Design, execution and analysis of the livestock breed survey in Oromiya Regional State, Ethiopia

Oromiya Agricultural Development Bureau

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INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

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Table of contents

Acronyms

AEZ	Agro-ecological zone
AHC	Agglomerative hierarchical clustering
AnGR	Animal genetic resources
ARTP	Agricultural Research and Training Project
CBPP	Contagious bovine pleuro-pneumonia
CCPP	Contagious caprine pleuro-pneumonia
DA	development agents
EARO	Ethiopian Agricultural Research Organization
FAO	Food and Agriculture Organization of the United Nations
FMD	Foot-and-mouth disease
ha	hectare
HH	households (number of)
ILRI	International Livestock Research Institute
masl	metre above sea level
OADB	Oromiya Agricultural Development Bureau
OARI	Oromiya Agricultural Research Institute
PA	Peasant association
PCA	Principal component analysis
PPR	*Peste des petits ruminants*
SADC	Southern Africa Development Community
sd	standard deviation (of the sample)
se	standard error (of the mean)
UNDP	United Nations Development Programme

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The research team is also heavily indebted to Mr Asfaw Tolossa of the Oromiya Agricultural Development Bureau (OADB) who served as the main link between the research team, OADB in Addis Ababa and the field staff of the OADB at zone and district levels throughout the implementation of this study and without whom this study would not have been possible.

Dr Edward Rege of the International Livestock Research Institute (ILRI) initiated the project and provided overall supervision. Dr Enyew Negussie, during his stay at ILRI up to the middle of 2000, led the first part of the project, which involved the development of the questionnaires, sampling frame and field co-ordination of the survey. Ms Anette van Dorland, an Associate Professional Officer at ILRI between 01 April 2000 and 30 April 2003 with support from the Government of The Netherlands, led the second part of the project, and co-ordinated the remainder of the field data collection, supervised the data entry and analysed the data on cattle (Chapter 10). At the request of the OADB, the ILRI team composed of Dr Workneh Ayalew, Mr Gemechu Degefa, Dr Markos Tibbo and Ms Yetnayet Mamo analysed data on sheep, goats and secondary species and produced chapters 11, 12 and 13 of this report. Dr John Rowlands provided biometric assistance at various stages in the process from survey design to report writing.

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Foreword

This report presents a comprehensive description of the methods used in the planning, execution and analysis of the livestock breed survey conducted in the Oromiya Regional State of Ethiopia between 2000 and 2003, as well as a baseline set of results of data analysis. It has 15 chapters. The first nine chapters describe the background of the study, its planning and implementation. Chapters 10, 11 and 12, respectively, present results of the survey on cattle, sheep and goats, which are considered in this survey as primary livestock species or entry points for the design and execution of the study. Chapter 13 deals with secondary species, namely chickens, donkeys, horses, mules and camels, which were captured in the survey based on consideration of the primary species. Pigs were also included in the list of secondary species, but the data generated is too small to be included in the results as only a handful of households reported maintaining pigs. The last two chapters present an evaluation of the survey process and concluding remarks. The three questionnaires developed and administered in this survey are presented in the accompanying CD-ROM of the report, together with the coat colour chart developed and successfully used in the survey. The CD-ROM also contains breed descriptors and outputs of the supervisors training and reporting back workshops.

This livestock breed survey was a collaborative initiative between the Oromiya Agricultural Development Bureau (OADB) and the International Livestock Research Institute (ILRI). The United Nations Development Programme (UNDP) funded this initiative. ILRI took charge of the design, execution and analysis of the data generated in consultation with OADB. This survey highly benefitted from the experiences in the implementation of a similar livestock survey project, supported by the Food and Agriculture Organization of the United Nations (FAO) that ILRI undertook in Zimbabwe in collaboration with the University of Zimbabwe and the Matapos Research Station. This work is undertaken as part of ILRI's continuing research on the characterisation and conservation of indigenous animal genetic resources with emphasis on providing essential research tools and building human capacity in collaborating national institutions to carry out related research as well as development activities.

The survey primarily aims to provide a wide range of baseline data on livestock production, mainly cattle, sheep and goats (primary species) but also chickens, donkeys, horses, mules and camels (secondary species) in Oromiya Regional State. It also aims at developing and testing a livestock field survey methodology as a tool for breed characterisation. The survey has, however, failed short of identifying the indigenous breed types of the major livestock species due to unforeseen limitations of the data collected and especially because of the many ways farmers identify their livestock breed types. An appropriate statistical procedure was identified and demonstrated on a subset of the data to help achieve this last objective.

Despite a very short planning and implementation time, the survey was generally implemented successfully, with the key lesson that the time needed for such surveys should not be underestimated. It is hoped that the baseline information generated can support future livestock development activities, and the survey tools developed can be extensively used and adapted for similar purposes in and outside Oromiya Regional State.

1 Project background and objectives

1.1 Background

Oromiya Regional State is Ethiopia's largest region covering over 30% of the country. It is characterised by immense geographical and climatic diversity with altitudes ranging from below 500 metres above sea level (masl) to over 4300 masl. The climatic types prevailing in the region may be grouped into three major categories: dry, tropical rainy, and temperate rainy climate. Annual rainfall is variable, ranging from 1600–2400 mm in the highlands and less than 400 mm in the semi-arid lowlands. The diversity in altitudes and climatic types has resulted in a variety of habitats. The selection pressure of these habitats on domestic animals, and the human selection for domestic animals suited best for their needs, has led to the development of a variety of localised livestock breeds and strains. These breeds/strains or breed types are well adapted to the specific local environments in which they are kept.

Only limited technical information is available on domestic animal genetic resources in Oromiya Regional State, and in the country as a whole. There is a need to characterise the diverse livestock breeds/strains, so that action can be taken to develop them, to meet the current and future demands for animal products, to conserve existing indigenous breeds so that genetic diversity is not lost for future generations, and to develop programmes for genetic improvements. Characterisation of domestic animal genetic resources (AnGR) includes all descriptive features that could be used to provide better knowledge of the resources and their status (FAO 1999). Characterisation of domestic AnGR helps to identify breeds and/or populations, along with their specific traits, which can be used in livestock development programmes. Characterisation can also identify breeds and/or populations, which are at risk of extinction or breeds that are highly desired by farmers. Both categories provide important inputs into national livestock development planning.

In 2000, in response to the situation described above, the Oromiya Agricultural Development Bureau (OADB) and the International Livestock Research Institute (ILRI) undertook the 'Oromiya–ILRI livestock breed survey' project to characterise domestic livestock breeds and their husbandry practices in Oromiya Regional State.

1.2 Objectives

The overall objective of the livestock breed survey was to identify and describe the indigenous animal genetic resources (AnGR) of Oromiya Regional State and the production systems in which they are found. In addition, it aimed to describe the economic, social and cultural roles of AnGR as well as farmers' preferences for traits and breeds.

The emphasis of the survey was on pure indigenous livestock, but information was also collected on crosses between indigenous with exotic breeds, as well as on pure exotic breeds. An additional objective of this study was to assess the suitability of the field survey methodology and questionnaire design applied as a tool for breed characterisation.

It is hoped that the generated baseline information can support future livestock development activities, identify possible causes of threat for AnGR and indicate possible actions to mitigate their impacts.

2 Planning and organisation of activities

2.1 Planning

The planning and organisation of a livestock breed survey requires careful attention. Good planning will ultimately result in a good course of events, which in turn will lead to a good result. From our experience, a period of at least six months should be allowed for the planning of a survey of this nature. The following activities were undertaken for the Oromiya Regional State survey:

- preliminary planning meetings, seeking collaborators and agreeing on the objectives of the survey
- establishment of guidelines for administration and organisation, making decisions on how to implement the survey activities and on who should be involved in doing what
- survey design planning and preparation, including: 1) collecting information on households, animal numbers etc. to assist in the planning and preparation of the survey design; 2) preparing survey sampling frame; 3) preparing survey materials and questionnaires, instruction manuals, descriptor lists, colour charts etc.
- pilot survey for pre-testing the survey material, to test the survey materials and to refine them if necessary
- preparation of briefing workshops for zonal livestock experts
- discussions by telephone on issues related to logistics required for the survey (it was not possible to make planned visits to selected survey sites prior to the survey for this purpose as well as to create awareness in the community) and
- putting in place plans for data entry and analysis.

The general administrative organisation set up for the implementation of the survey was based on the administrative structure in Oromiya Regional State. At the time of the planning of the survey, Oromiya Regional State comprised 12 administrative zones, 180 *woredas*, 5386 peasant associations (PA) and some 3.5 million households (Oromiya Physical Planning Department 2000). The distribution of the *woredas* is shown in Figure 2.1.

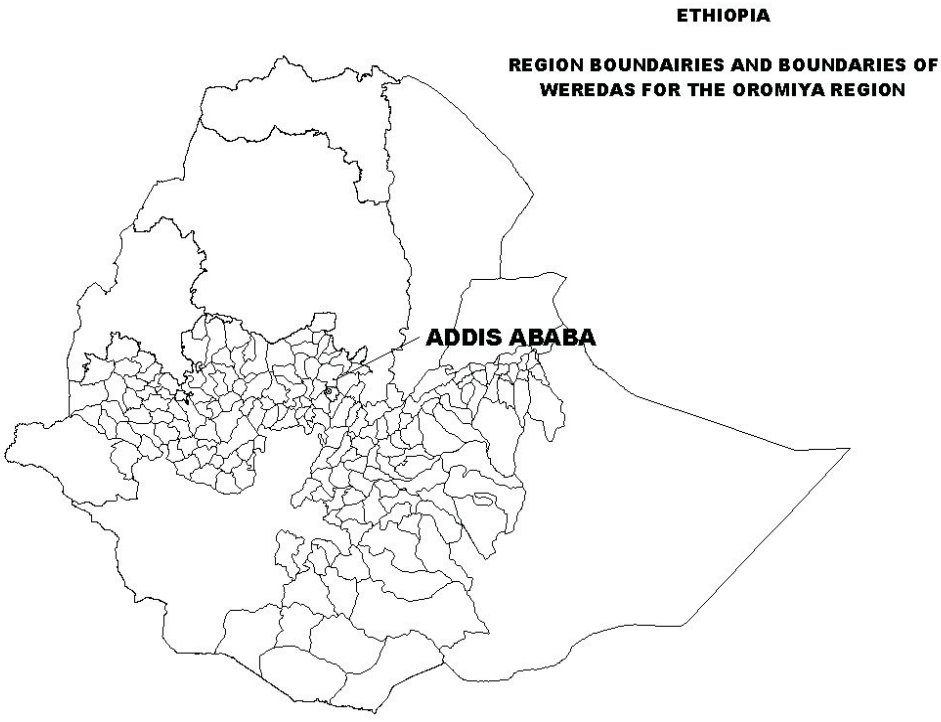


Figure 2.1. *Administrative structure of Oromiya Regional State in 2000.*

2.2 Organisation

There are agricultural offices in all 12 zones of Oromiya Regional State, with sub-offices at the *woreda* level, and offices for development agents at the PA (village) level. Livestock experts from the zonal offices were appointed as focal points for communication for each zone in the region. Following the selection of the survey sites and households, zone supervisors appointed *woreda* livestock experts from the sub-offices in the selected *woredas* as *woreda* supervisors. They in turn identified development agents as enumerators at the PA level.

A single preparation workshop was organised for all zonal livestock experts in order to create awareness on the background of the project and its objectives. The workshop also served as a consultation forum whereby livestock experts from the different zones provided background livestock information useful for the initial design of the project activities. The workshop also helped the OADB–ILRI team in developing a survey design and sampling frame for each zone, and in planning for field activities.

2.3 Activities

Planning is the first activity in a breed survey. The second activity is the implementation of the planned activities. Figure 2.2 shows the activities of the breed survey along a time line. Each of these activities lasted about eight months. Field work was followed by data entry, which took about nine months, as well as data analysis and report writing. The time taken by these activities was determined by the scope of the survey, the timeliness of the field work (e.g. timing of field activities as preferred by enumerators and farmers), resource availability (e.g. the number of computers and data-entry assistants) and the available budget.

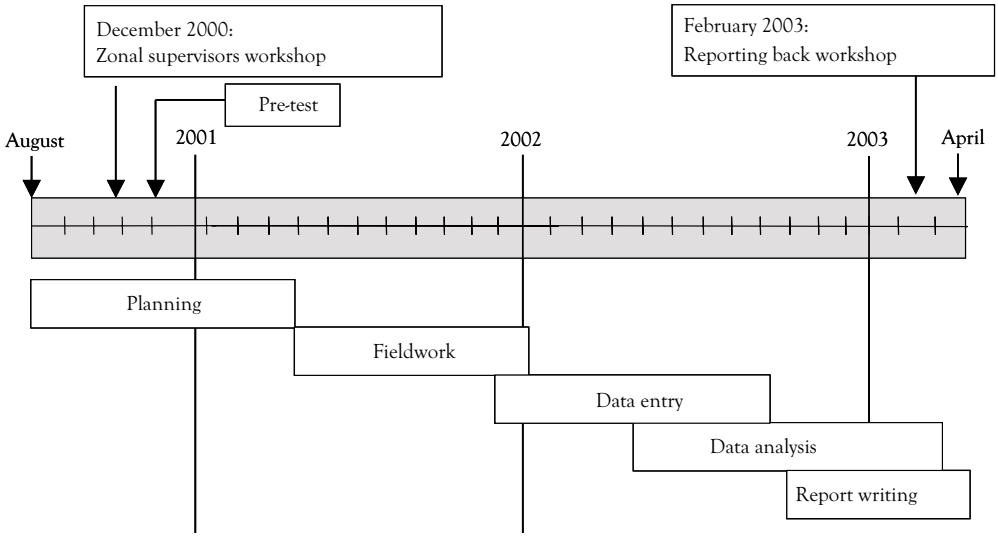


Figure 2.2. *Time schedule of project activities in Oromiya Regional State.*

3 Development and design of sampling frame

3.1 Sampling

Before designing the livestock breed survey in Oromiya Regional State, different approaches to sampling were considered.

There are different types of sampling methods. The first is known as cluster sampling. Within any of the regions in Ethiopia, households come under a hierarchy of administrative units. First, there is division by administrative zones. At the time of execution of the survey, there were 12 zones in Oromiya Regional State. The administrative layer below the zonal level is known as the *woreda* and below that, the peasant association (PA). Within each PA there are many households. As was mentioned in Chapter 2, there were 180 *woredas* within the 12 zones and 5386 PAs within the 180 *woredas* when the survey was planned. This hierarchical structure is illustrated diagrammatically in Figure 3.1. In the cluster sampling method, samples are selected at each layer and in turns. Thus, in Figure 3.1 two zones (marked by large dots) were selected, and one *woreda* was picked up from each of these zones, and then two PAs were selected from one *woreda* and one PA from the other selected *woreda* was included in the sample.

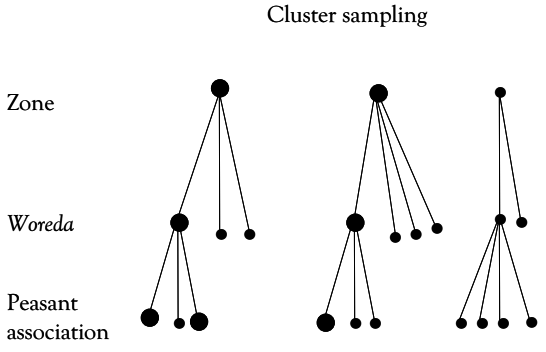


Figure 3.1. *Diagrammatical illustration of the process of sampling by clusters (large dots represent selected sampling units).*

Another method of sampling that can be used alongside cluster sampling is stratified sampling. *Woredas* within a zone may vary with respect to different characteristics. Thus, some *woredas* are situated in *dega* (highland) areas, others are found in *weinadega* (midland) areas, others in *kolla* (lowland) areas and still others are situated in mixed altitude agro-ecological zones (AEZs). A completely randomised sample may miss *woredas* from

one of these areas. Likewise, some *woredas* are situated in areas of high livestock densities, while others could be in areas where the livestock population is low. Grouping *woredas* by AEZs and livestock densities and taking samples from each group can cover all areas. This principle was applied in this survey, both at the zonal level, where AEZs and livestock densities were considered, and at the *woreda* level where, in those *woredas* that were spread over more than one AEZ, PAs were grouped by AEZ. In the survey, farming systems were not considered for stratification purposes but it is a factor that might be considered in future surveys, depending on the general objectives of a livestock breed survey. A different form of stratification was considered at the PA level, namely stratification by number of livestock in the household and whether they had cattle, sheep or goats.

Having decided on methods to be used for stratification, alternative approaches for sampling zones, *woredas*, PAs and households for the sample need to be considered. There are essentially four methods of sampling: random, representative, convenience and purposive. Random sampling is the only method that allows unbiased estimation of population size. Samples are drawn completely at random, each with an equal chance of being chosen. This method was essentially applied to select households from PAs and to choose PAs from selected *woredas*. For *woredas,* which were themselves stratified by AEZs, sampling was done within each stratum. When working at the PA level it may not be easy to select households at random. An approximate method that is sometimes applied is to define a series of trajectories and, walking along them, take every fifth household, say, until the required number of households has been attained for each stratum. This produces a sample that can be considered to be sufficiently random for the purposes of the survey. For Oromiya Regional State, however, a more rigorous approach was adopted and households were selected from a list of households compiled for the whole PA. One disadvantage of this was that enumerators often had to travel long distances from one household to another.

Under the representative sample approach, samples are selected in such a way that the final selection of units is felt to be representative of the sub-population being sampled. This method was applied in the selection of *woredas*. Whilst achieving a representative assessment of the distribution of livestock across a zone, the method, on the other hand, makes estimation of overall number of the population in the zone more difficult.

Sometimes it may be difficult to reach a PA or certain households within a PA, and, to make the best use of available manpower, it is more convenient to instead choose a PA or household that is more accessible. Such a method of sampling is known as convenience sampling. The occasional use of this method is inevitable in such a survey, but, provided such cases are few, it may be reasonable to assume randomness for the purpose of estimation of number of the population.

The fourth method is purposive sampling. Under this method, sampling is based, for example, on knowledge of a known farming system or of a breed known to be unique to a certain area. It may not be reasonable to include such a sample for calculation of population estimates. On the other hand, it may be important to capture information related to the conservation of an indigenous breed. This method was sometimes applied in the Oromiya Regional State livestock breed survey where zonal supervisors were asked to

provide information on any known pockets of unique breeds of livestock or special areas that might be included.

3.2 Sampling frame

After deciding on the general approach for selecting households to be included in the survey a sampling frame can be drawn up. For the Oromiya Regional State it was decided to sample all zones, a sample of *woredas* to be chosen within each zone and a sample of PAs within each selected *woreda*. The sampling frame can thus be thought of as follows:

- zone (*woredas* within each zone were stratified by AEZs and livestock densities)
- *woreda* (PAs within each *woreda* were stratified by AEZ) and
- PA (households within PA were stratified by number of animals they keep).

Figure 3.2 illustrates how *woredas* were selected for sampling from one of the zones, namely East Wellega. Data on number of cattle, sheep and goats in each *woreda* as well as on physical and socio-economic profiles of the 180 *woredas* of the Oromiya Regional State were obtained from the Council of Regional State of Oromiya, Bureau of Planning and Economic Development (Oromiya Physical Planning Department 2000). The total livestock density per km^2 was calculated for each *woreda* and ranked as low, medium, high and very high. At the same time, *woredas* were characterised by AEZs (*dega*, *weinadega* and *kolla*) and sorted according to the proportion of *weinadega* area in the *woreda*. Five of the 17 *woredas* were then chosen to provide a cross-section of *woredas* both by livestock densities and type of AEZs (Figure 3.2). Similar processes were carried out in the other zones. As can be seen, the sampling method was representative, not random. A selection of *woredas* was made first by ILRI, and its recommendation forwarded to field staff from the zonal agricultural offices for verification. In some cases, the Bureau made further modifications. An alternative representation of the way in which *woredas* were selected is illustrated in Figure 3.3. This figure shows the different categories by AEZ, the number of *woredas* that fell into the different categories, and the number of *woredas* selected.

