanena Marako	06	Butajira	
				Goro	01	Wolkitie	
		Hadeyia	02	02	Limu	01	Hosaena
					Badawacho	03	Shonie
		Kembeta Alabati	03	03	Alaba	04	Alaba
					Angacha	02	Doyugena
		Sidama	04	04	Awassa	02	Awasa
					Hula	07	Hagere Selam
					Bensa	08	Dayu
		Gedio	05	05	Wenago	01	Dilla
					Yirga Chefie	02	Yirga Chefie
		Wolyita	06	06	Sodo Zuria	01	Wolayta Sodo
					Damot Gale	03	Boditi
					Humbo	07	Humbo Tebela
		Gamo Gofa	10	10	Arba Minch	01	Arba Minch
					Gofa Zuria	10	Sawla
		Dawro	17	17	Mareka	01	Waka
					Loma	03	Bestecherie
		Basketo Leyu	18	18	Basketo	01	Lasoka
		Konta Leyu	19	19	Ela	01	Ameya
		Keffa	09	09	Gimbi	05	Bonga
					Chena	07	Chena
		Sheka	08	08	Yeki	03	Tepi
					Masha	01	Masha
		S. Omo	07	07	Bako Gazer	02	Jinka
					Hamer	04	Dimeka
		Bench Maji	11	11	Bench	03	Mizanteferi
					Shewa Bench	02	Shewa Bench
Yim Leyu	12	12	Yem	01	Deri		
Amaro Leyu	13	13	Amaro	01	Kelie		
Burji Leyu	14	14	Burji	01	Soyama		
Konso Leyu	15	15	Konso	01	Karat		
Derashie Leyu	16	16	Derashie	01	Gidole		
Gambella	12	And	01	Gambella	04	Gambella	
		Hulet	02	Abobo	05	Shebo Kire	
Harar	13	Harar	02	Godere	10	Meti	
			01	Hundene	01	Harar	
Dire Dawa	15	Dire Dawa	01	Dire Dawa	01	Dire Dawa	
		Dire Dawa	01	Gurgura	02	Melka Jebdu	
Addis Ababa	14	04	04	12	12		
		03	03	19	19		
		05	05	8	8		
		05	05	10	10		
		03	03	20	20		
		02	02	23	23		
		05	05	25	25		
		01	01	5	5		
		04	04	16	16		
		03	03	17	17		
06	06	27	27				
03	03	28	28				

Appendix B. Domestic livestock market routes

These market routes are local micro routes that connect an area or a primary market with a destination market (secondary or tertiary or terminal) through some intermediate stages. A local market route may originate in a rural area or a primary market located in one administrative domain (*woreda*, zone or region) but serve a destination market (secondary or tertiary or terminal) located in another administrative domain. A particular destination market may be served by several micro market routes.

1 Tigray region

- 1.1. Kemisse → Alamata → Mehoni → Adi Gudo → Mekelle
- 1.2. Alamata → Korem → Maychew → Adi Gudo → Mekelle
- 1.3. Kobo → Sekota → Samri → Abi Adi → Adwa → Axum
- 1.4. Guba Lafto → Sekota → Samri → Abi Adi → Adwa → Axum
- 1.5. Habru → Sekota → Samri → Abi Adi → Adwa → Axum
- 1.6. North Wello → Sekota → Samre → Abi Adi → Adwa → Axum
- 1.7. Humera → Axum
- 1.8. Humera → Mekelle
- 1.9. Sehota → Temben → Mekele
- 1.10. Kobo → Waja → Alamata → Debub → Adigudom → Mekele – cattle
- 1.11. Sekota → Korem → Maichew → Mehoni → Debub → Adigudom → Mekele – sheep, cattle
- 1.12. Sekota → Finarwa → Samre → Mekele – shoats
- 1.13. Sekota → Finarwa → Yechila → Adwa → Axum – shoats
- 1.14. Yechila → Gijet → Mekele – shoats
- 1.15. Zarema → Tselmti → Endada Guna → Shire – goats
- 1.16. Adiabo → Shire → Adwa → Bizet – cattle, goats
- 1.17. Adiabo → Medebay Zana → Chila → Rama – cattle, goats
- 1.18. Adiabo → Medebay Zana → Seleklek → Axum → Adwa → Bizet – cattle, goats
- 1.19. Fiyelwaha Zarema → Tselmti Maitebre → Endaba Guna → Adidaeiro – goats
- 1.20. North Gonder → Dansha → Humera – shoats
- 1.21. Gugubdo → Chercher → Mehoni → Mekele – cattle, goats
- 1.22. Shiket → Quiha → Mekele – cattle, goats
- 1.23. Berahile → Wukro → Adigrat – goats, cattle
- 1.24. Berahile → Endalelassie (Dera) → Edaghamuse → Adigrat – shoats