Peasant associations were chosen at random from each of the selected *woredas* after taking account of the number of livestock kept in each PA. For Sibu Sire and Limu, which covered more than one AEZ (see Figure 3.2), PAs were first grouped by AEZ and the PAs to be sampled chosen at random from the different zones. The selection of PAs for East Wellega Zone is illustrated in Figure 3.4. The complete sampling frame for East Wellega Zone down to the PA level is displayed in Figure 3.5. This figure also shows the total number of *woredas* in East Wellega, the total number of PAs in each selected *woreda* and the total number of households in each selected PA from which the sample was chosen. Similar sampling processes were adopted for the other 11 zones.

Woredas sorted by livestock densities				*Woredas* sorted by agro-ecological zones				
Woredas		Livestock per km^2	Livestock densities	*Woredas*		Agro-ecological zones (%)		
Name	No.			Name	No.	*Weinadega*	*Kolla*	*Dega*
Abe Dongoro	2	13	Low	Sasiga	14	0	100	0
Sasiga	14	14	Low	Abe Dongoro	2	0	0	100
Wama Boneya	16	22	Low	Jimma Horro	11	0	0	100
Ebantu	6	25	Low	Jimma Arjo	10	33	33	33
Limu	12	35	Medium	Sibu Sire	15	33	33	33
Amuru Jarte	3	35	Medium	Wama Boneya	16	38	47	15
Nunu Kumba	13	50	Medium	Abay Chomen	1	50	50	0
Gidda Kiremu	7	52	Medium	Ebantu	6	50	50	0
Jimma Arjo	10	71	High	Limu	12	50	40	0
Guduru	8	72	High	Bila Sayo	4	50	0	50
Diga Leka	5	73	High	Diga Leka	5	50	0	50
Guto Wayu	9	73	High	Jimma Rare	17	50	0	50
Sibu Sire	15	74	High	Amuru Jarte	3	100	0	0
Bila Sayo	4	76	High	Gidda Kiremu	7	100	0	0
Abay Chomen	1	84	High	Guduru	8	100	0	0
Jimma Horro	11	181	Very high	Guto Wayu	9	100	0	0
Jimma Rare	17	241	Very high	Nunu Kumba	13	100	0	0

Figure 3.2. *Selection of* woredas *for sampling in East Wellega Zone to provide a representative sample of* woredas *that covered a range of livestock densities and different agro-ecological zones.*

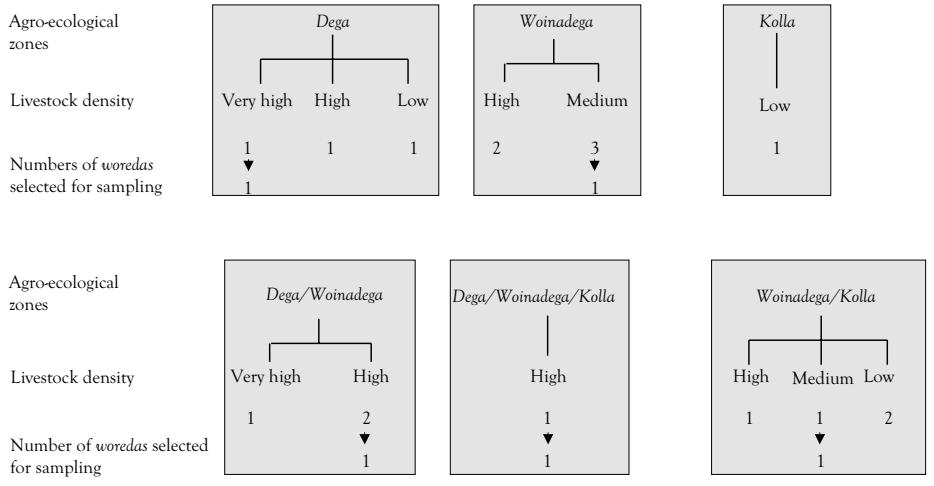


Figure 3.3. *Illustration of how the five* woredas *in East Wellega Zone selected for the survey fell into different categories of livestock densities and agro-ecological zones.*

Households were grouped by size into low, medium and high number of livestock and 10 households selected in turn for cattle, sheep and goat questionnaire interviews.

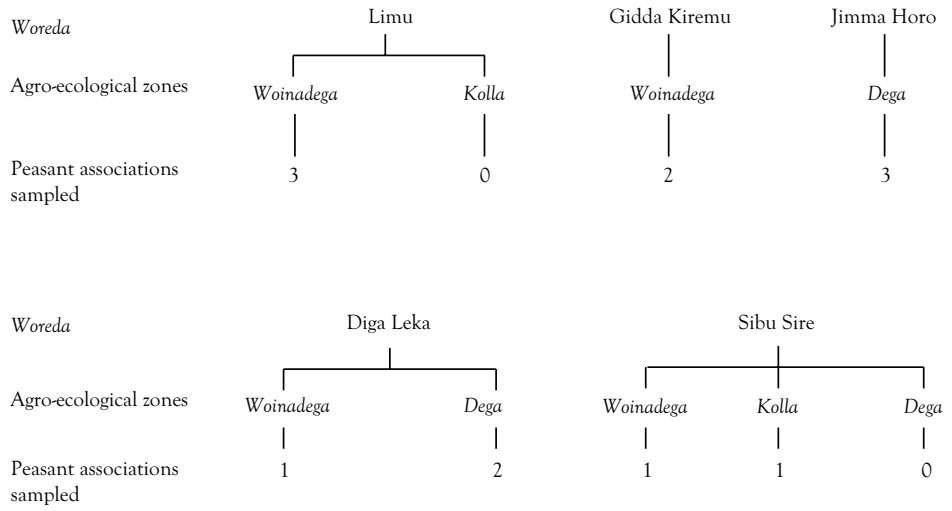


Figure 3.4. *Illustration of how peasant associations sampled from the different* woredas *represent the different agro-ecological zones contained in each* woreda.

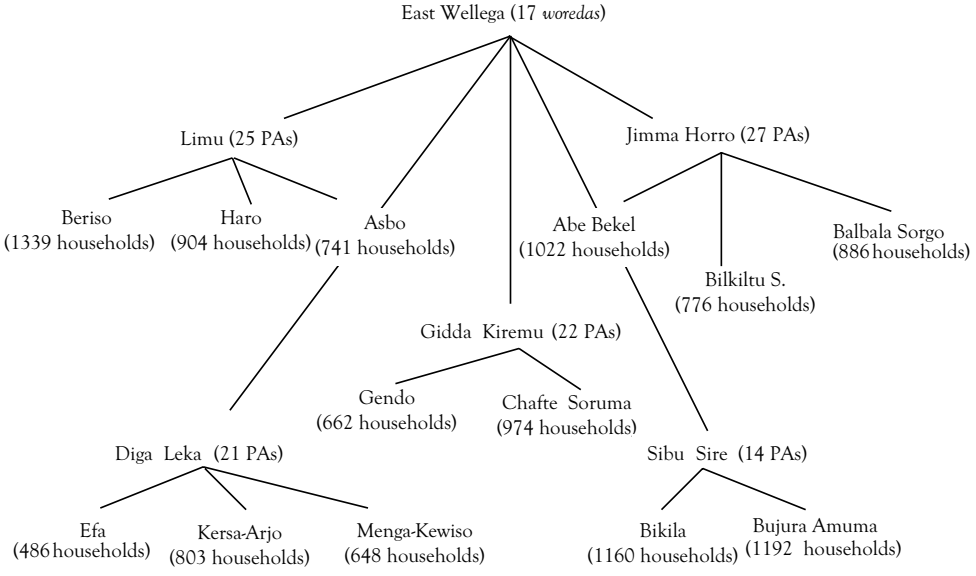


Figure 3.5. *A summary of the* woredas *and PAs selected for sampling from East Wellega Zone showing, in parentheses, the total numbers of* woredas, *PAs and households at each layer available for selection.*

This was done so that a reasonable cross-section of household sizes could be covered by the sample. Account was not taken in the sample selection in the Oromiya livestock

breed survey of the total number of households in each household size category. In future surveys, however, it is recommended that households be selected approximately in proportion to stratum size, but weighted towards the high size category which will tend to be more variable in livestock number than the lower two categories. Table 3.1 shows how the sample of households was distributed by household size for the survey in Haro PA in Limu *Woreda*, and compares this distribution with that of a more desirable one based on proportional allocation that would have been preferable from the point of view of estimation of population size.

Table 3.1. *Sample selection of households by size of cattle in Haro peasant association in Limu* Woreda.

	Cattle numbers			
	Low	Medium	High	Total
Total no. of households	565	216	78	859
Selected sample	7	12	11	30
Desirable sample[a]	16	7	7	30

a. Calculated in proportion to the total number of households in each stratum but with extra households sampled in the high size category to allow for the greater variation in household size in the category.

In developing the sampling frame, it is important to record the number of potential sampling units at each administrative layer, and, when stratified sampling is used within each stratum. This applies at each of the layers of zone (number of *woredas* per zone), *woreda* (number of PAs per *woreda*) and PA (number of households per PA). Without this information, it is impossible to estimate population number. It is also important to document the method of selection of sampling used in each instance, whether it be random, representative, convenience or purposive, in order to determine the appropriateness of inclusion of the sample in the calculation of population estimates at each hierarchical layer.

3.3 Number of households to be sampled

When planning the sampling structure for a survey it is preferable to sample higher percentage of units at the upper than the lower layers. This is because the variation in number of livestock among households within a PA will be generally lower than that among PAs in a *woreda*, and so on. Bearing this in mind, on average 30% of *woredas*, approximately 17% of PAs per *woreda* and 4% of households per PA were sampled. This meant that approximately 1 in 500 households were sampled in each PA. Thus, since the number of livestock in a household was collected both as primary and secondary species as described in Chapter 4, the sampling fraction to estimate the size of cattle, sheep and goats was approximately 0.2%. Most of the questions, however, were only for the pri-

mary species. For these questions, the sampling fraction was reduced by a third to 0.067%.

How does one decide on how large a sample survey should be? This depends on funds, costs of organising the survey, manpower, administrative support, means of transport and ease of access to PAs and households. It also depends on the different types of information to be collected. If population estimation is an important objective of a survey then the sampling fraction will need to be increased somewhat towards 1%. But 5587 households were sampled in the Oromiya Regional State livestock breed survey and this is a large number—just about the maximum that could be contemplated within the time scale permitted. Should population estimation be an important survey requisite then one approach could be to undertake a subsidiary survey, in parallel within the same PAs to collect information only on livestock number.

The distribution of sampled households across PAs and *woredas* is illustrated in Table 5.1. Four to five *woredas* were selected per zone depending on the size of the zone. Between 13–25 PAs were selected per *woreda*. Numbers were proportional to the numbers of PAs in each *woreda*. On average, 30 households were selected in each selected PA. The cattle questionnaire was used in 10, the sheep questionnaire in 10 and the goat questionnaire in 10 of the 30 households.

4 Questionnaire design and content

Characterisation of animal genetic resources (AnGR) not only involves a description of animals, what they physically look like and what traits and production characteristics they have, but also a description of the environment in which the animals are kept, both the natural and production environments and the husbandry practices employed by farmers. Therefore, the questionnaires designed for the breed survey covered aspects of the environment as well as characterisations of the animals themselves.

4.1 Questionnaires

Three types of questionnaires were developed, each with a main focus on either cattle, sheep or goats. These three species were referred to as 'primary' species. Cattle, sheep and goats were selected as primary species owing to their high numbers and wide distribution in the region under study. Within each of the three questionnaire types, information was also collected on the other species, which were referred to as 'secondary' species. These were chickens, donkeys, mules, horses and camels. When cattle, sheep or goats were not the primary species in an area, information was also collected on them as a secondary species. This was done in order to reduce the overall size of a questionnaire but without leaving out any of the livestock species mentioned above.

The questionnaires were designed to collect information on:

- the environment in which the animals were kept (e.g. descriptors of the environment, farming system, husbandry practices etc.)
- breed types observed in the region
- herd/flock structure
- population size and trend
- physical, adaptive and production characteristics and
- main uses and reasons for keeping different species of livestock.

Data collected on the secondary species were less detailed. The content of the questionnaires on either primary or secondary species was as follows:

- location and identification of the interview: details of the enumerator, farmer and location of the household
- general information of the household: number of household members, age and gender information, size and type of land holding, numbers and types of livestock species owned
- production systems: husbandry practices employed by farmers and purposes for keeping livestock species, e.g. cattle, sheep or goats

- health aspects: diseases prevalent in the area, farmers' opinions on disease tolerance/resistance of their livestock, treatments (including traditional ones), types of veterinary services available and distances to veterinary services
- breeding, mating and castration practices: type of mating, breeding method, sources of breeding bulls/rams/bucks, reasons for keeping them, criteria for their choice and castration practices
- herd dynamics: numbers of animals that entered and left the household over the previous year, methods of sale and reasons for disposal
- breed specific information (focusing on pure breeds and crossbreds separately and collected for both primary and secondary species): breed names, number of animals (including gender and age), trends in composition of farmers' livestock, reasons for trends, origins of breeds and qualities of breed traits as assessed by farmers
- phenotypic description: coat colour of several body parts of the farmers' animals, description of physical appearance of the animals by qualitative and quantitative assessment and
- production characteristics: production and reproduction.

The questionnaires consisted of open-ended, closed-ended and scaled-response questions.

4.2 Additional survey materials

Additional survey materials were developed and prepared to assist the enumerators during the completion of a questionnaire. The additional survey materials consisted of:

- translated questionnaires: all three types of questionnaires were translated into Amharic. These were not completed during our interview but one copy was given to each enumerator to assist him/her during an interview with a farmer. This was done to minimise possible differences in interpretation of the questions.
- descriptor list of phenotypic characteristics of animals: a descriptor list, together with photographs of different animals, was prepared to assist with the qualitative description of the animals
- colour chart: developed to describe the coat colour of the animals
- measurement tape: used to measure the quantitative physical characteristics of the animals, e.g. girth, body length.

A pre-test was conducted on the questionnaire prior to the actual survey in West and East Shewa zones to evaluate the appropriateness of its design, clarity of the questions, interpretation of the questions by enumerators and farmers, relevance of the questions, quality of the data recorded, and the time taken for an interview. Results from the pre-test were used to make a few final refinements to the questionnaires.

5 Field work activities

5.1 Field work organisation

The Oromiya Regional State was divided into four phases to segment the field activities of the survey. This was done to simplify the conducting of the survey, because the region was too large to implement the survey in one phase. To avoid any coincidence of the survey activities with rainy seasons (and their inevitable effects on road accessibility) or with cropping activities, it was decided to divide the region into four phases on the basis of seasons of rainfall, accessibility, crop activities and zone location (Table 5.1). The survey started in Borana Zone in May 2001 and ended in West Wellega Zone in December 2001. Between each phase, there were short intervals of one to two weeks to prepare for the next phase, e.g. to restore supplies such as questionnaires and training material, carry out maintenance work on vehicles etc.

Table 5.1. *Division of Oromiya Regional State into four phases for execution of survey and numbers of* woredas, *peasant associations (PAs) and households sampled, 2001.*

Phases	Zones	Month(s) of survey	No. of *woredas*	No. of PAs	No. of households
I	Borana	May	5	20	600
	Bale	May/June	5	20	428
	Arsi	June	5	22	450
II	East Shewa	August	4	18	510
	East Hararge	August	5	16	420
	West Hararge	August/September	4	25	419
III	North Shewa	October	4	16	360
	West Shewa	October	4	26	600
	Jimma	October	5	14	420
IV	East Wellega	December	4	20	390
	Illubabor	December	5	13	390
	West Wellega	December	5	25	600

A hierarchical approach, based on the people working within the zonal agricultural offices and sub-offices, was adopted to implement the survey activities. Development agents (DAs) were employed as enumerators and were supervised by the *woreda* livestock experts, who were in turn supervised by the zonal livestock experts. The project team, who travelled from zone to zone to give training and to start up the survey activities in each zone supervised zonal experts.

5.2 Enumerator and supervisor training

Training content, method and duration are important aspects to be considered when preparing for training. A suitably long and well-conducted course helps to ensure good quality of data collected later during the livestock breed survey. Both supervisors and enumerators attended the training courses. Training was given to enumerators and supervisors in each zone prior to the commencement of the survey in the zone. Each training period took three days, and contained classroom training and group exercises on the first and second days, and field exercises on the third day. The training covered the background and the objectives of the project, careful examination of each question in the questionnaires, and interviewing techniques. During the course of the training ample time was allocated for discussions and practices.

Classroom exercises were aimed to familiarise the enumerators and supervisors with the contents of the questionnaires. During these exercises, one of the group members played the part of the farmer, and was interviewed by the others (Figure 5.1). On the third day, enumerators and supervisors were taken to nearby farms to practice interviewing farmers. This exercise was done in groups as well.

Figure 5.1. *Group exercise in Illubabor Zone.*

On interviewing techniques, enumerators were taught to approach farmers politely and to respect farmers for the answers they give, keep time and repeat questions. Procedures were also discussed for handling non-responses, that is, the failure of an enumerator to meet a farmer, either because he/she was absent or because roads were inaccessible etc.

Three days is recommended as the minimum time to be allocated for training. Longer training periods are desirable to help the 'weaker' enumerators and supervisors

to get a better understanding of the questionnaires. A longer course also allows for greater individual tuition.

5.3 Data collection and supervision

Training was followed by distribution of survey funds and materials by the project team to enumerators and supervisors. Materials included fuel and lubricants for vehicles and motorcycles and spare parts, and funds were provided to cover daily allowances. In some cases mules, horses or bicycles were rented for enumerators or supervisors to enable them to get to the selected households (Figure 5.2). A vehicle was organised from agricultural offices of OADB for the zone supervisors.

Figure 5.2. *Means of transport for supervisors and enumerators.*

On average, the survey took ten days per zone. Each enumerator was asked to interview 30 farmers from the PA where they were based. This meant enumerators were required to do three interviews on average per day. The duration of an interview was on average two to two-and-a-half hours. One supervisor was appointed for each sampled *woreda*, who had to supervise between 2–5 enumerators for a total of 10 days. Zonal supervisors supervised 4–5 *woreda* supervisors per zone (Figure 5.3). Project team members initiated the survey in each zone, and at the beginning worked together with the zonal supervisor in supervising the enumerators. Thereafter, zonal supervisors supervised on their own.

Figure 5.3. *Supervision in North Shewa Zone.*

6 Data coding and entry

6.1 Preparation of code lists and coding of questionnaires

Field data collection was followed by coding the data in the questionnaires and entering the data into a computer data-capture system. Data coding required most attention. Code lists were in some cases prepared before the survey and in some cases following the survey. Code lists for enumerators, zones and *woredas*, for example, were prepared prior to the survey. This was possible because the information to be coded was known in advance.

In the case of data obtained from open questions such as type of disease, type of treatment and breed name, code lists were prepared following the survey. Information for these was not available in advance. To keep the code lists concise and effective, answers to the questions that required coding were first listed. These lists were then screened to reject unsuitable answers, which may, for example, have resulted from misunderstanding of questions by farmers or enumerators. The lists were also screened for repetitions, where, diseases, for example, had different synonyms. Data obtained in a local language were the most difficult to code. For instance, 13 local names were recorded for the disease blackleg, and these all had to be translated. This required extra effort by the supervisors, who often had to consult veterinarians from the area where the local disease name was to be found.

All codes were made numeric so that they could easily be analysed in data analysis programs such as SAS or GENSTAT. Some of the codes given stood on their own, and some were a combination of codes. For instance, clan names were coded in combination with the ethnic group to which they belonged. This helped to reduce the number of different codes and enhanced their clarity for data analysis. Combining codes in this way provided the possibility of analysing the data either by clan name or by major ethnic group. Figure 6.1 illustrates the coding of clan names and ethnic groups.

Code	Ethnic group — Clan name
1001	Oromo tribe — Borana clan
1002	Oromo tribe — Guji clan
2001	Amhara tribe — Gondere
2002	Amhara tribe — Menze
etc.	

Figure 6.1. *Coding for clan names within ethnic groups.*

Another example is provided by the coding of breed types. Pure breeds were given a code of two digits starting with '10', while crossbreds consisted of four digits, which combined the codes from two pure breeds. Figure 6.2 shows an example of codes for pure

breeds and crossbreds. Codes for *woreda*, PA and household formed together a unique code that distinguished one questionnaire from another. One member of the project team did coding of questionnaires to ensure that the answers were interpreted consistently.

Code	Pure breeds and crossbreds
10	Arsi
11	Borana
13	Guji
1011	Arsi × Borana cross[a]
1113	Borana × Guji cross
etc.	

a. The two pure breed codes to form the crossbred code were combined by having the lower number appear first.

Figure 6.2. *Coding for pure breed and crossbred types.*

6.2 Data capture system

A data-capture system in Microsoft Access 2000 was developed to store the survey data (see Figure 6.3). The data-capture system is based on the BREEDSURV system developed by ILRI for similar livestock breed surveys conducted in Southern Africa Development Community (SADC) countries in sub-Saharan Africa (Rowlands et al. 2003). The BREEDSURV system was used as a starting point for the data capture system developed for the Oromiya Regional State livestock breed survey.

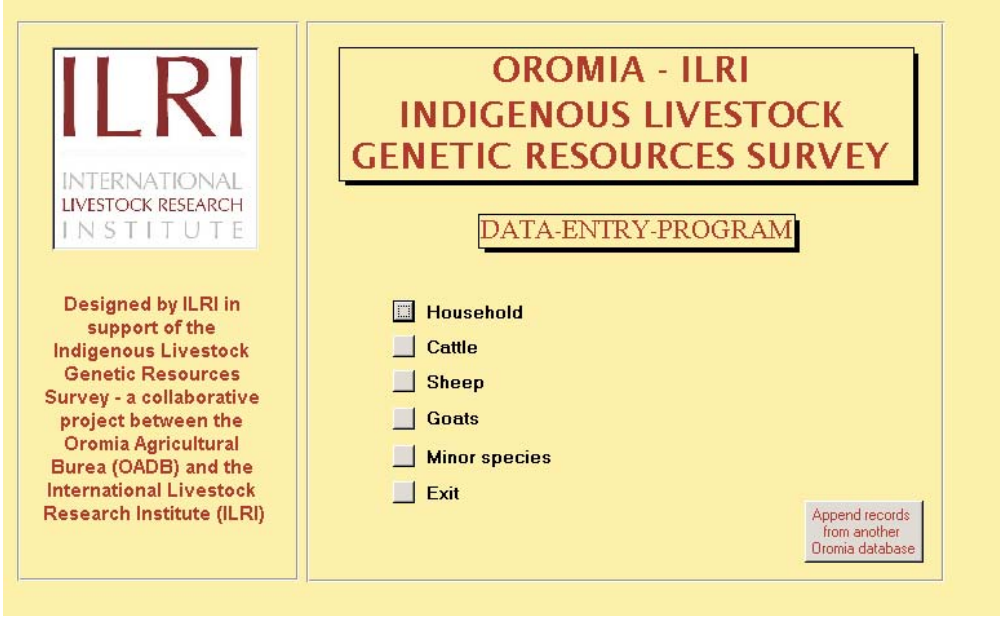


Figure 6.3. *Opening page of the data-capture system developed for the Oromiya Regional State livestock breed survey.*

The data-capture system was designed to be user-friendly. Each entry form in the system resembles a certain part/page of the questionnaire (e.g. households, production systems etc.). The forms are linked together for each household. Data are entered by selecting answers from drop-down lists, by ticking answers displayed on the screen, or by entering information (codes, values) in boxes on the screen (see a, b, c, respectively in Figure 6.4). Data are stored in sets of Access tables that can be exported to other programs for data analysis.

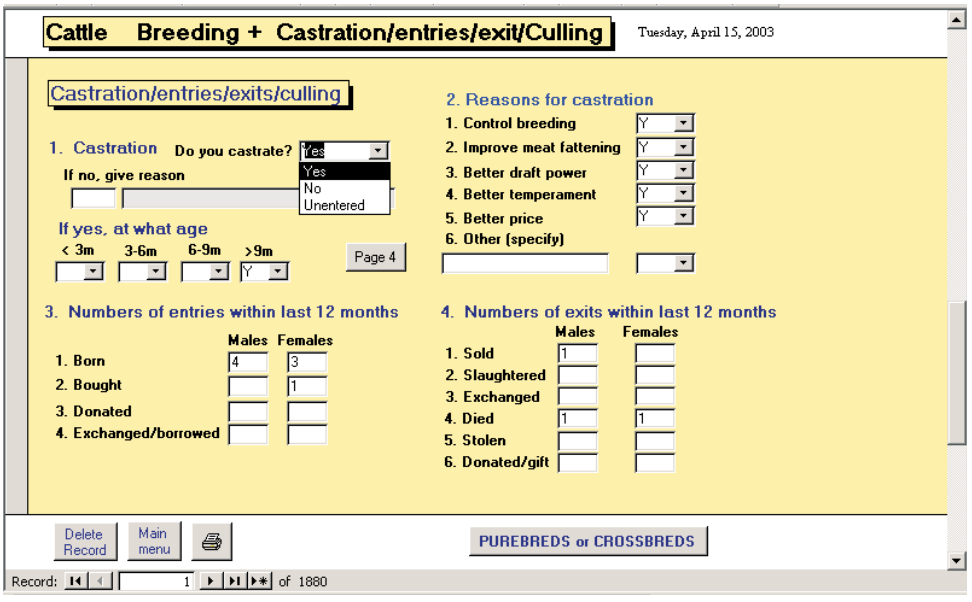


Figure 6.4. *Breeding and castration form of data-capture system developed for the Oromiya Regional State livestock breed survey illustrating different forms of data entry.*

6.3 Data entry and quality control

Data were entered by a number of data-entry assistants, each with his/her own computer. Each questionnaire took about 30 to 45 minutes to enter. After all the data from one zone had been entered, the data were verified with each data-entry assistant verifying data entered by another assistant. Verification was performed to identify and correct errors made during data entry. This could be due either to loss of concentration by the data-entry assistant or by misreading of written information due to bad handwriting of an enumerator. A supervisor was appointed to supervise the processes of data-entry and verification, and to answer questions of data entry assistants when help was needed.

Verification was followed by copying the separate databases from the different computers to one computer where they were merged to form one complete database per zone. Each database for each zone was backed up in duplicate. Finally, all 12 zonal databases were merged to form the regional database. The complete database was backed up in duplicate too.

7 Survey budget

7.1 Budget preparation

Careful budget preparation is important in the planning of a livestock breed survey. The budget for the Oromiya Regional State livestock breed survey was prepared in advance of the initiation of the project, which meant that many of the planning issues were resolved before the survey began. Overall, the budget prepared for the survey was meant to cover expenses for three components:

1. planning
   - preliminary meeting
   - setting up general administrative organisation
   - planning and preparation of survey design
   - pre-surveys—listing of households in villages to be sampled
   - preparation of survey materials
   - pilot surveys—pre-testing of questionnaires
2. executing survey activities
   - training
   - survey
3. data processing
   - data management, data coding, entry and verification
   - data analysis and report writing
   - reporting back meeting.

The size of budget for a survey depends on:

- the size of the sample, number of sampled households
- number of enumerators and supervisors involved
- means of transport to be used by supervisors and enumerators
- fuel and lubricants requirements
- number of computers available and number of data-entry assistants required
- number of people involved in data analysis and report writing.

7.2 Expenses

The expenses provided during the execution of the survey activities needed most attention. This was due to the differences in expenses required by each zone. Some zones had sufficient means of transport, while others had not. The larger zones tended to require more fuel and lubricants for transport than the smaller zones. Figure 7.1 shows the

relative distribution of the main expenses incurred during the execution of the survey activities. It can be seen that most of the budget is allocated to allowances for the enumerators and supervisors.

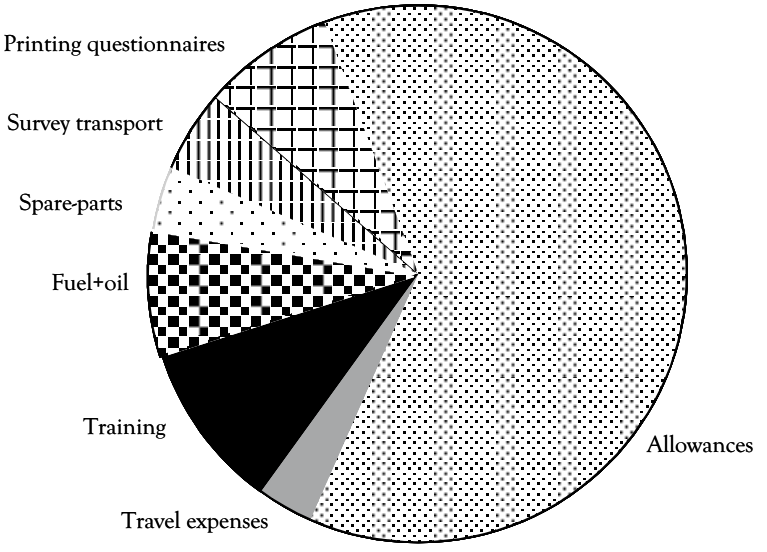


Figure 7.1.*Relative sizes of expenses incurred during the field activities of the livestock breed survey in Oromiya Regional State.*

8 Population estimation

Population estimates are not provided in this report, as more analyses are needed to generate this information. Here, however, a simple example is given to illustrate the process. Generally, one might be interested in estimating the number of cattle in a PA, in a *woreda* or in a zone. Since *woredas* were not selected randomly from zones, it will be more difficult, as mentioned earlier, to obtain reliable population estimates at this layer. At the PA level, however, it is easier.

8.1 Random sample of households in a PA

Suppose, for example, n households are sampled at random from N households in a PA. To get an estimate of the average number of cattle per household in the sample, add the number of cattle in the sampled households and divide by the size of the sample, n. Write the sample mean as m.

Multiply m by n and get an estimate of the total number of cattle in PA = Nm. We also need to calculate a standard error (se) for this estimate in order to provide some measure of precision.

The formula for the se is:

$$\sqrt{N(N-n)S\,/\,n}$$

where S = Sum $(y - m)^2/(n - 1)$, where the summation is over all households, and where y is the number of livestock in each sample household.

We can then write the estimated number of cattle in the PA as:

$$Nm \pm \sqrt{N(N-n)S\,/\,n}$$

8.2 Stratified random sample in a PA

In the case of a stratified random sample, the method gets more complicated but the principle is the same. For example, the estimated number of cattle in a PA stratified by household size is:

$$SUM\,Nm \pm \sqrt{SUM\,N(N-n)S\,/\,n}$$

where the individual expressions in the above formula are calculated for each stratum and then summed. The process is illustrated for Haro PA in Limu *Woreda* in Table 8.1

(S is written as s^2, sometimes referred to as the 'variance', in the table). The square root of the variance (s) is known as the 'standard deviation'. The results show that the estimated number of cattle in Haro PA is 5355 ± 342. By multiplying the se by 2 we can say that the actual number of cattle (had a complete census of the PA been taken) is likely to be in the range of 5355 ± (2 × 342) or between 4671 and 6039 cattle. (This range is referred to as the 95% confidence range). The 95% confidence range in this case is quite large. Reduction in its width can be achieved in one of two ways:

a. choose the sample size as far as possible in proportion to the number of households in each stratum and
b. increase total sample size.

Table 8.1. *Method of calculation of the estimated total number of cattle in all households in Haro PA in Limu* Woreda *based on sample cattle numbers in low, medium and high herd size categories.*

Herd size	Low	Medium	High				
Cattle numbers	1	6 10	12 15				
	3	7 10	13 15				
	4	8 10	13 15				
	5	8 10	14 21				
	5	8 10	15 22				
	5	8 10	15				
	5						
Number (n)	7	12	11				
Sample mean (m)	4	8.8	15.5				
Standard deviation (s)	1.53	1.42	3.17				
No. of households in village (N)	565	216	78				
Nm	2260	1890	1205	Sum of Nm	5355		
	105,090	7427	4785	Sum of $N(N-n)s^2/n$	117,303	Square root	342
Estimated number of cattle in village =		5355 ± 342					

8.3 Random samples of PAs

Estimation of the numbers of cattle in a *woreda* follows a similar approach to that at the PA level. But instead of using the numbers of cattle per household as the *y* value, the estimated numbers of cattle per PA are used. Instead of *N* referring to the numbers of households, *N* now refers to the numbers of PAs in a *woreda*. Finally, the se is based on the variation, not only among households within the PA, but also among PAs within the *woreda*.

It may be that population estimates for different zones in the Oromiya Regional State can be calculated as an addendum to this report. Judgements can then be made as to the suitability of the survey design for estimating population size, and on alternative methods (such as collection of livestock numbers only from subsidiary households) for

improving the precision of sample estimates. Further discussion on estimation of population size is given in Rowlands et al. (2003) in relation to the implementation of a livestock breed survey in Zimbabwe.

9 Descriptive results

9.1 Structure of data

This chapter provides a range of tables of research results. As mentioned in the previous chapter it is not possible at present, because of the difficulties in identifying breed types from the information provided by farmers, to provide results on a breed basis. Following further exploratory analysis with the cluster analysis methodology in different zones, classification of certain of the tables by breed type can be attempted at a later stage.

As mentioned earlier, AEZs and livestock densities were the two criteria used for stratification purposes in planning the sampling frame. Three AEZs, namely: *dega* (highland), *weinadega* (midland) and *kolla* (lowland) were used, and livestock densities were grouped into four categories: low (1–50 animals per km^2), medium (51–100 animals per km^2), high (101–200 animals per km^2) and very high (above 200 animals per km^2). Animal, in this case, refers to the sum of numbers of cattle, sheep and goats at the *woreda* level. Many of the tables are presented, throughout this report, in turn by AEZs, livestock densities and the production systems. Although production systems were not used as stratification criteria during sampling design, they were considered as important management/environmental characteristic, and so output tables are classified by production systems too.

Wherever appropriate, the numbers of households providing data are included in each table. Whenever the data analysed are based on single responses to questions the percentage values should add up to 100%. Some questions, however, allow multiple answers. In these cases, percentages will not add up to 100%. Percentage units (%) are shown alongside the levels of one of the classification variables, either along the top or down the side, to indicate how the contents of the tables are to be interpreted and in which direction the percentage values are to be summed.

Table 9.1.1 shows the number of households interviewed during the survey throughout the 12 zones. A total of 5587 households were sampled, on average 466 households per zone. In addition, the table shows a breakdown of the different species of livestock owned by the sample households. This ranged from 95% with cattle to 5% with camels to 0.2% with pigs.

Table 9.1.1. *Number of households sampled and species kept and number of households providing data on cattle breeds by administrative zones.*

Items	Species	Administrative zones												
		Borana	Bale	Arsi	East Shewa	West Hararge	East Hararge	North Shewa	West Shewa	East Wellega	Jimma	Illubabor	West Wellega	Overall
No. of households sampled		600	428	450	510	419	420	360	600	390	420	390	600	5587
No. of households keeping														
	Cattle	595	405	448	504	389	375	355	589	382	388	362	514	5306
	Sheep	416	217	359	336	207	225	223	339	258	207	253	332	3372
	Chickens	287	144	279	311	247	133	215	431	262	192	287	486	3274
	Goats	479	232	263	339	273	301	161	286	156	178	181	276	3125
	Donkeys	236	191	231	439	213	226	220	278	167	73	28	276	2578
	Horses	120	134	259	120	3	10	92	288	79	46	125	33	1309
	Mules	67	34	35	30	3	2	21	49	30	48	33	93	445
	Camels	146	45	6	11	5	69	0	0	0	0	0	1	283
	Pigs	0	1	1	3	0	1	0	2	0	0	2	1	11
Cattle ownership (%)		99.2	94.6	99.6	98.8	92.8	89.3	98.6	98.2	97.9	92.4	92.8	85.7	95.0
Sheep ownership (%)		69.3	50.7	79.8	65.9	49.4	53.6	61.9	56.5	66.2	49.3	64.9	55.3	60.4
Chicken ownership (%)		47.8	33.6	62.0	61.0	58.9	31.7	59.7	71.8	67.2	45.7	73.6	81.0	58.6
Goat ownership (%)		79.8	54.2	58.4	66.5	65.2	71.7	44.7	47.7	40.0	42.4	46.4	46.0	55.9
Donkey ownership (%)		39.3	44.6	51.3	86.1	50.8	53.8	61.1	46.3	42.8	17.4	7.2	46.0	46.1
Horse ownership (%)		20.0	31.3	57.6	23.5	0.7	2.4	25.6	48.0	20.3	11.0	32.1	5.5	23.4
Mule ownership (%)		11.2	7.9	7.8	5.9	0.7	0.5	5.8	8.2	7.7	11.4	8.5	15.5	8.0
Camel ownership (%)		24.3	10.5	1.3	2.2	1.2	16.4	0.0	0.0	0.0	0.0	0.0	0.2	5.1
No. of records providing data														
Pure breed cattle		595	402	444	503	390	400	350	587	383	386	362	511	5313
Crossbred cattle		7	16	34	12	5	50	55	0	13	1	2	0	195
No. of records providing phenotypic data														
Pure breed cattle		200	157	149	170	138	125	117	200	130	139	130	200	1855
Crossbred cattle		6	11	16	6	5	29	28	0	7	1	1	0	110

9.2 Ownership and use of land and livestock species

9.2.1 Distribution of households sampled across different administrative zones

Tables 9.2.1a, b and c show the distribution of households sampled across different administrative zones. Fifty-five percent of the households sampled from *dega* AEZ of the Oromiya Regional State were from Arsi, West Shewa and Bale zones. Exactly half of the 2742 households sampled from *weinadega* AEZ were from West Wellega, West Shewa, East Shewa and Jimma zones, and about 1680 households sampled from the *kolla* AEZ were from Borana, East Hararge and West Wellega zones alone (Table 9.2.1a).

Two-thirds of the 730 households sampled from low livestock density (Table 9.2.1b) were from Bale, Borana and West Wellega zones alone while nearly half of the 1275 households sampled from very high livestock density were from East Hararge, Arsi and North Shewa administrative zones.

Almost all households (99%) sampled from the pastoral production system (Table 9.2.1c) were from Borana and East Hararge zones, while 63% of the 443 households sampled from agro-pastoral production system were from Borana and East Shewa zones. However, the households sampled from crop–livestock systems were fairly distributed among all the 12 administrative zones of the region.

Table 9.2.1a. *Distribution of households sampled across administrative zones by agro-ecological zones.*

Administrative zones (%)	Agro-ecological zones			Overall
	Dega	*Weinadega*	*Kolla*	
No. of households	1165	2742	1680	5587
Arsi	23	5	2	8
Bale	15	3	10	7
Borana	10	5	20	11
East Hararge	5	3	16	8
East Shewa	10	10	7	9
East Wellega	6	12	0	7
Illubabor	5	10	4	7
Jimma	0	11	7	8
North Shewa	6	7	6	6
West Hararge	1	9	10	8
West Shewa	18	12	4	11
West Wellega	0	13	14	11

Table 9.2.1b. *Distribution of households sampled across administrative zones by livestock densities.*

Administrative zones (%)	Livestock densities				Overall
	Low	Medium	High	Very high	
No. of households	730	1649	1933	1275	5587
Arsi	0	11	5	14	8
Bale	34	0	5	6	7
Borana	16	15	12	0	11
East Hararge	12	0	5	19	8
East Shewa	0	0	6	3	9
East Wellega	12	13	5	0	7
Illubabor	8	15	5	0	7
Jimma	0	5	12	7	8
North Shewa	0	0	9	14	6
West Hararge	0	13	11	0	8
West Shewa	0	7	19	9	11
West Wellega	16	22	6	0	11

Table 9.2.1c. *Distribution of households sampled across administrative zones by production systems.*

Administrative zones (%)	Production systems			Overall
	Crop–livestock	Agro-pastoral	Pastoral	
No. of households	4899	443	200	5542
Arsi	9	2	0	8
Bale	8	8	2	8
Borana	5	36	86	10
East Hararge	7	10	13	8
East Shewa	8	27	0	9
East Wellega	8	1	0	7
Illubabor	8	1	0	7
Jimma	9	<1	0	8
North Shewa	7	0	0	7
West Hararge	7	12	0	8
West Shewa	12	2	1	11
West Wellega	12	1	0	11

9.2.2 Types of production systems

In terms of production systems, most of the sampled households were from crop–livestock system followed by agro-pastoral and pastoral systems (Tables 9.2.2a and b). However, sizable proportions of the sampled households in agro-pastoral and pastoral production systems were from *dega* agro-ecological zone. Households sampled from low to very high livestock densities were again mostly in crop–livestock production system

although 17% of the low and 11% of the very high proportion of households were from pastoral and agro-pastoral production systems, respectively.