2. Amhara region

A. East Gojam administrative zone

- 2.1. Mota → Bichena → Dejen → AA
- 2.2. Debre Werk → Bichena → Dejen → AA
- 2.3. Debre Markos → Dejen → AA
- 2.4. Mota → Bahirdar
- 2.5. Lay Gaint → Zemend → Bahir Dar – sheep
- 2.6. Lay Gaint → Zemend → Alefa → Metema

- 2.7. Alefa → Metema – cattle
- 2.8. Metekel → Pawe – cattle
- 2.9. Metekel → Benshangul – cattle
- 2.10. Chilga → Addis Zemen → Marawi – cattle
- 2.11. Chilga → Addis Zemen → Achefer – cattle
- 2.12. Chilga → Addis Zemen → Bahir Dar – cattle
- 2.13. Kemissie → Kembolcha → Bati – goats, cattle
- 2.14. Kobo → Woledia → Dessie → Kombolcha – sheep, cattle
- 2.15. Demebecha → Bure → Shindi – cattle, sheep
- 2.16. Alefa → W Tseged → Tigray – cattle
- 2.17. Alefa → Sanja → Humera – cattle
- 2.18. North Gondar → Lay Armacheho → Debark → Aderkay – cattle
- 2.19. North Shewa → Addis Ababa → Marawi – cattle
- 2.20. Kobo → Raya – cattle

B Wello administrative zone

- 2.21. Mile → Bati → Debre Berhan → Addis Ababa
- 2.22. Dubti → Bati → Debre Berhan → Addis Ababa
- 2.23. Kalu → Bati → Debre Berhan → Addis Ababa
- 2.24. Werebabau → Bati → Debre Berhan → Addis Ababa
- 2.25. Bati Market → Woldya → Mekelle

3 Oromia region

A Bale administrative zone

- 3.1. Arsi Negele → Shashemene → Adama → AA
- 3.2. Arsi Negle → Dilla → Yirg Cheffe
- 3.3. Adaba → Shashemene → Adama → AA
- 3.4. Delo Mena → Goba → Shashemene → Adama → AA
- 3.5. Melka oda → Ginir → Gasera → Adama → AA
- 3.6. Melka oda → Robe → Shashemene → Adama → AA
- 3.7. Haro → Robe → Dera → Adama → AA
- 3.8. Meliyu → Robe → Dera → Adama
- 3.9. Delo Sebro → Gasera → Dera → Adama
- 3.10. Ali → Robe → Dera → Adama
- 3.11. Robe → Adama
- 3.12. Robe → Shashemene
- 3.13. Goba → Dera
- 3.14. Goba → Dodola → Assela → Dera → Nazret (Adama)
- 3.15. Dinsho → AA
- 3.16. Raytu → AA
- 3.17. Moyale → Yabello → Hager-Mariam → Wenago → Dilla → Negele
- 3.18. Yabello → Hagere-Mariam → Dilla → Shashemene → Nazret (Adama)
- 3.19. Tula → Shashemene → Debre Zeit – shoats