Table 9.2.2a. *Distribution of sampled households by agro-ecological zones and production systems.*

Agro-ecological zones	No. of households	Production systems (%)		
		Crop–livestock	Agro-pastoral	Pastoral
Dega	1153	98	2	<1
Weinadega	2728	94	6	<1
Kolla	1661	73	15	12
Overall	5542	88	8	4

Table 9.2.2b. *Distribution of sampled households by livestock densities and production systems.*

Livestock densities	No. of households	Production systems (%)		
		Crop–livestock	Agro-pastoral	Pastoral
Low	728	73	10	17
Medium	1624	88	8	4
High	1925	92	6	1
Very high	1271	89	11	0
Overall	5566	88	8	4

9.2.3 Land ownership

Tables 9.2.3a, b and c show land ownership patterns among sampled households. From about half to three-quarters of the sampled households use own and communal land irrespective of AEZs and livestock densities. At least 45% of the sampled households use own and communal land in *dega* AEZ, and in areas where livestock density is very high while only 13% of the households use only communal land in low livestock density areas. In the pastoral system, 65% of the households use communal land whereas in the agro-pastoral system, 83% of the households use own and communal land.

Table 9.2.3a. *Land ownership by agro-ecological zones.*

Type of land ownership (%)	Agro-ecological zones			Overall
	Dega	*Weinadega*	*Kolla*	
No. of households	1161	2734	1664	5559
Own land	24	20	15	19
Rented land	<1	<1	<1	<1
Communal land	1	1	9	3
Own and rented land	12	7	2	6
Rented and communal land	1	1	<1	1
Own and communal land	45	58	68	59
Own, rented and communal land	17	13	6	12

Table 9.2.3b. *Land ownership by livestock densities.*

Type of land ownership (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	725	1641	1923	1270	5559
Own land	11	17	24	19	19
Rented land	0	<1	<1	1	<1
Communal land	13	4	1	1	3
Own and rented land	2	2	7	13	6
Rented and communal land	0	<1	<1	1	1
Own and communal land	72	68	54	45	59
Own, rented and communal land	1	9	14	20	12

Table 9.2.3c. *Land ownership by production systems.*

Type of land ownership (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	1647	158	67	1872
Own land	21	4	1	19
Rented land	<1	0	0	<1
Communal land	1	1	65	3
Own and rented land	7	3	0	6
Rented and communal land	1	<1	0	1
Own and communal land	57	83	34	58
Own, rented and communal land	13	8	0	12

9.2.4 Sizes of land owned and rented

Tables 9.2.4a, b and c show average sizes of land owned and rented by the households. Average size of land owned in *dega* AEZ was higher than land owned in *kolla* and *weina-dega* AEZs, which may be associated with the high number of households owning land in the former case. Land owned and rented were 2.2 and 0.7 ha for low livestock density, whereas 2.6 and 1.9 ha for very high livestock density. Land owned and rented was 2.4 and 1.5 ha for crop–livestock whereas 2.1 and nil ha for pastoral system.

Table 9.2.4a. *Average sizes of land owned and rented by agro-ecological zones.*

Agro-ecological zones	Owned land (ha)			Rented land (ha)		
	No. of households	Mean ± sd	Range	No. of households	Mean ± sd	Range
Dega	1141	2.8 ± 1.8	0.3–16.0	354	1.4 ± 1.2	0.3–8.0
Weinadega	2682	2.3 ± 1.8	0.10–25.0	580	1.6 ± 2.0	0.1–20.0
Kolla	1511	2.4 ± 4.9	0.03–126.0	139	1.4 ± 1.4	0.1–12.0
Overall	5334	2.4 ± 3.0	0.03–126.0	1073	1.5 ± 1.7	0.1–20.0

Table 9.2.4b. *Average sizes of land owned and rented by livestock densities.*

	Own land (ha)			Rented land (ha)		
Livestock densities	No. of households	Mean ± sd	Range	No. of households	Mean ± sd	Range
Low	628	2.2 ± 5.1	0.10–125.0	22	0.7 ± 0.9	0.1–4.5
Medium	1574	2.5 ± 2.0	0.13–27.8	187	1.1 ± 1.0	0.3–10.0
High	1895	2.3 ± 1.8	0.10–21.5	420	1.3 ± 1.4	0.1–12.0
Very high	1237	2.6 ± 3.9	< 1.0–126.0	444	1.9 ± 2.1	0.1–20.0
Overall	5334	2.4 ± 3.0	< 1.0–126.0	1073	1.5 ± 1.7	0.1–20.0

Table 9.2.4c. *Average sizes of land owned and rented by production systems.*

	Own land (ha)			Rented land (ha)		
Production systems	No. of households	Mean ± sd	Range	No. of households	Mean ± sd	Range
Crop–livestock	4802	2.4 ± 3.1	<1.0–126.0	1019	1.5 ± 1.7	0.1–20.0
Agro-pastoral	433	2.3 ± 1.3	0.3–9.0	50	1.1 ± 0.8	0.3–5.0
Pastoral	68	2.1 ± 1.2	0.3–6.0	0	–	–
Overall	5303	2.4 ± 3.0	<1.0–126.0	1069	1.5 ± 1.7	0.1–20.0

9.2.5 Distribution of land for grazing and crops

Tables 9.2.5a, b and c show distribution of land for grazing and crops. Thirty percent of owned land in *dega* AEZ was for grazing whereas two-thirds of the land was for cropping. On the other hand, approximately one-fifth of the land in *weinadega* and *kolla* was for grazing and four-fifths for crops. Renting land for grazing was a common practice in *dega* and *weinadega* than in *kolla* AEZ whereas land was mainly rented for cropping in *kolla* AEZ. Thirty percent of own land was used for grazing in very high livestock density areas whereas 16–19% of own land was used for grazing in low and medium livestock density areas. Correspondingly, 31% of the rented land was used for grazing in the former and 37–43% in the latter case. Sixty-five percent of own land in pastoral system was used for grazing whereas 34% of rented land in crop–livestock system was used for grazing. Ninety percent of all land rented in agro-pastoral system was for cropping purpose. No land renting was exercised in pastoral system.

Table 9.2.5a. *Distribution of land for grazing and crops by agro-ecological zones.*

	Agro-ecological zones			
Land type	*Dega*	*Weinadega*	*Kolla*	Overall
Own land				
No. of households	1141	2682	1511	5334
Total land size (ha)	3198	6120	3567	12885
Grazing (%)	30	18	20	22
Cropping (%)	67	77	78	75
Other (%)	3	5	2	4
Rented land				
No. of households	354	580	139	1073
Total land size (ha)	498	930	188	1616
Grazing (%)	44	32	10	33
Cropping (%)	55	68	89	66
Other (%)	<1	1	1	<1

Table 9.2.5b. *Distribution of land for grazing and crops by livestock densities.*

	Livestock densities				
Land type	Low	Medium	High	Very high	Overall
Own land					
No. of households	628	1574	1895	1237	5334
Total land size (ha)	1405	3869	4433	3178	12,885
Grazing (%)	19	16	21	30	22
Cropping (%)	78	79	75	70	75
Other (%)	3	5	4	1	3
Rented land					
No. of households	22	187	420	444	1073
Total land size (ha)	16	203	541	856	1616
Grazing (%)	43	37	36	31	33
Cropping (%)	54	61	64	69	66
Other (%)	1	1	<1	<1	<1

Table 9.2.5c. *Distribution of land for grazing and crops by production systems.*

Land type	Production systems			Overall
	Crop–livestock	Agro-pastoral	Pastoral	
Own land				
No. of households	4802	433	68	5303
Total land size (ha)	11,666	1007	141	12,814
Grazing (%)	22	14	65	22
Cropping (%)	75	85	35	75
Other (%)	4	1	0	3
Rented land				
No. of households	1019	50	0	1069
Total land size (ha)	1557	55	0	1612
Grazing (%)	34	10	0	33
Cropping (%)	66	90	0	66
Other (%)	<1	0	0	<1

9.2.6 Households with different types of grazing on own land

Tables 9.2.6a, b and c show different types of grazing on land that they own. Most of the land owned was open grazing land across AEZs. However, a significant proportion of the land in *kolla* was tree covered grazing land, bush/shrub covered grazing land and stone covered grazing land. With respect to livestock densities, most of the owned land was open grazing land type for all livestock density categories except for low livestock density where a tree covered grazing land is nearly equivalent to the open grazing land. Likewise, by production systems, most of the owned land was open grazing land type.

Table 9.2.6a. *Distribution of land for grazing on own land by agro-ecological zones.*

Types of grazing land (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	883	1420	515	2818
Open grazing land	90	83	64	82
Tree covered grazing land	28	23	44	29
Bush/shrub covered grazing land	21	36	52	35
Stone covered grazing land	20	16	39	21

Table 9.2.6b. *Distribution of land for grazing on own land by livestock densities.*

Types of grazing land (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	283	800	1049	686	2818
Open grazing land	58	80	89	83	82
Tree covered grazing land	53	30	27	20	29
Bush/shrub covered grazing land	43	38	32	32	35
Stone covered grazing land	27	14	25	21	21

Table 9.2.6c. *Distribution of land for grazing on own land by production systems.*

Types of grazing land (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	2616	143	44	2803
Open grazing land	82	73	70	82
Tree covered grazing land	28	38	30	29
Bush/shrub covered grazing land	34	41	45	35
Stone covered grazing land	21	28	25	21

9.2.7 Households with different types of grazing on rented land

Tables 9.2.7a, b and c show different types of grazing on rented land. Irrespective of AEZs, most of the rented land was open grazing land. However, a significant proportion of the rented land in *kolla* was bush/shrub and stone covered grazing land. For all livestock density categories and production systems, most of the rented land was open grazing land type except for pastoral production system where no land was rented for grazing.

Table 9.2.7a. *Households with different types of grazing on rented land by agro-ecological zones.*

Types of grazing land (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	194	265	13	472
Open grazing land	90	80	77	84
Tree covered grazing land	6	8	15	7
Bush/shrub covered grazing land	14	25	54	21
Stone covered grazing land	16	22	46	30

Table 9.2.7b. *Households with different types of grazing on rented land by livestock densities.*

Types of grazing land (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	5	81	185	201	472
Open grazing land	100	80	84	85	84
Tree covered grazing land	0	5	9	6	7
Bush/shrub covered grazing land	0	26	24	18	21
Stone covered grazing land	0	2	24	24	20

Table 9.2.7c. *Households with different types of grazing on rented land by production systems.*

Types of grazing land (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	466	5	0	471
Open grazing land	84	80	–	84
Tree covered grazing land	7	40	–	7
Bush/shrub covered grazing land	21	60	–	21
Stone covered grazing land	21	0	–	20

9.2.8 Households with different types of grazing on communal lands

Tables 9.2.8a, b and c show different types of grazing on communal land. Both in *dega* and *weinadega* AEZs, the larger portion of the communal land was open grazing land whereas in *kolla*, bush/shrub and tree covered grazing land had larger shares. With respect to livestock densities, most of the communal land was open grazing land type for all livestock density categories except for low livestock density where tree and bush/shrub covered grazing land are more dominant. Most of the communal land used for grazing in agro-pastoral and pastoral production systems was characterised by bush/shrub covered grazing land, whereas in the crop–livestock system, a larger share of the communal land used for grazing is in the form of open grazing lands.

Table 9.2.8a. *Households with different types of grazing on communal land by agro-ecological zones.*

Types of grazing land (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	661	1915	1337	3913
Open grazing land	82	77	64	74
Tree covered grazing land	38	39	73	50
Bush/shrub covered grazing land	39	55	81	61
Stone covered grazing land	26	21	51	32

Table 9.2.8b. *Households with different types of grazing on communal land by livestock densities.*

Types of grazing land (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	620	1277	1234	782	3913
Open grazing land	67	80	77	62	74
Tree covered grazing land	81	54	43	31	50
Bush/shrub covered grazing land	73	67	50	59	61
Stone covered grazing land	50	25	30	33	32

Table 9.2.8c. *Households with different types of grazing on communal land by production systems.*

Types of grazing land (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	3281	404	193	3878
Open grazing land	76	57	58	73
Tree covered grazing land	45	74	92	50
Bush/shrub covered grazing land	57	80	99	61
Stone covered grazing land	27	58	59	32

9.2.9 Household ownership of different species of livestock

Tables 9.2.9a, b and c show ownership of different species of livestock. Almost all households own cattle irrespective of AEZs, livestock densities or production systems. Larger proportion of households in the *dega* AEZ own sheep than households in *weinadega* and *kolla* AEZs whereas higher number of households in *kolla* own goats compared to ownership of this species in *weinadega* and *dega* AEZs. Camels are entirely owned by households in *kolla* AEZ. The distribution of cattle, sheep, goats and donkeys is similar across all livestock density categories. Unlike this, the distribution of chickens and horses is low in low livestock density areas whereas camels are more concentrated in low livestock density areas and in pastoral and agro-pastoral production systems.

Table 9.2.9a. *Household ownership of different species of livestock by agro-ecological zones.*

Species (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	1164	2741	1679	5584
Cattle	98	95	94	95
Sheep	77	58	53	60
Chickens	58	65	49	59
Goats	49	51	69	56
Donkeys	45	44	51	46
Horses	65	18	3	23
Mules	9	9	6	8
Camels	<1	1	16	5
Pigs	<1	<1	<1	<1

Table 9.2.9b. *Household ownership of different species of livestock by livestock densities.*

Species (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	730	1647	1934	1273	5584
Cattle	92	96	94	97	95
Sheep	55	63	58	64	60
Chickens	43	68	60	53	59
Goats	59	55	54	58	56
Donkeys	30	44	43	63	46
Horses	13	22	28	25	23
Mules	7	12	6	7	8
Camels	19	5	3	1	5
Pigs	<1	<1	<1	<1	<1

Table 9.2.9c. *Household ownership of different species of livestock by production systems.*

Species (%)	Production systems			Overall
	Crop–livestock	Agro-pastoral	Pastoral	
No. of households	4897	442	200	5539
Cattle	95	98	100	95
Sheep	61	48	75	61
Chickens	62	44	4	59
Goats	53	76	91	56
Donkeys	45	60	40	46
Horses	26	9	2	23
Mules	8	5	11	8
Camels	2	22	52	5
Pigs	<1	0	0	<1

9.3 Household characteristics

9.3.1 Number of people in households

Tables 9.3.1a, b and c show average number of people present in the household. Mean number of children in the household was higher in *weinadega* than in other AEZs. Consequently, family size in *weinadega* was higher than in the *kolla* and *dega* AEZs. Mean number of children in the household was high in very high livestock density and low in low livestock density areas. By production systems, mean number of children in the households from pastoral system was very low compared to mean number of children in agro-pastoral and crop–livestock production systems.

9.3.2 Gender of household heads

Tables 9.3.2a, b and c show gender of household heads. Irrespective of AEZs, livestock densities and production systems, males headed 94% of the households and females headed the rest (6%).

9.3.3 Age of household heads

Tables 9.3.3a, b and c show age distribution of household heads. Overall, about 60% of the households in the region are headed by members with age classes between 31 and 50 years. This proportion appears to be slightly higher in the *kolla* AEZ, low livestock density areas and in agro-pastoral production system compared to other respective categories. In all the categories, there is a sharp drop in the proportion of household heads with ages above 60 years.

Table 9.3.1a. *Average number of people in households by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
No. of households	1165		2742		1680		5587	
Members of households	Mean ± sd	Range	Mean ± sd	Range	Mean ± sd	Range	Mean ± sd	Range
Children 15 yrs	2.0 ± 2.5	0–14	3.4 ± 2.6	0–17	2.8 ± 2.7	0–28	2.9 ± 2.7	0–28
Adult males >15 yrs	2.0 ± 1.3	0–11	1.8 ± 1.1	0–10	1.8 ± 1.3	0–13	1.8 ± 1.2	0–13
Adult females >15 yrs	1.9 ± 1.3	0–12	1.7 ± 1.0	0–11	1.7 ± 1.1	0–10	1.7 ± 1.1	0–12
All	5.9 ± 3.2	1–14	6.9 ± 3.3	1–26	6.2 ± 3.3	0–28	6.5 ± 3.3	1–28

Table 9.3.1b. *Average number of people in households by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
No. of households	730		1649		1933		1275			
Members of households	Mean ± sd	Range	Mean ± sd	Range	Mean ± sd	Range	Mean ± sd	Range	Mean ± sd	Range
Children 15 yrs	1.9 ± 2.5	0–18	3.0 ± 2.7	0–17	2.9 ± 2.5	0–28	3.4 ± 2.8	0–16	2.9 ± 2.7	0–28
Adult males >15 yrs	1.6 ± 1.1	0–10	1.8 ± 1.3	0–13	1.9 ± 1.2	0–11	1.8 ± 1.2	0–8	1.8 ± 1.2	0–13
Adult females >15 yrs	1.7 ± 1.0	0–10	1.8 ± 1.1	0–11	1.7 ± 1.1	0–12	1.8 ± 1.2	0–9	1.7 ± 1.1	0–12
All	5.2 ± 3.2	1–18	6.6 ± 3.3	0–17	6.5 ± 3.2	0–28	7.0 ± 3.4	0–16	6.5 ± 3.3	1–28

Table 9.3.1c. *Average number of people in households by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
No. of households	4899		443		200		5542	
Members of households	Mean ± sd	Range	Mean ± sd	Range	Mean ± sd	Range	Mean ± sd	Range
Children 15 yrs	3.0 ± 2.6	0–28	2.8 ± 3.4	0–18	0.6 ± 1.6	0–10	2.9 ± 2.7	0–28
Adult males >15 yrs	1.8 ± 1.2	0–13	1.8 ± 1.2	0–7	1.8 ± 1.3	0–8	1.8 ± 1.2	0–13
Adult females > 15 yrs	1.7 ± 1.1	0–12	1.9 ± 1.2	0–7	1.8 ± 1.0	0–7	1.7 ± 1.1	0–12
All	6.6 ± 3.2	1–28	6.5 ± 4.3	1–18	4.2 ± 2.6	1–10	6.5 ± 3.3	1–28

Table 9.3.2a. *Gender of household heads by agro-ecological zones.*

Gender (%)	Agro-ecological zones			Overall
	Dega	*Weinadega*	*Kolla*	
No. of households	1155	2723	1663	5541
Male	95	94	94	94
Female	5	6	6	6

Table 9.3.2b. *Gender of household heads by livestock densities.*

Gender (%)	Livestock densities				Overall
	Low	Medium	High	Very high	
No. of households	723	1643	1915	1260	5541
Male	94	94	94	95	94
Female	6	6	6	5	6

Table 9.3.2c. *Gender of household heads by production systems.*

Gender (%)	Production systems			Overall
	Crop–livestock	Agro-pastoral	Pastoral	
No. of households	4861	436	199	5497
Male	94	93	95	94
Female	6	7	5	6

Table 9.3.3a. *Age of household heads by agro-ecological zones.*

Age in years (%)	Agro-ecological zones			Overall
	Dega	*Weinadega*	*Kolla*	
No. of households	1133	2680	1651	5464
<31	11	13	12	12
31–40	26	31	34	31
41–50	30	27	31	29
51–60	17	18	14	17
61–70	11	9	6	9
>70	4	3	3	3

Table 9.3.3b. *Age of household heads by livestock densities.*

Age in years (%)	Livestock densities				Overall
	Low	Medium	High	Very high	
No. of households	720	1626	1906	1212	5464
<31	12	12	11	14	12
31–40	32	30	29	34	31
41–50	33	27	29	28	29
51–60	14	18	19	14	17
61–70	7	9	10	8	9
>70	3	4	3	2	3

Table 9.3.3c. *Age of household heads by production systems.*

Age in years (%)	Production systems			Overall
	Crop–livestock	Agro-pastoral	Pastoral	
No. of households	4783	438	198	5419
<31	13	10	7	12
31–40	30	35	27	31
41–50	28	30	32	29
51–60	17	14	21	17
61–70	9	8	9	9
>70	3	4	5	3

9.3.4 Ethnic groups covered by survey

Nineteen ethnic groups were known to exist in Oromiya Regional State as reported by respondents of sample households (Tables 9.3.4a, b and c). Overall, the Oromo ethnic group accounted for 85% of the responses followed by the Amhara (7%). Proportion of the Oromo increased markedly in the pastoral and agro-pastoral areas. Likewise, greater than the average proportion of the Amhara was observed in the *dega* AEZ and in the low livestock density category.

Table 9.3.4a. *Ethnic identity of respondents by agro-ecological zones.*

Ethnic groups (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	1091	2691	1608	5390
Oromo	84	85	86	85
Amhara	12	7	5	7
Gurage	1	1	<1	<1
Kenbate	<1	<1	1	1
Somali	2	1	3	2
Adere	<1	0	0	<1
Tigre	0	1	1	<1
Yem Yem	0	3	1	2
Kulo	0	1	0	<1
Kaffa	0	1	<1	<1
Hosana/Hadiya	<1	<1	<1	<1
Jebelawi	<1	0	<1	<1
Argoba	0	<1	0	<1
Konso	0	0	2	1
Burji	0	<1	0	<1
Ari	1	0	0	<1
Hamer	0	0	<1	<1
Koyra/Kore	0	<1	<1	<1
Mao	0	0	<1	<1

Table 9.3.4b. *Ethnic identity of respondents by livestock densities.*

Ethnic groups (%)	Livestock densities				Overall
	Low	Medium	High	Very high	
No. of households	675	1616	1896	1203	5390
Oromo	80	89	81	90	85
Amhara	10	5	9	5	7
Gurage	1	1	<1	1	<1
Kenbate	2	0	0	1	1
Somali	1	3	1	2	2
Adere	0	0	0	<1	<1
Tigre	1	1	<1	0	<1
Yem Yem	0	1	4	1	2
Kulo	0	0	1	0	<1
Kaffa	0	<1	1	0	<1
Hosana/Hadiya	<1	0	<1	0	<1
Jebelawi	<1	<1	0	0	<1
Argoba	0	0	<1	0	<1
Konso	4	0	0	0	1
Burji	0	<1	<1	0	<1
Ari	0	0	1	0	<1
Hamer	0	<1	0	0	<1
Koyra/Kore	0	<1	<1	0	<1
Mao	<1	<1	0	0	<1

Table 9.3.4c. *Ethnic identity of respondents by production systems.*

Ethnic groups (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	4730	416	199	5353
Oromo	84	95	97	85
Amhara	8	1	1	7
Gurage	<1	<1	0	<1
Kenbate	<1	2	0	1
Somali	2	2	2	2
Adere	<1	0	0	<1
Tigre	1	0	0	<1
Yem Yem	2	0	0	2
Kulo	<1	0	0	<1
Kaffa	<1	0	0	<1
Hosana/Hadiya	<1	0	0	<1
Jebelawi	<1	0	0	<1
Argoba	<1	0	0	<1
Konso	1	0	0	1
Burji	<1	0	0	<1

(cont'd...)

Table 9.3.4c. cont'd.

Ethnic groups (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
Ari	<1	0	0	<1
Hamer	<1	0	0	<1
Koyra/Kore	<1	0	0	<1
Mao	<1	0	0	<1

9.3.5 Settlement status of sample households

Over a third of the sample households have relocated their homesteads either through the recent government-moderated villagisation scheme (35%) or through government-sponsored or voluntary resettlement (3%). The rest consider their homesteads as being found in their origin (Table 9.3.5). There are clear differences in this general pattern between the classification variables. The case for villagisation is by far more frequent in the *dega* than in other AEZs. Cases of resettled households are also more frequent in the *kolla* than in other AEZs. Differences between the production systems are less clear as some data from pastoral and agro-pastoral areas relates to villagisation and resettlement (Table 9.3.5).

Table 9.3.5. *Settlement status of sample households by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Settlement status					
		Original		Villagisation		Resettlement	
		No.	%	No.	%	No.	%
Agro-ecological zones							
Dega	1124	546	48.6	563	50.1	15	1.3
Weinadega	2465	1706	69.2	701	28.4	58	2.4
Kolla	1670	1022	61.2	558	33.4	90	5.4
Overall	5259	3274	62.3	1822	34.6	163	3.1
Livestock densities							
Low	721	365	50.6	314	43.6	42	5.8
Medium	1517	1067	70.3	443	29.2	7	0.5
High	1819	970	53.3	803	44.1	46	2.5
Very high	1202	872	72.5	262	21.8	68	5.7
Overall	5259	3274	62.3	1822	34.6	163	3.1
Production systems							
Crop–livestock	4604	3027	65.7	1416	30.8	161	3.5
Agro-pastoral	450	213	47.3	235	52.2	2	0.4
Pastoral	205	34	16.6	171	83.4	0	0.0
Overall	5259	3274	62.3	1822	34.6	163	3.1

9.3.6 Levels of livestock management

Based on the level of care provided to livestock around homestead, livestock management in sample households was classified as extensive, semi-intensive and intensive. Overall, just half of the respondents adopt extensive livestock management, and only 3% of them provide intensive care. In this regard, there was no difference between the different AEZs. However, a higher proportion of respondents in the pastoral production system as well as those in the low livestock density area practice extensive management (Tables 9.3.6a, b and c).

Table 9.3.6a. *Levels of livestock management by agro-ecological zones.*

Categories (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	380	915	574	1869
Intensive	7	1	5	3
Semi-intensive	45	53	39	47
Extensive	47	47	56	50

Table 9.3.6b. *Levels of livestock management by livestock densities.*

Categories (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	254	547	646	422	1869
Intensive	9	2	3	1	3
Semi-intensive	18	67	41	48	47
Extensive	73	31	56	50	50

Table 9.3.6c. *Levels of livestock management by production systems.*

Categories (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	1640	157	70	1867
Intensive	3	4	17	3
Semi-intensive	48	55	0	47
Extensive	49	41	83	50

9.3.7 Mobility of homesteads and livestock

Up to 97% of the households in the region across AEZs and livestock density categories practice sedentary livestock management. This pattern changes when viewed from the perspective of production systems, whereby 70% of the households in the pastoral system are essentially nomadic and another 22% are transhumant (moving parts of their homestead and livestock during some parts of the year). It is interesting to note that about 5% of the households in the *dega* and *weinadega* AEZs are transhumant (Tables 9.3.7a, b and c).

Table 9.3.7a. *Mobility of homesteads and livestock by agro-ecological zones.*

Mobility (%)	Agro-ecological zones			Overall
	Dega	*Weinadega*	*Kolla*	
No. of households	360	806	395	1561
Sedentary	95	96	83	92
Transhumant	5	4	9	5
Nomadic	0	0	8	2

Table 9.3.7b. *Mobility of homesteads and livestock by livestock densities.*

Mobility (%)	Livestock densities				Overall
	Low	Medium	High	Very high	
No. of households	184	459	583	335	1561
Sedentary	84	92	97	91	92
Transhumant	7	7	2	9	5
Nomadic	9	2	1	0	2

Table 9.3.7c. *Mobility of homesteads and livestock by production systems.*

Mobility (%)	Production systems			Overall
	Crop–livestock	Agro-pastoral	Pastoral	
No. of households	1468	45	46	1559
Sedentary	97	31	9	92
Transhumant	3	67	22	5
Nomadic	0	2	70	2

9.4 Possibilities of using cluster analysis to characterise breed types

This Oromiya Regional State livestock breed survey resulted in over 60 breed names of cattle being recorded across the region (Tables 9.4a and b for cattle). It is not known how many of these names describe distinctive breeds. Different breed names for similar breed types may have been developed in different areas. For example, individual names of breeds are often closely related to the clan or ethnic group to which farmers belong or, alternatively, they may be derived from the location where the animals are raised. Despite the variety of breed names recorded, the vast majority of cattle were reported as belonging to the local breed (Table 9.4a). This means that it is difficult to analyse the results to describe and compare different breed types. One possible solution is to use a statistical method known as 'cluster analysis' to use the phenotypic data collected in the survey to form different groups or clusters of animals that can then be summarised and mapped.

Data on cattle raised in Borana Zone are used in this chapter to demonstrate this procedure. The map of Borana Zone shows the five *woredas* selected for the survey (Figure 9.4.1). Of these, Dire, Liben and Teltele *woredas* are found predominantly in *kolla* (lowland), while Bore and Hagere Mariam *woredas* are found predominantly in *dega* (highland) agro-ecological zones with some parts of Hagere Mariam in between (*weinadega*). Two-hundred and nine sets of phenotypic data were collected from households sampled in Borana Zone. The majority of these data were collected from breeds identified by farmers as Borana or Guji with a few Konso and Arsi breeds. From the phenotypic data collected, 27 variables were defined for use in the cluster analysis (Table 9.4.2).

9.4.1 Methodology

The method applied starts with what is known as a Principal Component Analysis (PCA) which calculates a few new variables (known as principal components) that are functions of the existing 27 variables and account for most of the variation expressed by them. Since most of the phenotypic data collected are discrete, i.e. defined according to different categories, the method in our case incorporates what is known as a Spearman coefficient. The PCA is followed by a method known as Agglomerative Hierarchical Clustering (AHC) that calculates average dissimilarities between the phenotypic observations using the method of 'Mahalanobis distance'. The 'strong linkage' approach is used then to aggregate individual animal into clusters. This is done using a dendrogram or 'tree' and a cut-off line can be drawn anywhere across the dendrogram to form the required number of clusters or groups. See McGarical et al. (2000) for further details on the methodology.

Table 9.4a. *Numbers of different breed type names recorded from study households by administrative zones.*

	Administrative zones												
Breed types	Borana	Bale	Arsi	East Shewa	West Hararge	East Hararge	North Shewa	West Shewa	East Wellega	Jimma	Illubabor	West Wellega	Total
Arsi	16	106	215	235	179	–	–	–	–	–	–	–	751
Borana	290	7	2	8	–	–	–	–	–	–	–	–	307
Guji	267	4	–	–	–	–	–	–	–	–	–	–	271
Konso	29	–	–	–	–	–	–	–	–	–	–	–	29
Ogaden	1	15	–	–	36	1	–	–	–	–	–	–	53
Bale	–	54	–	2	–	–	–	–	–	–	–	–	56
Dega	–	38	–	–	2	–	–	–	–	–	–	–	40
Jilbeguro	–	28	–	–	1	–	–	–	–	–	–	–	29
Salea	–	47	–	–	–	–	–	–	–	–	–	–	47
Karayuu	–	–	1	33	1	–	–	–	–	–	–	–	35
Chefe	–	–	–	22	–	–	–	–	–	–	–	–	22
Oboo	–	–	–	16	–	–	–	–	–	–	–	–	16
Anniya	–	–	–	–	–	78	–	–	–	–	–	–	78
Doba	–	–	–	–	85	–	–	–	–	–	–	–	85
Issa	–	–	–	–	2	37	–	–	–	–	–	–	39
Somali	–	–	–	–	8	37	–	–	–	–	–	–	43
Sidamo	–	–	–	–	–	34	–	–	–	–	–	–	34
Buche	–	–	–	–	15	–	–	–	–	–	–	–	15
Other types[a]	–	17	3	34	5	55	2	1	–	–	3	5	125
No given names	2	98	228	179	37	150	348	600	383	412	362	508	3307
Anniya × Somera	–	–	–	–	–	16	–	–	–	–	–	–	16
Local × Holstein Friesian	–	4	4	4	–	1	46	–	4	–	–	–	63
Unknown local × exotic	–	1	21	1	–	1	5	–	9	–	–	–	38
Unknown local cross	–	1	1	–	2	10	–	1	–	1	–	1	17
Other crosses[a]	7	12	12	7	41	32	5	–	–	1	2	–	119

a. Breed types under 'Other types', and 'Other crosses' are listed by administrative zones in Table 9.4b.

Table 9.4b. *List of some of the125 other breed type names and the 119 other crosses (as classified in Table 9.4a) by administrative zones.*

Administrative zones										
Borana	Bale	Arsi	East Shewa	West Hararge	East Hararge	North Shewa	West Shewa	Jimma	Illubabor	West Wellega
Arsi × Borana	Gedo	Kofele	Abichu	HF[a]	Abadho	Damen	HF	Arsi × HF	Abigar	Messala
Borana × Guji	Kola	Negele	Fogera	Baltu	Babile	Dalacha			Horro cross	Red horned
Borana × Konso	Kurbi	Unknown exotic	Chore	Etu	Hawiya	Arsi × HF			Abigar cross	Abigar
	Loon Hunde	Arsi × HF	Gimbichu	Jamusi	Tumiro	Arsi cross				
	Sanete	Borana cross[b]	Arsi × HF	Aroji	Wabora	Borana × HF × Jersey				
	Arsi × Borana		Arsi × Karayuu	Rogitu	Obora					
	Arsi × HF		Borana cross	Adal	Asabote					
	Borana × Konso			Maye	Mayo					
	Ogaden × Salea			Messala	Alaa					
	Bale × HF			Red horned	Fedis					
	Ogaden × Salea			Tullo	Jijiga					
	Arsi × Borana × HF			Baku	Momu					
				Afuran Qalo	Fatah (Somali)					
				Nole	Abadho × Sidamo					
				Short breed	Anniya × Wabora					
				Mola	Anniya × Soka					
				Arsi × Doba	Anniya × Obora					
				HF × Jamusi	Anniya × Sidamo					
				Arsi cross	Babile cross					
				Arsi × Adal	Babile × Fedis					
				Doba × Mola	Issa cross					

cont'd...

Table 9.4b. *(cont'd.)*

	Issa × Somali
	Issa × Sidamo
	Sidamo cross
	Aroji × Somali

a. HF = Holstein Friesian.
b. A cross between Borana and another local breed type.

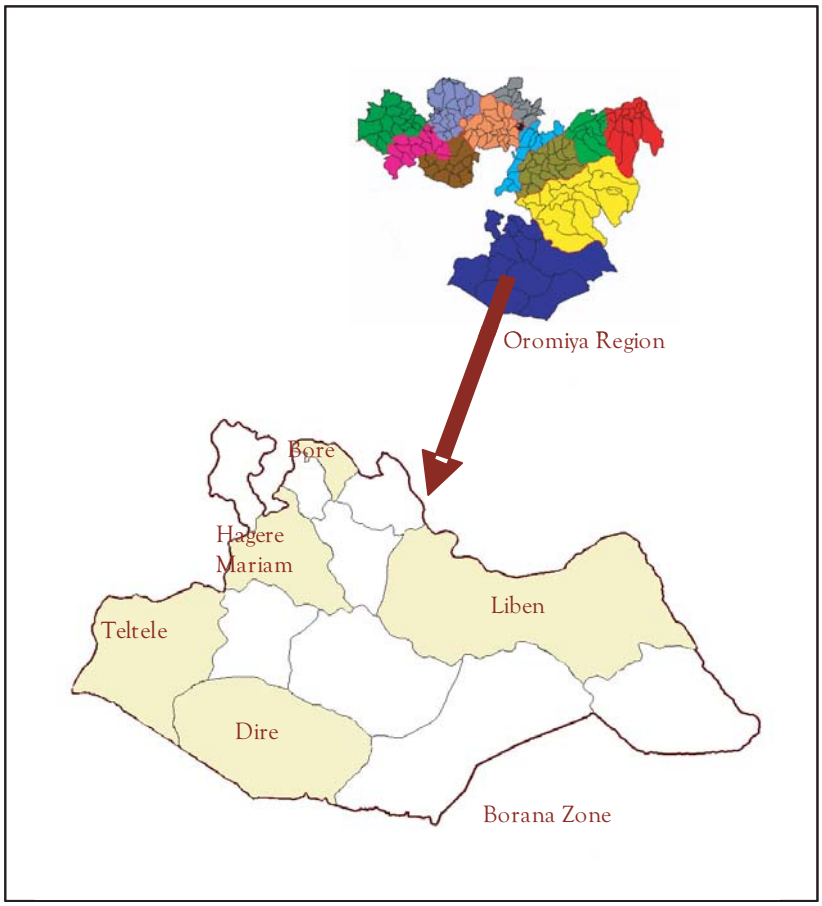


Figure 9.4.1 Oromiya Regional State and the five selected woredas of Borana Zone for the livestock breed survey.

9.4.2 Formation of clusters

The PCA procedure resulted in 10 principal components accounting for 64% of the variation in the phenotypic traits described for the different cattle. Table 9.4.2 shows results for the first three principal components and the percentage contributions that each of the original 27 variables made to each component. The first principal component tends to differentiate observations on the basis of colour (largest percentage values) and the second on the basis of size, e.g. dewlap and udder size. The third principal component distinguishes observations based on other physical characteristics such as face profile and ear orientation.

Table 9.4.2. *Percentage contributions of 27 phenotypic variables to the first three principal co-ordinates that accounted for the highest amount of the variation among cattle in Borana Zone.*

Characteristics	PC* 1	PC 2	PC 3
Body colour 1	22	1	0
Body colour 2	0	0	7
Head colour	20	1	0
Ear colour	21	1	0
Tail switch colour	5	2	10
Hoof colour	9	3	4
Coat colour pattern	1	1	0
Hair length	2	3	13
Hair type	0	1	2
Frame size	2	8	0
Dewlap size	1	15	0
Hump size	0	10	6
Hump orientation	0	0	6
Face profile	1	1	17
Back profile	1	2	0
Rump profile	1	0	8
Horn shape	0	0	1
Horn orientation	0	0	2
Horn spacing	1	1	7
Horn length	0	3	1
Ear size	0	8	0
Ear shape	2	0	0
Ear orientation	3	2	12
Tail length	0	4	0
Udder size	3	11	1
Teat size	2	10	1
Navel flap size	2	13	1
Total	100	100	100

* PC = Principal component.

The PCA procedure was followed by the AHC procedure already described to produce the dendrogram output shown in Figure 9.4.2. The dendrogram is truncated intuitively at the position shown in the figure resulting in three groupings or clusters, one with results from 11 households, one with results from 70 households and one with results from 128 households. By moving the position of truncation up or down the axis, more or fewer clusters can be formed. For illustrative purposes, however, we confine ourselves to three.

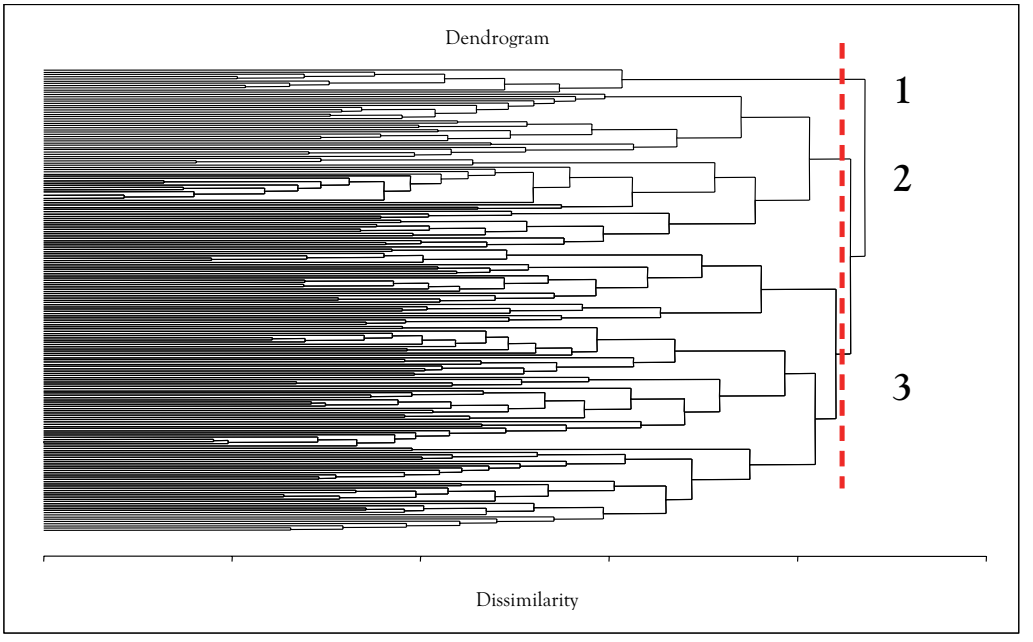


Figure 9.4.2. *Dendrogram illustrating the grouping of results from different households for Borana Zone and truncation at 3 clusters.*

9.4.3 Characterisation of households within clusters by agro-ecological zones and production systems

Nine of the 11 households in Cluster 1 fell in Bore *Woreda* in the *dega* AEZ and two in Teltele *Woreda* (see Figures 9.4.1 and 9.4.3a). Most of the households in Cluster 2 were from Liben and Dire *woredas* (*kolla*) with a few scattered across the other *woredas* (Figure 9.4.3b). The majority of households belonging to Cluster 3 were in the north-west of Borana Zone, predominantly in Bore, Hagere Mariam and Teltele *woredas* (Figure 9.4.3c). The breed types named by farmers residing in each of the *woredas* is shown in Table 9.4.3. The majority of the breeds in Bore and Hagere Mariam *woredas* were reported to be Guji. These fell primarily into Clusters 1 and 3. Over three-quarters of cattle in Teltele *Woreda* were reported to be Borana and just under a quarter were Konso (Table 9.4.3); the majority of which were captured in Cluster 3 (Figure 9.4.3c). The majority of cattle in Liben *Woreda* were reported by farmers to belong to the Borana breed with the remainder Guji and Arsi, and the majority of cattle in this *woreda* fell into Cluster 2. All breeds in Dire *Woreda* were reported to be Borana but the households were shared between Clusters 2 and 3.