- 3.20. Tula → Shashemene → Debre Zeit → AA – shoats, cattle
- 3.21. Wenage → Awassa → Shashemene → AA – shoats, cattle
- 3.22. Sen Bate → Debre Berhan → Sheno Kotu → Addis Ababa – shoats, cattle
- 3.23. Dodola → Sagure → Asela → Dera → Nazret (Adama) → Debre Zeit – cattle, shoats
- 3.24. Shashemene → Koka → Mojo → Debre Zeit → AA – cattle, shoats
- 3.25. Arsi Negelle → Koka → Mojo → Debre Zeit → AA – shoats, cattle
- 3.26. Negele Borena → Koka → Mojo → Debre Zeit → AA – cattle, shoats
- 3.27. Water → Tulo → Mieso → Nazret (Adama) → Debre Zeit → AA – cattle
- 3.28. Guder → Ambo → Ginchi → Addis Ababa – cattle, shoats
- 3.29. Kuyu → Ginbichu → Fiche → Debre Libanos → Sululta → AA – cattle, shoats
- 3.30. Kofele → Guguma → Tula – shoats, cattle
- 3.31. Kofele → Shashemene → Awassa → Tula – shoats, cattle
- 3.32. Arsi Negele → Shashemene → Awassa → Tula – shoats, cattle
- 3.33. Negele Borena → Hagre Selam → Aleta Wondo → Awassa – shoats, cattle

B Arsi administrative zone

- 3.34. Tiyo → Golja market → Asela → Dera → Adama
- 3.35. Kersa → Golja market → Asela → Dera → Adama
- 3.36. Golja *woreda* → Golja market → Asela → Dera → Adama
- 3.37. Tiyo → Dera → Adama → AA
- 3.38. Kersa → Dera → Adama → AA
- 3.39. Bokoji → Dera → Adama → AA
- 3.40. Boru Jawa → Dera → Adama → AA

C Wollega zone

- 3.41. Shambu → Bako → Guder → Meti → Beroda → Legebatu → Chiri → AA
- 3.42. Shambu → Gedo → Guder → Meti → Beroda → Legebatu → Chiri → AA

D Hararghe zone

- 3.43. Mechara → Gelemso → Bedesa → Chelenko → Kersa → Dire Dawa

4 SNNPR

A Gamogofa administrative zone

- 4.1. Teltele → Konso → Arba Minch → Welayta Sodo → Adama
- 4.2. Teltele → Konso → Arba Minch → Welayta Sodo → Adama → AA
- 4.3. Kemba → Arba Minch → Chano Mille → Welayita Sodo → Adama → AA
- 4.4. Chenchu → Arba Minch → Chano Mille → Welayita Sodo → Adama → AA
- 4.5. Gofa → Kucha → Welayita Sodo → Adama → Addis Ababa
- 4.6. Soddo (Damota) → Boditi → Koito → Shashemene → Addis Ababa
- 4.7. Dale → Aleta Wendo → Wenago – shoats, cattle
- 4.8. Dale → Tula → Awassa – shoats, cattle
- 4.9. Dimitu (Wolayita) → Belela (Bonicha) → Dale – shoats, cattle

- 4.10. Dimitu → Belela → Dale → Wonago – shoats, cattle
- 4.11. Dimitu → Belela → Dale → Tula – shoats, cattle
- 4.12. Dimitu → Belela → Dale → Tula → Awassa – shoats, cattle
- 4.13. Dimitu → Belela → Tula → Awassa – shoats, cattle
- 4.14. Dimitu → Belela → Shebedino → Tula – shoats, cattle
- 4.15. Kuraz → Konso → Arbamnich → Wolyita → Awassa
- 4.16. Alaba → Shashemene → Debre Zeit – shoats
- 4.17. Alaba → Shashemene → Debre Zeit → AA – shoats, cattle
- 4.18. Dale → Gelana Abaya → Dila → Yirgachefe → Hagremariam – cattle
- 4.19. Dale → Tula → Shashemene → Debre Zeit – shoats, cattle
- 4.20. Dale → Tula → Shashemene → Debre Zeit → AA – shoats, cattle
- 4.21. Kuraz → Konso → Arbamnich → Wolyita → Awassa → Debre Zeit – shoats
- 4.22. Kuraz → Konso → Arbamnich → Wolyita → Awassa → Debre Zeit → AA – shoats, cattle
- 4.23. Wenago → Awassa → Shashemene → Addis Ababa – shoats, cattle

Source: Mitiku Gobana, personal communication (unpublished data).