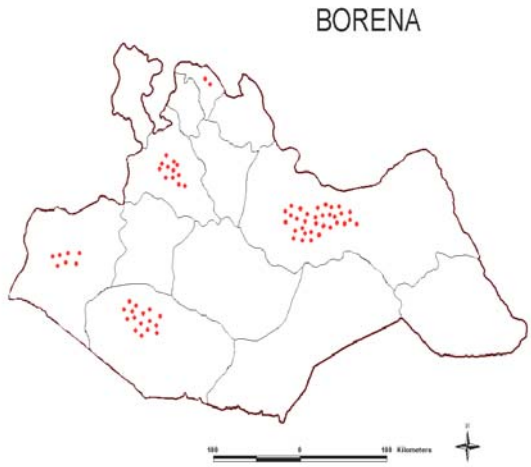
Table 9.4.3. *Percentage (%) distribution of breeds across* woredas *in Borana Zone as described by farmers.*

	Woredas					
Breed types	Bore	Dire	Hagere Mariam	Liben	Teltele	Total
No. of households	40	40	44	44	41	209
Arsi	0.0	0.0	0.0	16.0	0.0	3.0
Borana	0.0	100.0	9.0	59.0	78.0	49.0
Guji	98.0	0.0	91.0	25.0	0.0	43.0
Konso	0.0	0.0	0.0	0.0	22.0	4.3
Unknown local	2.0	0.0	0.0	0.0	0.0	<1.0

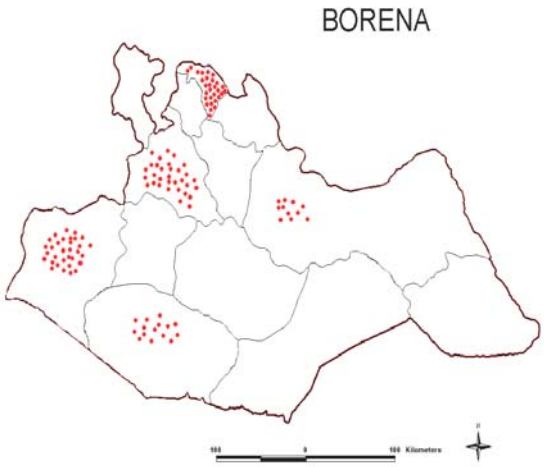
These three clusters of households are further categorised in Figure 9.4.3b into *dega*, *weinadega* and *kolla* AEZs. The figure shows households belonging to Cluster 1 were primarily in the *dega* AEZ, and those from Cluster 2 mainly in *weinadega* and *kolla* AEZs. Households in Cluster 3, however, were situated throughout the three AEZs.

Figure 9.4.3c shows the distribution of households within each cluster across production systems. Households in Cluster 2 were found more often in agro-pastoral and pastoral than in crop–livestock system. Households in Cluster 3 were distributed across all three types of production systems, whereas those in Cluster 1 were to be found mainly in the crop–livestock system.

a. Cluster 1



b. Cluster 2



c. Cluster 3

Figure 9.4.3a. *Distribution of households from each cluster across the five selected woredas in Borana Zone.*

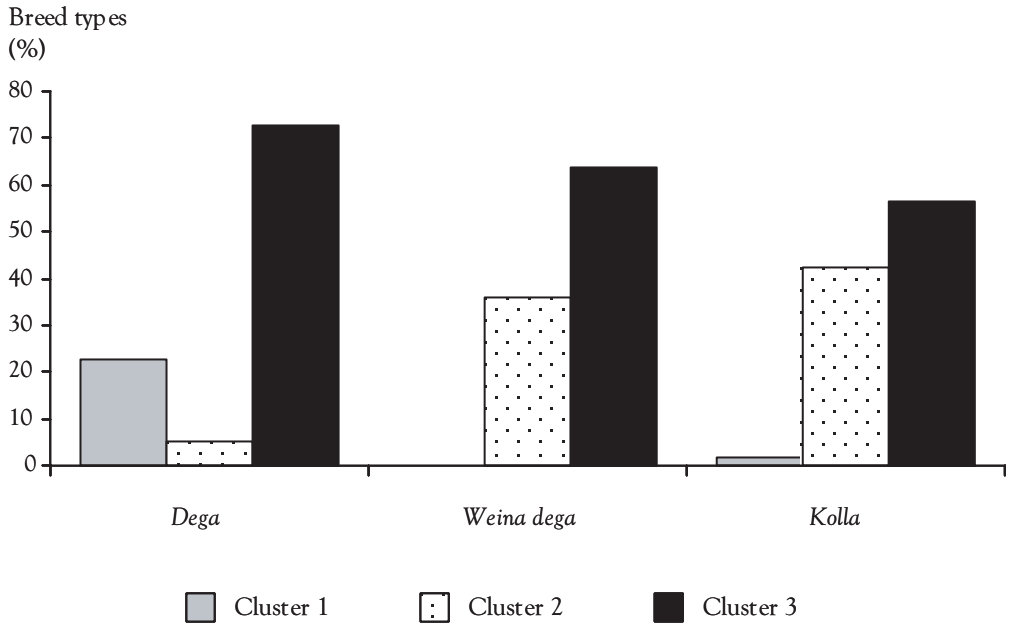


Figure 9.4.3b. *Distribution of clusters of households in Borana Zone by agro-ecological zones.*

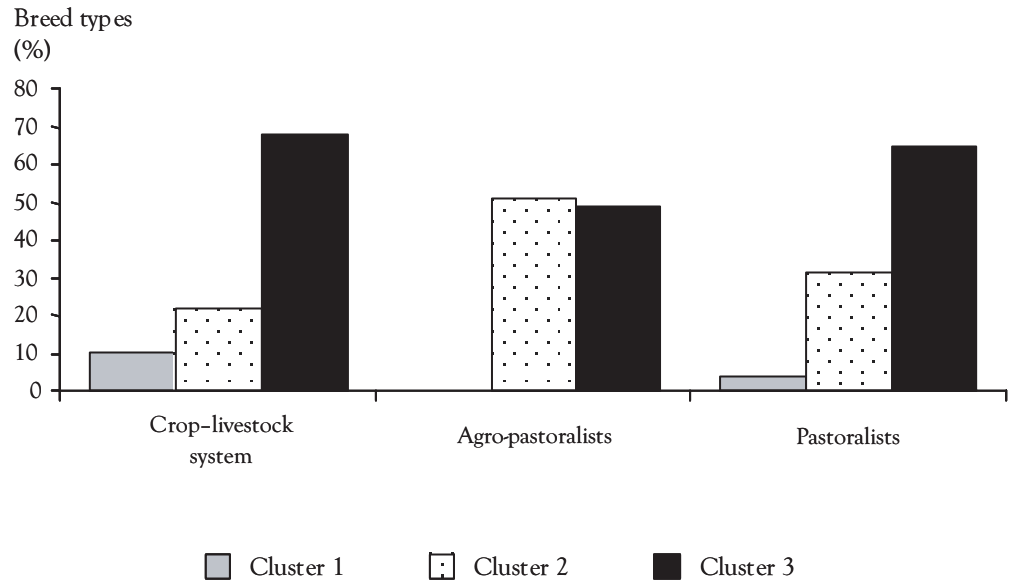


Figure 9.4.3c. *Distribution of clusters of households in Borana Zone by production systems.*

9.4.4 Phenotypic characteristics of cattle in the three clusters of households

One of the phenotypic traits used in the cluster analysis was coat colour (Table 9.4.2). Figures 9.4.4a, b and c show the percentages of households that reported different colour or colour combinations. The cattle belonging to households in Cluster 1 were predominantly black and white (34%) or uniformly black (27%) (Figure 9.4.4a). Cattle from households belonging to Cluster 2 were reported to be uniformly white by 22%, red-brown by 15%, and combinations of black, white or red-brown by the remainder of the households (Figure 9.4.4b). Similar colour combinations to those in Cluster 2 were found in Cluster 3.

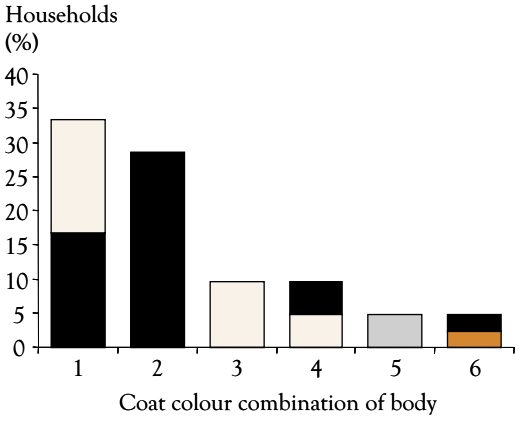


Figure 9.4.4a. *Coat colours of cattle in households belonging to Cluster 1 (photograph taken in Bore* Woreda, *probably Guji breed type).*

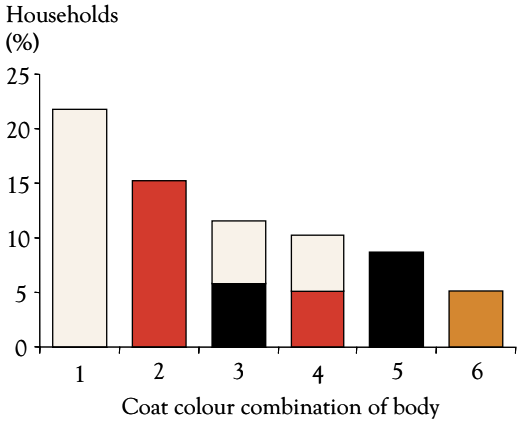


Figure 9.4.4b. *Coat colours of cattle in households belonging to Cluster 2 (photograph taken in Dire* Woreda, *probably Borana breed type).*

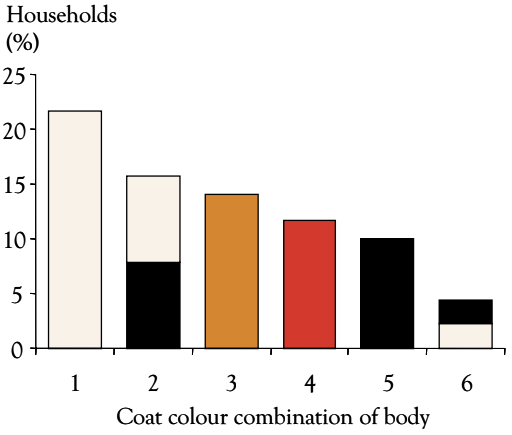


Figure 9.4.4c. *Coat colours of cattle in households belonging to Cluster 3 (photograph taken in Teltele* Woreda, *probably Konso breed type).*

Another way of comparing the breed types as defined by the three clusters is by body size (Table 9.4.4). Cattle in Cluster 1 generally seemed to be larger in terms of physical attributes than cattle from the other two clusters. Cattle in this cluster also had concave face profiles in contrast to cattle in the other clusters. Cattle in Clusters 2 and 3 appeared to be of similar body size (Table 9.4.4) but cattle in Cluster 2 showed a tendency for their ears to droop, and to have slightly larger average sizes of dewlap, navel flap, udder and hump, more so than those in Cluster 3.

Table 9.4.4. *Percentages of households in the three clusters in Borana Zone reporting different size characteristics of their animals.*[a]

Phenotypic characteristic		Cluster 1	Cluster 2	Cluster 3
Frame size	Short	0	31	28
	Medium	45	53	53
	Long	55	16	19
Dewlap size	Absent	0	0	2
	Small	9	26	46
	Medium	73	61	46
	Large	18	13	6
Hump size	Absent	0	0	1
	Small	0	49	63
	Medium	91	49	35
	Large	9	3	1
Face profile	Flat	0	97	83
	Convex	9	1	9
	Concave	91	1	8
Ear orientation	Erect	40	9	11
	Lateral	60	56	82

cont'd...

Table 9.4.4. cont'd.

Phenotypic characteristic		Cluster 1	Cluster 2	Cluster 3
	Drooping	0	36	6
Udder size	Small	0	23	46
	Medium	90	57	45
	Large	10	20	9
Navel flap	Absent	0	7	27
	Small	30	34	53
	Medium	60	50	15
	Large	10	0	5

a. Shaded numbers are the highest for each cluster.

Finally, data on perception by farmers of the qualities of traits possessed by their cattle are classified by cluster (Figures 9.4.4d and e). The figures show the percentages of households reporting a trait as 'good'. Farmers in each cluster valued milk off-take on average equally but there were indications of differences in certain other traits (Figure 9.4.4d). Work and growth rate were considered to be poorer by farmers in Cluster 1 than by those in other clusters. Levels of fertility were rated better by households in Cluster 1 than others. The number of households constituting this cluster, however, was low. Cattle in Cluster 2 tended to be favoured for their drought tolerance but cattle in Cluster 1, again from few households, appeared to have generally better disease tolerance and ability to walk long distances than cattle in the other two clusters.

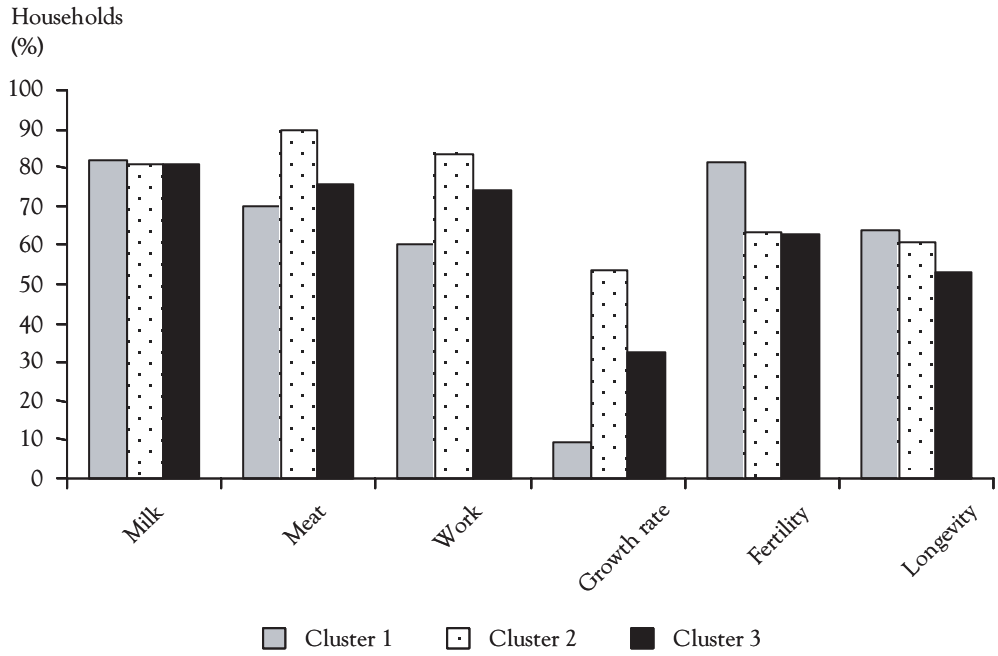


Figure 9.4.4d. *Percentages of farmers in Borana Zone rating performance traits as good by clusters.*

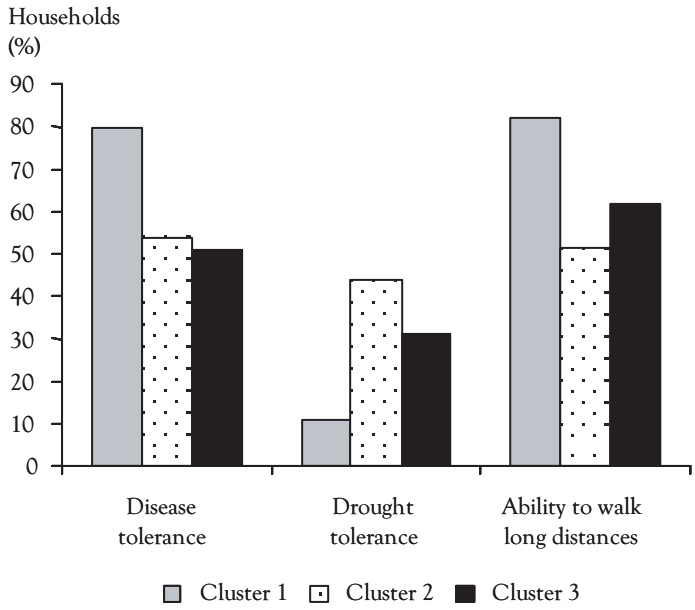


Figure 9.4.4e. *Percentages of farmers in Borana Zone rating adaptation traits as good by clusters.*

9.4.5 Discussion of results

The analyses described above have possibly identified three breed types of cattle in Borana Zone. The first cluster is small in number but confined primarily to Bore *Woreda* in the highland AEZ. The cattle belonging to this cluster tend to be larger than cattle in the two other clusters and with a concave shape of head. Their characteristics such as hump size and udder size seem also larger compared to cattle in the other clusters. The characteristics of cattle in Cluster 2 with their tendencies to have drooped ears and with slightly larger average sizes of dewlap, navel flap, udder and hump compared with cattle in Cluster 3 put them into the Borana type, known to be favoured by pastoralists who raise them in the *kolla* AEZ. However, the fact that there is not very sharp distinction between the phenotypic characteristics of the breed types defined by these clusters (Table 9.4.4) and that many of the cattle in Dire and Teltele *woredas* fall into Cluster 3 (Figure 9.4.3a) suggests possible interbreeding with other breeds such as Konso and Guji. Many of the cattle in Cluster 3, primarily associated with Bore and Hagere Mariam *woredas* (Table 9.4.4), are likely to be of the Guji-type as indicated by farmers.

Table 9.4.5 provides a two-way classification of breed type as determined by the three clusters against the breed name given by farmers. Over half the breed names provided by Cluster 2 farmers were Borana and a third Guji indicating possible interbreeding as indicated above. Cluster 3 consists of similar proportions of Borana and Guji breeds as named by the farmers again indicating interbreeding. The named Konso cattle fell between clusters 2 and 3.

Table 9.4.5. *Distribution of named breed types by farmers appearing in the different clusters.*

	Cluster (%)			
Breed types	1	2	3	Total
No. of households	11	70	128	209
Arsi	0	6	2	3
Borana	18	53	49	49
Guji	73	36	44	43
Konso	0	6	4	4
Unknown local	9	0	0	<1

These are very preliminary findings and the results need to be treated with caution. Different enumerators collected data in different *woredas* and variations might exist among them in their perceptions of sizes of animal body parts. This may hinder the ability of the clustering method to distinguish between breed types and may be one reason for the difficulties in characterising the phenotypic patterns between Clusters 2 and 3. Further experimentation with this method is needed. For example, it might be informative to move the truncation line down to select a larger number of clusters to see whether better discrimination between breed types can be achieved. The method, as so far applied has, however, helped to locate the geographical distributions of the different clusters. Further matching of individual records to the overall characteristics of the cluster to which they have been assigned may help to elucidate better the breed-type definitions. Once satisfactorily implemented in this zone the method can be tried out in other zones where only local breed names have been collected. Additional information on breed-types known to exist in different *woredas*, however, will enhance the interpretation of the results. Until such analyses are completed, it is impossible to undertake further analysis by breed types. The results contained in Chapter 10 are thus presented on an overall cattle basis without regard to any individual breed type.

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10 Cattle

This survey generated data on cattle from 5279 cattle-owning households across Oromiya Regional State. These households have current holdings of over 62 thousand heads of cattle. Only 3.5% of the households reported to have crossbred cattle in their herds, indicating that almost all farmers in Oromiya Regional State maintain indigenous cattle. As expected from extensive surveys like this, neither all households responded to all the questions, nor all questions apply equally to all of the households. As a result, the output tables in this chapter show different numbers of sample households. Except the tables on herd dynamics towards the last part of this chapter, most of the tables are based on data from 1800 households from the different categories of agro-ecological zones (AEZs), livestock densities and production systems. Because numerous tables accommodate multiple responses to particular questions, the respective percent values may not add up to 100%.

10.1 Purposes of keeping cattle

The tables presented here show the percentages of households that reported different purposes for which they kept cattle. As can be seen from the tables, cattle are kept for many purposes. In any household, different species of livestock (e.g. cattle) are kept for multiple purposes, e.g. milk and income, work and meat. Purposes for which cattle are kept resemble more or less the breeding objectives farmers have for cattle. Data were collected for male and female cattle separately.

10.1.1 Reasons households keep male and female cattle

Tables 10.1.1a, b and c show purposes for keeping male and female cattle by AEZs, livestock densities and production systems, respectively.

Irrespective of the AEZs, livestock densities and production systems, male cattle are mainly kept for work, breeding and as a source of income, whereas female cattle are primarily kept for milk and breeding. The uses of male cattle for work and breeding received similar ratings in *kola* AEZ, but their use for work assumed the highest importance in the other AEZs. The greatest differences are seen in relation to production systems (Table 10.1.1c). The need of male cattle for work was reported by only a third of pastoralists. Instead, the keeping of males for meat ranked very high, and two-thirds of pastoralists keep male cattle for blood. The keeping of cattle for manure is not a requirement in the pastoral community, whereas it was considered as one purpose by 84% of crop–livestock farmers.

Table 10.1.1a. *Purposes given by households for keeping male and female cattle by agro-ecological zones.*

Purposes (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
Male cattle				
No. of households	382	912	567	1861
Work	98	93	86	92
Breeding	88	86	89	87
Income	74	88	78	82
Manure	74	88	59	77
Meat	67	64	70	67
Savings	55	55	52	54
Hide	41	34	37	36
Wealth	36	31	39	35
Ceremony	43	29	33	33
Dowry	34	25	38	31
Blood	6	4	18	9
Female cattle				
No. of households	381	915	571	1867
Milk	96	98	97	97
Breeding	99	97	95	97
Income	68	85	72	78
Manure	71	83	54	72
Meat	52	51	53	52
Savings	51	50	45	49
Hides	39	31	35	34
Wealth	34	31	35	33
Dowry	34	27	37	31
Ceremony	37	23	28	28
Work	24	18	14	18
Blood	5	4	15	8

Table 10.1.1b. *Purposes given by households for keeping male and female cattle by livestock densities.*

Purposes (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
Male cattle					
No. of households	250	548	643	420	1861
Work	82	93	93	95	92
Breeding	90	90	83	88	87
Income	64	86	81	92	82
Manure	57	77	81	81	77
Meat	80	69	62	63	67
Savings	55	52	57	51	54
Hides	57	34	33	31	36
Wealth	38	30	31	44	35
Ceremony	45	29	28	40	33
Dowry	44	22	29	36	31
Blood	16	9	7	6	9
Female cattle					
No. of households	254	548	644	421	1867
Milk	96	97	98	98	97
Breeding	97	98	96	98	97
Income	60	82	75	88	78
Manure	56	72	76	75	72
Meat	66	52	49	47	52
Savings	53	47	51	45	49
Hides	54	33	30	28	34
Wealth	35	29	29	41	33
Dowry	42	27	29	35	31
Ceremony	39	24	24	31	28
Work	17	20	21	14	18
Blood	13	7	6	6	8

Table 10.1.1c. *Purposes given by households for keeping male and female cattle by production systems.*

Purposes (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
Male cattle				
No. of households	1632	157	70	1859
Work	94	93	37	92
Breeding	86	98	97	87
Income	85	64	57	82
Manure	84	38	3	77
Meat	63	89	99	67
Savings	52	72	46	54
Hides	34	55	47	36
Wealth	31	54	76	35
Ceremony	31	52	50	33
Dowry	26	68	59	31
Blood	5	18	67	9
Female cattle				
No. of households	1637	158	70	1865
Milk	97	98	99	97
Breeding	97	94	97	97
Income	80	61	47	78
Manure	78	37	4	72
Meat	49	67	81	52
Savings	47	67	31	49
Hides	32	53	40	34
Wealth	29	51	67	33
Dowry	27	64	57	31
Ceremony	25	46	40	28
Work	19	13	5	18
Blood	5	14	46	8

10.1.2 Reasons households keep bulls

Tables 10.1.2a, b and c show reasons for keeping bulls. Irrespective of the AEZs, livestock densities and production systems, bulls were mainly kept for mating (88%) and work (56%). Keeping bulls for mating decreased with increasing livestock density, and by production systems from pastoral to agro-pastoral and crop–livestock systems. Keeping bulls for work was rare in pastoral systems (10%) and only a small proportion of households (18%) throughout all AEZs kept bulls for socio-cultural purposes.

Table 10.1.2a. *Reasons given by households for keeping bulls by agro-ecological zones.*

Reasons (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	357	897	552	1806
Mating	92	86	88	88
Socio-cultural	15	16	23	18
Draft/work	50	60	53	56
Other	3	<1	<1	1

Table 10.1.2b. *Reasons given by households for keeping bulls by livestock densities.*

Reasons (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	237	547	627	395	1806
Mating	94	91	87	81	88
Socio-cultural	19	14	19	20	18
Draft/work	55	52	58	62	56
Other	< 1	1	< 1	2	1

Table 10.1.2c. *Reasons given by households for keeping bulls by production systems.*

Reasons (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	1580	155	69	1804
Mating	86	97	100	88
Socio-cultural	16	21	49	18
Draft/work	59	52	10	56
Other	1	1	0	1

10.2 Ownership of cattle and different activities

10.2.1 Ownership of cattle by family members

The ownership pattern of cattle by family members is shown in Tables 10.2.1a, b and c. Cattle are owned either by the head of the household or jointly with other members of the family, including spouses, sons, daughters and other members. However, across AEZs, production systems and livestock densities, the most frequent pattern is the joint ownership between the head of household and the spouse. The next most frequent forms of ownership are ownership by the head of the household followed by ownership by the whole family.

Table 10.2.1a. *Ownership of cattle by family members by agro-ecological zones.*

Family members (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	380	916	574	1870
Head	19	21	33	24
Head + spouse	51	46	30	42
Head, spouse and son	12	9	8	9
Head, spouse, son and daughter	2	3	2	3
The whole family	9	13	20	14
Head and son	3	3	3	3
Other family members	4	5	4	5

Table 10.2.1b. *Ownership of cattle by family members by livestock densities.*

Family members (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	255	548	643	424	1870
Head	25	32	16	25	24
Head + spouse	48	31	48	43	42
Head, spouse and son	7	9	10	10	9
Head, spouse, son and daughter	2	4	3	1	3
The whole family	13	14	16	13	14
Head and son	< 1	3	3	4	3
Other family members	3	4	3	3	3

Table 10.2.1c. *Ownership of cattle by family members by production systems.*

Family members (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	1641	157	70	1868
Head	23	32	20	24
Head + spouse	45	25	16	42
Head, spouse and son	9	11	14	9
Head, spouse, son and daughter	3	1	6	3
The whole family	12	29	31	14
Head and son	3	1	7	3
Other family members	3	1	6	3

10.2.2 Ownership of cattle by gender of head of households

Tables 10.2.2a, b and c compare ownership of cattle between male and female heads of households. In the sample where the head of household owns the cattle, males head 96% of the households, while females head the remaining 4%. None of the heads of female-

headed households in the pastoral production system own cattle, compared to 4% ownership in other producion systems.

Table 10.2.2a. *Gender of head of household owning cattle by agro-ecological zones.*

Gender of head (%)	Agro-ecological zones			Overall
	Dega	*Weinadega*	*Kolla*	
No. of households	70	189	189	448
Male	93	99	95	96
Female	7	1	5	4

Table 10.2.2b. *Gender of head of household owning cattle by livestock densities.*

Gender of head (%)	Livestock densities				Overall
	Low	Medium	High	Very high	
No. of households	65	173	102	108	448
Male	94	98	97	95	96
Female	6	2	3	5	4

Table 10.2.2c. *Gender of head of household owning cattle by production systems.*

Gender of head (%)	Production systems			Overall
	Crop–livestock	Agro-pastoral	Pastoral	
No. of households	383	50	14	447
Male	96	96	100	96
Female	4	4	0	4

10.2.3 Responsibility in cattle management activities of family by age and gender

Details of the responsibilities of family members in cattle management activities categorised by age and gender are shown in Tables 10.2.3a, b and c. The selling and buying of cattle is mostly the responsibility of males above 15 years of age. This group is also responsible for breeding, health care and feeding activities whereas their female counterparts are responsible for milking, making and selling dairy products and feeding cattle in about one-third of households. In pastoral systems, however, the feeding of cattle is the primary responsibility of older females than males (Table 10.2.3c). Males under 15 years of age are given responsibilities mainly for herding and feeding. In pastoral communities, over two-thirds of females under 15 years of age are also involved in herding. Young females are also involved in helping older women in dairying activities.

Table 10.2.3a. *Division of cattle raising activities among age and gender groups in crop–livestock systems.*

Activity (%)	No. of households	Age and gender group[a]			
		Male 15 yrs	Female 15 yrs	Male 15 yrs	Female <15 yrs
Purchasing	1629	98	17	2	< 1
Selling	1636	98	19	2	1
Herding	1480	56	31	70	32
Breeding	1487	93	34	21	8
Health care	1598	96	40	15	7
Feeding	1570	82	61	38	22
Milking	1591	8	97	4	16
Making dairy products	1516	5	97	4	19
Selling dairy products	1464	4	97	3	12

a. Sometimes more than one category of adult males, adult females, boys and girls within a household is involved in the same activity.

Table 10.2.3b. *Division of cattle raising activities among age and gender groups in the agro-pastoral systems.*

Activity (%)	No. of households	Age and gender group[a]			
		Male 15 yrs	Female 15 yrs	Male 15 yrs	Female <15 yrs
Purchasing	157	99	5	1	0
Selling	158	99	8	2	1
Herding	148	41	28	85	50
Breeding	148	95	29	33	19
Health care	155	97	27	17	10
Feeding	154	78	68	44	38
Milking	154	8	97	6	29
Making dairy products	135	2	96	5	33
Selling dairy products	124	6	96	6	27

a. See footnote of Table 10.2.3a.

Table 10.2.3c. *Division of cattle raising activities among age and gender groups in the pastoral systems.*

Activity (%)	No. of households	Age and gender group[a]			
		Male 15 yrs	Female 15 yrs	Male 15 yrs	Female <15 yrs
Purchasing	67	99	5	0	0
Selling	68	99	5	0	0
Herding	69	41	35	87	71
Breeding	55	86	53	53	44
Health care	70	97	61	36	33
Feeding	69	44	93	38	39
Milking	70	21	100	27	37
Making dairy products	70	0	100	11	43
Selling dairy products	54	2	100	20	46

a. See footnote of Table 10.2.3a.

10.3 Cattle husbandry practices

Husbandry practices cover all aspects of management, which include housing, feeding, breeding, health care etc. Husbandry practices form part of the immediate environment of the animals, and thus directly influence their performance.

10.3.1 Types of housing for cattle

Table 10.3.1 shows types of housing for cattle. In general, animals are housed in kraals in two-thirds of households, followed by the family houses and sheds. A yard or veranda was only occasionally used for housing cattle. Differences were observed by production systems. Whereas a third of the households in the crop–livestock system use the family house, only 4% did so in the pastoral system. The proportion of households who share housing with their cattle was directly related to livestock densities.

Table 10.3.1. *Types of cattle houses by agro-ecological zones, production systems and livestock densities.*

		Type of housing (%)						
Categories	No. of households	Family house	Shed	Veranda	Kraal	Yard	None	Other
Agro-ecological zones								
Dega	383	40	22	1	70	9	0	0
Weinadega	917	34	23	4	63	12	<1	<1
Kolla	577	27	27	6	71	10	1	<1
Production systems								
Crop–livestock	1647	36	25	5	63	11	<1	<1
Agro-pastoral	158	22	7	0	92	8	1	0
Pastoral	70	4	29	0	96	4	0	0
Livestock densities								
Low	256	27	29	7	76	9	1	0
Medium	549	17	20	3	82	12	<1	<1
High	646	38	25	6	59	15	<1	<1
Very high	426	50	23	1	53	3	0	0
Overall	1877	33	24	4	67	11	<1	<1

10.3.2 Households that keep their cattle under a roof during dry and wet seasons

Tables 10.3.2a, b and c show households that keep their cattle under a roof during dry and wet seasons. Irrespective of the AEZs, production systems and livestock densities, calves are mostly kept under roofed houses during both dry and wet seasons, whereas only a third of the households keep other cattle under roof.

Table10.3.2a. *Households that keep their cattle under a roof during dry and wet seasons by agro-ecological zones.*

Animal group (%)	Agro-ecological zones			
	Dega	*Weina-dega*	*Kolla*	Overall
Dry season				
No. of households	272	706	347	1325
Cows	39	39	34	37
Bulls	28	31	26	29
Oxen	35	36	30	34
Calves	98	93	90	93
Other young stock	31	34	23	31
Wet season				
No. of households	272	707	355	1334
Cows	38	44	39	41
Bulls	26	34	31	31
Oxen	34	42	38	39
Calves	98	93	90	93
Other young stock	33	36	26	33

Table 10.3.2b. *Households that keep their cattle under a roof during dry and wet seasons by livestock densities.*

Animal group (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
Dry season					
No. of households	183	352	481	309	1325
Cows	19	14	42	68	37
Bulls	10	14	33	52	29
Oxen	21	14	41	54	34
Calves	88	95	92	96	93
Other young stock	4	26	32	51	31
Wet season					
No. of households	187	359	484	304	1334
Cows	20	18	49	70	41
Bulls	11	16	38	53	31
Oxen	24	21	47	58	39
Calves	88	64	92	96	93
Other young stock	4	27	36	52	33

Table 10.3.2c. *Households that keep their cattle under a roof during dry and wet seasons by production systems.*

Animal group (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
Dry season				
No. of households	1248	54	22	1324
Cows	38	37	0	37
Bulls	30	19	0	29
Oxen	35	33	5	34
Calves	93	98	95	93
Other young stock	32	19	0	31
Wet season				
No. of households	1254	56	23	1333
Cows	42	39	0	41
Bulls	33	16	0	32
Oxen	40	32	4	39
Calves	93	98	96	93
Other young stock	34	18	0	33

10.3.3 Materials used for cattle house constructuion

Tables 10.3.3a, b and c show types of materials used to construct cattle houses. Across all AEZs, earthen material and grass are primarily used for roofing while wood, together with earthen material in a few cases is used for walls. For the few households that constructed floor from materials other than earth, stone or bricks were the primary material used almost entirely in the crop–livestock systems.

Table 10.3.3a. *Materials used to construct cattle houses by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Materials	No.	%	No.	%	No.	%	No.	%
Roof materials								
Iron sheet	13	4.2	131	16.3	59	11.2	203	12.4
Grass/bushes	226	73.4	404	50.4	247	47.0	877	53.6
Wood	35	11.4	83	10.3	85	16.2	203	12.4
Stone/brick	3	1.0	2	0.2	9	1.7	14	0.9
Earth	278	90.3	760	94.8	514	97.9	1552	94.9
Other	0	0.0	1	0.1	11	2.1	12	0.7
No. of households	308		802		525		1635	
Wall materials								
Grass/bushes	6	1.9	11	1.3	5	1.0	22	1.3
Wood	297	96.1	797	96.7	502	97.9	1596	97.0
Stone/brick	28	9.1	27	3.3	5	1.0	60	3.6
Earth	57	18.4	108	13.1	92	17.9	257	15.6

cont'd...

Table 10.3.3a. cont'd.

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Materials	No.	%	No.	%	No.	%	No.	%
Concrete	0	0.0	0	0.0	1	0.2	1	0.1
Other	0	0.0	2	0.2	0	0.0	2	0.1
No. of households	309		824		513		1646	
Floor materials								
Grass/bushes	0	0.0	1	1.8	2	10.0	3	2.4
Wood	1	2.1	7	12.5	4	20.0	12	9.7
Stone/brick	46	95.8	40	71.4	10	50.0	96	77.4
Earth	3	6.3	3	5.4	4	20.0	10	8.1
Concrete	1	2.1	3	5.4	2	10.0	6	4.8
Other	0	0.0	2	3.6	0	0.0	2	1.6
No. of households	48		56		20		124	

Table 10.3.3b. *Materials used to construct cattle houses by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		All	
Materials	No.	%	No.	%	No.	%	No.	%	No.	%
Roof materials										
Iron sheet	22	10.5	55	12.2	77	13.5	49	12.1	203	12.4
Grass/bushes	113	53.8	171	37.8	335	58.9	258	63.9	877	53.6
Wood	24	11.4	58	12.8	52	9.1	69	17.1	203	12.4
Stone/brick	9	4.3	0	0.0	4	0.7	1	0.2	14	0.9
Earth	201	95.7	444	98.2	544	95.6	363	89.9	1552	94.9
Other	1	0.5	11	2.4	0	0.0	0	0.0	12	0.7
No. of households	210		452		569		404		1635	
Wall materials										
Grass/bushes	1	0.5	3	0.7	12	2.1	6	1.5	22	1.3
Wood	203	99.5	453	98.9	540	94.1	400	97.6	1596	97.0
Stone/brick	1	0.5	2	0.4	38	6.6	19	4.6	60	3.6
Earth	0	0.0	48	10.5	108	18.8	101	24.6	257	15.6
Concrete	0	0.0	0	0.0	1	0.2	0	0.0	1	0.1
Other	0	0.0	1	0.2	1	0.2	0	0.0	2	0.1
No. of households	204		458		574		410		1646	
Floor material										
Grass/bushes	1	6.7	0	0.0	1	2.0	1	2.1	3	2.4
Wood	5	33.3	4	30.8	2	4.1	1	2.1	12	9.7
Stone/brick	7	46.7	6	46.2	41	83.7	42	89.4	96	77.4
Earth	3	20.0	0	0.0	5	10.2	2	4.3	10	8.1
Concrete	0	0.0	2	15.4	3	6.1	1	2.1	6	4.8
Other	0	0.0	1	7.7	1	2.0	0	0.0	2	1.6
No. of households	15		13		49		47		124	

Table10.3.3c. *Materials used to construct cattle houses by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		All	
Materials	No.	%	No.	%	No.	%	No.	%
Roof materials								
Iron sheet	201	13.9	2	1.6	0	0.0	203	12.4
Grass/bushes	841	58.1	33	26.2	3	5.0	877	53.7
Wood	184	12.7	6	4.8	13	21.7	203	12.4
Stone/brick	14	1.0	0	0.0	0	0.0	14	0.9
Earth	1366	94.3	125	99.2	60	100.0	1551	94.9
Other	1	0.1	1	0.8	9	15.0	11	0.7
No. of households	1448		126		60		1634	
Wall materials								
Grass/bushes	19	1.3	2	1.6	1	1.7	22	1.3
Wood	1412	96.8	125	97.7	59	98.3	1596	97.0
Stone/brick	59	4.0	1	0.8	0	0.0	60	3.6
Earth	254	17.4	3	2.3	0	0.0	257	15.6
Concrete	0	0.0	1	0.8	0	0.0	1	0.1
Other	2	0.11	0	0.0	0	0.0	2	0.1
No. of households	1458		128		60		1646	
Floor materials								
Grass/bushes	3	2.5	0	0.0	0	0.0	3	2.4
Wood	10	8.3	2	50.0	0	0.0	12	9.7
Stone/brick	95	79.2	1	25.0	0	0.0	96	77.4
Earth	10	8.3	0	0.0	0	0.0	10	8.1
Concrete	5	4.2	1	25.0	0	0.0	6	4.8
Other	2	1.7	0	0.0	0	0.0	2	1.6
No. of households	120		4				124	

10.3.4 Grazing/feeding practices

Tables 10.3.4a, b and c show reported grazing/feeding practices. Irrespective of AEZs, production systems and livestock densities, herded grazing is by far the most common practice. Tethering is sometimes practised in medium to high livestock densities and crop–livestock systems. Unherded grazing is most common in agro-pastoral systems of the region.

Table 10.3.4a. *Grazing/feeding practices by agro-ecological zones.*

Type of grazing (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	382	917	573	1872
Unherded grazing	6	7	10	8
Herded grazing	92	90	85	89
Paddock grazing	10	5	3	5
Tethered	14	18	13	15
Stall/yard feeding	5	3	4	4

Table 10.3.4b. *Grazing/feeding practices by livestock densities.*

Type of grazing (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	254	548	646	424	1872
Unherded grazing	6	11	9	2	8
Herded grazing	93	86	87	94	89
Paddock grazing	3	4	9	4	5
Tethered	3	16	20	16	15
Stall/yard feeding	2	3	4	6	4

Table 10.3.4c. *Grazing/feeding practices by production systems.*

Type of grazing (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	1644	157	69	1870
Unherded grazing	6	24	1	8
Herded grazing	90	78	99	89
Paddock grazing	6	2	0	5
Tethered	17	8	1	15
Stall/yard feeding	4	3	0	4

10.3.5 Provision of supplementary feeds during the dry and wet seasons

Tables 10.3.5a, b and c show supplementation given to cattle by season. In general, roughage/crop residue supplementation is higher during the dry than wet seasons. In contrast, mineral/vitamin supplementation is higher during the wet than the dry season. Few households, but more so in the *dega* AEZ, supplement their cattle with concentrates. There is a tendency for concentrate feeding to increase among households in high/very high livestock density areas in the wet season, but generally, percentages of households feeding concentrates are similar between seasons. Roughage/crop residue and concentrate feeding is practised by more crop–livestock farmers than those in agro-pastoral and pastoral systems. In contrast, virtually all households in pastoral communities supplement their cattle with minerals/vitamins during both seasons.

Table 10.3.5a. *Provision of supplementary feeds by agro-ecological zones.*

Agro-ecological zones	Number of households	Type of supplements (%)				
		Roughage/crop residues	Minerals/ vitamins	Concentrates	None	Other
Dry season						
Dega	375	75	72	14	2	2
Weinadega	867	74	70	9	1	7
Kolla	497	70	56	6	1	5
Overall	1739	73	66	9	1	5
Wet season						
Dega	351	55	85	10	2	0
Weinadega	852	51	87	7	1	0
Kolla	543	34	91	3	1	0
Overall	1746	46	88	6	2	0

Table 10.3.5b. *Provision of supplementary feeds by livestock densities.*

Livestock densities	No. of households	Type of supplements (%)				
		Roughage/crop residues	Minerals/ vitamins	Concentrates	None	Other
Dry season						
Low	220	68	66	5	2	7
Medium	533	58	82	6	2	8
High	604	80	65	12	1	4
Very high	382	85	46	13	1	3
Overall	1739	73	66	9	1	5
Wet season						
Low	242	27	96	5	2	0
Medium	522	37	94	7	3	0
High	608	48	88	6	1	0
Very high	374	70	76	8	1	0
Overall	1746	46	88	7	2	0

Table 10.3.5c. *Provision of supplementary feeds by production systems.*

Production systems	No. of households	Type of supplements (%)				
		Roughage/ crop residues	Minerals/ vitamins	Concentrates	None	Other
Dry season						
Crop–livestock	1568	76	66	10	1	6
Agro-pastoral	117	56	57	2	1	3
Pastoral	52	21	96	0	0	4
Overall	1737	73	66	9	1	5
Wet season						
Crop–livestock	1527	49	87	7	2	0
Agro-pastoral	149	32	91	2	1	0
Pastoral	68	6	100	0	0	0
Overall	1744	46	88	6	2	0

10.3.6 Feed supplementation by type of animal

Tables 10.3.6a, b and c show supplementation by type of animal. Irrespective of AEZs, livestock densities and production systems, higher percentages of households provide supplementary feeds to their cows and oxen (bulls in pastoral systems) than to other classes of animals.

Table 10.3.6a. *Feed supplementation by type of animal and agro-ecological zones.*

Animal group (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	372	886	561	1819
Cows	95	95	95	95
Bulls	64	60	66	63
Oxen	95	90	83	89
Calves	83	71	79	76
Other young stock	36	35	42	37

Table 10.3.6b. *Feed supplementation by type of animal and livestock densities.*

Animal group (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	247	530	635	407	1819
Cows	96	97	95	92	95
Bulls	61	63	67	57	63
Oxen	86	90	90	87	89
Calves	82	72	78	75	76
Other young stock	37	34	37	43	37

Table 10.3.6c. *Feed supplementation by type of animal and production systems.*

Animal group (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of household	1591	158	68	1817
Cows	95	92	100	95
Bulls	60	78	91	63
Oxen	89	91	74	89
Calves	76	83	74	76
Other young stock	34	56	78	37

10.3.7 Types of animals most important to supplement

Tables 10.3.7a, b and c show types of animals most important to supplement. Oxen are on average the most important animals to be provided with feed supplements, especially in crop–livestock systems and in high and very high livestock density areas, followed by cows. Cows, however, are considered by pastoral households to be the most important class of cattle to supplement.

Table 10.3.7a. *Types of animals most important to supplement by agro-ecological zones.*

Animal group (%)	Agro-ecological zones					
	Dega		*Weinadega*		*Kolla*	
	No. of households	Rank 1	No. of households	Rank 1	No. of households	Rank 1
Cows	355	34	843	39	527	37
Bulls	238	5	535	9	373	17
Oxen	352	56	799	55	466	45
Calves	310	8	632	6	445	14
Other young stock	133	2	311	4	238	3

Table 10.3.7b. *Types of animals most important to supplement by livestock densities.*

Animal group (%)	Livestock densities							
	Low		Medium		High		Very high	
	No. of households	Rank 1	No. of households	Rank 1	No. of households	Rank 1	No. of households	Rank 1
Cows	237	44	512	46	601	32	375	31
Bulls	151	14	335	14	426	9	234	9
Oxen	212	41	478	45	571	60	356	58
Calves	302	8	380	12	497	9	307	6
Other young stock	92	1	180	7	237	2	173	2

Table 10.3.7c. *Types of animals most important to supplement by production systems.*

Animal group (%)	Production systems					
	Crop–livestock		Agro-pastoral		Pastoral	
	No. of households	Rank 1	No. of households	Rank 1	No. of households	Rank 1
Cows	1510	35	145	50	68	59
Bulls	960	9	123	18	62	27
Oxen	1422	54	144	47	50	16
Calves	1204	8	131	15	50	22
Other young stock	539	1	89	17	53	0

10.3.8 Sources of water

Tables 10.3.8a, b and c show sources of water by season, AEZs, livestock densities and production systems. In general, rivers are the most important source of water during both wet and dry seasons, followed by rain, springs and dams. Dams are particularly important sources of water for pastoral and agro-pastoral production systems during the wet season, as are bore wells during the dry season. Rivers, as a source of water, are more frequently used in *dega* and *weinadega* than *kolla* AEZ. Dams and bore wells are more important water sources in *kola* than in *weinadega* and *dega* AEZs.

Table 10.3.8a. *Sources of water by agro-ecological zones.*

Source of water (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
Wet season				
No. of households	381	915	570	1866
Bore well	6	3	9	5
Dam	3	11	39	18
River	73	67	46	62
Spring	14	16	14	15
Piped	3	1	2	1
Rain	29	26	38	30
Other	0	2	0	1
Dry season				
No. of households	383	918	576	1877
Bore well	8	9	27	14
Dam	5	5	14	8
River	83	73	56	70
Spring	15	16	18	16
Piped	5	5	5	5
Rain	1	1	1	1
Other	0	2	0	1

Table 10.3.8b. *Sources of water by livestock densities.*

Source of water (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
Wet season					
No. of households	255	543	644	424	1866
Bore well	13	4	5	3	5
Dam	31	13	14	21	18
River	60	75	69	35	62
Spring	14	10	18	16	15
Piped	1	< 1	1	4	1
Rain	24	21	32	44	30
Other	0	0	0	4	1
Dry season					
No. of households	255	549	647	426	1877
Bore well	35	15	9	9	14
Dam	2	6	10	10	8
River	59	74	76	61	70
Spring	17	11	19	19	16
Piped	4	2	5	11	5
Rain	0	1	1	1	1
Other	0	0	0	4	1

Table 10.3.8c. *Sources of water by production systems.*

Source of water (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
Wet season				
No. of households	1642	157	65	1864
Bore well	5	4	12	5
Dam	11	54	97	18
River	68	16	14	62
Spring	16	10	3	15
Piped	2	1	0	1
Rain	27	52	55	30
Other	1	1	0	1
Dry season				
No. of households	1647	158	70	1875
Bore well	10	33	81	15
Dam	6	26	14	8
River	74	42	29	70
Spring	17	13	6	16
Piped	4	8	14	5
Rain	1	1	0	1
Other	1	1	0	1

10.3.9 Quality of water in wet and dry seasons

Tables 10.3.9a, b and c show quality of water by season, AEZs, livestock densities and production systems. In general, most of the water drunk during the wet season is muddy water with only about two-fifths of households having access to good quality water. Households in crop–livestock system have more access to good quality water than households in agro-pastoral and pastoral systems in this season. In contrast, in general 80% of the households across the region have access to good quality water during the dry season. During the wet season, households in *dega* have more access to good quality water than households in *weinadega* and *kolla* AEZs. Smelly water tended to be more frequently reported in the *kolla* AEZ and in the pastoral systems where livestock mostly share the same watering points.

Table 10.3.9a. *Quality of water in wet and dry seasons by agro-ecological zones.*

Water quality/ season	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		All	
	No.	%	No.	%	No.	%	No.	%
Wet season								
Good/clear	237	62.5	334	36.5	203	35.7	774	41.6
Muddy	166	43.8	612	67.0	393	69.2	1171	62.9
Salty	0	0.0	20	2.2	7	1.2	27	1.5
Smelly	13	3.4	34	3.7	49	8.6	96	5.2
No. of households.	379		914		568		1861	
Dry season								
Good/clear	301	79.0	753	82.4	442	77.1	1496	80.0
Muddy	81	21.0	159	17.4	112	19.5	352	18.8
Salty	0	0.0	21	2.3	16	2.8	37	2.0
Smelly	30	8.0	55	6.0	55	9.6	140	7.5
No. of households	383		914		573		1870	

Table 10.3.9b. *Quality of water in wet and dry seasons by livestock densities.*

Water quality/ season	Livestock densities									
	Low		Medium		High		Very high		All	
	No.	%	No.	%	No.	%	No.	%	No.	%
Wet										
Good/clear	110	43.3	224	41.4	268	41.6	172	40.8	774	41.6
Muddy	164	64.6	330	61.0	416	64.6	261	61.8	1171	62.9
Salty	4	1.6	4	0.7	3	0.5	16	3.8	27	1.5
Smelly	45	17.7	14	2.6	20	3.1	17	4.0	96	5.2
No. of households	254		541		644		422		1861	
Dry										
Good/clear	218	85.8	391	71.6	513	79.4	374	88.2	1496	80.0
Muddy	36	14.2	144	26.4	133	20.6	39	9.2	352	18.8
Salty	5	2.0	1	0.2	12	1.9	19	4.5	37	2.0
Smelly	3	1.2	40	7.3	56	8.7	41	9.7	140	7.5
No. of households	254		546		646		424		1870	

Table 10.3.9c. *Quality of water in wet and dry seasons by production systems.*

Water quality/season	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		All	
	No.	%	No.	%	No.	%	No.	%
Wet								
Good/clear	718	43.9	39	24.8	15	23.1	772	41.5
Muddy	995	60.8	126	80.3	50	76.9	1171	63.0
Salty	18	1.1	7	4.5	2	3.1	27	1.5
Smelly	49	3.0	27	17.2	20	30.8	96	5.2
No. of households	1637		157		65		1859	
Dry								
Good/clear	1300	79.2	135	86.0	59	84.3	1494	80.0
Muddy	328	20.0	14	8.9	10	14.3	352	18.8
Salty	11	0.7	16	10.2	10	14.3	37	2.0
Smelly	109	6.6	21	13.4	10	14.3	140	7.5
No. of households	1641		157		70		1868	

10.3.10 Distance to nearest watering point in wet and dry seasons

Households from Borana, Bale and Arsi zones (Phase 1 of survey) were asked about distance to nearest watering point for all cattle, whilst in the second phase of the survey (East and West Hararge, East, West and North Shewa, East and West Wellega, Jimma and Illubabor zones) the question was confined to adult cattle only. Tables 10.3.10a, b and c show the average (across all zones) distance to nearest watering point by season, AEZs, livestock densities and production systems. In general, the distance to nearest watering point is

less than a kilometre for two-thirds of the households during wet season but this fell to half during the dry season. A greater proportion of households in low livestock density areas travel longer distances for water, irrespective of season, than households in medium to very high livestock densities.

Table 10.3.10a. *Distance to nearest watering point in wet and dry seasons by agro-ecological zones.*

Distance to nearest watering point (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
Wet season				
No. of households	362	882	536	1780
<1 km	72	69	58	66
1–5 km	27	28	36	30
6–10 km	2	2	3	2
>10 km	0	1	3	1
Dry season				
No. of households	374	901	554	1829
<1 km	55	56	33	49
1–5 km	40	35	41	38
6–10 km	5	4	15	7
>10 km	<1	5	11	6

Table 10.3.10b. *Distance to nearest watering point in wet and dry seasons by livestock densities.*

Distance to nearest watering point (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
Wet season					
No. of households	246	530	617	387	1780
<1 km	50	65	68	76	66
1–5 km	41	32	29	21	30
6–10 km	4	1	3	2	2
>10 km	4	1	<1	1	1
Dry season					
No. of households	250	543	635	401	1829
<1 km	35	56	53	42	49
1–5 km	42	36	35	42	38
6–10 km	11	5	8	8	7
>10 km	12	3	4	8	6

Table 10.3.10c. *Distance to nearest watering point in wet and dry seasons by production systems.*

Distance to nearest watering point (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
Wet season				
No. of households	1568	151	59	1778
<1 km	67	64	61	66
1–5 km	30	32	34	30
6–10 km	2	1	0	2
>10 km	1	3	5	1
Dry season				
No. of households	1605	155	67	1827
<1 km	52	25	42	49
1–5 km	40	28	18	38
6–10 km	6	14	22	7
>10 km	3	33	18	6

10.4 Mating practice

10.4.1 Types of mating

Table 10.4.1 shows the types of mating used by zones. Except for the North Shewa Zone where 10% of the households use both natural and artificial insemination, practically all households use natural mating of cattle. Borana and East Wellega zones did not report any use of artificial insemination.

Table 10.4.1. *Types of mating used by administrative zones.*

Administrative zones	No. of households	Breeding method (%)		
		Natural	Artificial insemination	Both
Borana	198	100	0	0
Bale	158	98	1	1
Arsi	149	97	0	3
East Shewa	165	97	0	3
West Hararge	139	99	0	1
East Hararge	141	99	0	1
North Shewa	120	90	0	10
West Shewa	195	99	1	1
East Wellega	129	100	0	0
Jimma	140	99	0	1
Illubabor	130	99	0	1
West Wellega	197	99	1	0
Overall	1861	98	<1	2

10.4.2 Control over mating

Tables 10.4.2a, b and c show the level of control exercised over cattle mating. In general, 70% of the households practice uncontrolled mating, while another 13% practice both controlled and uncontrolled mating. Slightly more households practice controlled mating in the *kolla* and *weinadega* than *dega* areas. The proportion of households practising controlled mating increases with increasing livestock densities. Households in pastoral systems practice no controlled mating. The study did not show, however, whether communities used selected breeding bulls for controlled mating.

Table 10.4.2a. *Control over mating by agro-ecological zones.*

Agro-ecological zones	No. of households	Mating type (%)		
		Controlled	Uncontrolled	Both
Dega	372	10	80	10
Weinadega	903	19	68	13
Kolla	567	19	66	15
Overall	1842	17	70	13

Table 10.4.2b. *Control over mating by livestock densities.*

Livestock densities	No. of households	Mating type (%)		
		Controlled	Uncontrolled	Both
Low	248	7	82	12
Medium	540	10	82	8
High	639	20	65	15
Very high	415	30	53	17
Overall	1842	17	70	13

Table 10.4.2c. *Control over mating by production systems.*

Production systems	No. of households	Mating type (%)		
		Controlled	Uncontrolled	Both
Crop–livestock	1619	19	69	12
Agro-pastoral	152	14	64	22
Pastoral	70	0	86	14
Overall	1841	17	70	13

10.4.3 Sources of bulls used for breeding within the previous 12 months

Seventy-three percent of households in general had used their home-grown bulls for breeding followed by use of neighbour's bull and a bull that had been bought (Tables 10.4.3a, b and c). Fourteen percent of households used communal or unknown bulls. Households using unknown and neighbour's bull decrease from *dega* to *weinadega* and

kolla AEZs. This may indicate a relative scarcity of bulls in the *dega* AEZ. Likewise, in areas of very high livestock density 40% of the households used bulls from neighbours compared with 31% in high, 25% in medium and 18% in low livestock density areas. The use of unknown bulls was also more frequent in high and very high livestock density areas than in medium and low livestock densities. The trend with the source of bull by production systems is similar although the percent of households that use own-bred bull was high in pastoral system compared to agro-pastoral and crop–livestock systems. A third of households in crop–livestock systems have used a neighbour's bull for breeding compared with only 3% of pastoralists.

Table 10.4.3a. *Sources of bulls used by agro-ecological zones.*

Sources of bulls (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	367	892	555	814
Own-bred	72	75	70	73
Bought	17	17	17	17
Donated	<1	1	<1	1
Borrowed	1	3	1	2
Bull from neighbour	43	31	18	29
Communal bull	4	6	4	5
Artificial insemination	4	<1	<1	1
Unknown	14	8	7	9

Table 10.4.3b. *Sources of bulls used by livestock densities.*

Sources of bulls (%)	Livestock densities				
	Low	Medium	High	Very high	Overall
No. of households	246	544	622	402	1814
Own-bred	78	74	71	70	73
Bought	15	14	22	14	17
Donated	0	1	2	<1	1
Borrowed	1	2	1	4	2
Bull from neighbour	18	25	31	40	29
Communal bull	6	7	4	5	5
Artificial insemination	2	1	<1	2	1
Unknown	2	5	13	12	9

Table 10.4.3c. *Sources of bulls used by production systems.*

Sources of bulls (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	Overall
No. of households	1592	154	66	1812
Own-bred	71	80	92	73
Bought	18	10	3	17
Donated	1	1	0	1
Borrowed	2	3	2	2
Bull from neighbour	32	16	3	29
Communal bull	5	6	11	5
Artificial insemination	1	1	0	1
Unknown	10	3	0	9

10.4.4 Monthly distribution of births of calves

Significant numbers of calves are reported born in every month of the year across AEZs and production systems, with the most frequent cases coming between September and November (Tables 10.4.4a and b). This means that mating practice tends not to be seasonal.

Table 10.4.4a. *Monthly distribution (%) of births of calves by agro-ecological zones.*

Months (%)	Agro-ecological zones			
	Dega	*Weinadega*	*Kolla*	Overall
No. of households	375	872	530	1777
January	19	31	20	25
February	22	27	25	25
March	29	31	40	33
April	37	32	36	34
May	37	29	26	30
June	43	32	27	33
July	25	27	34	29
August	25	33	36	32
September	48	58	51	54
October	47	56	43	50
November	50	49	35	45
December	33	37	25	32

Table 10.4.4b. *Monthly distribution (%) of births of calves by production systems.*

Months (%)	Production systems			
	Crop–livestock	Agro-pastoral	Pastoral	All
No. of households	1482	153	66	1701
January	16	11	61	17
February	13	24	70	16
March	21	43	58	24
April	23	34	24	24
May	19	11	12	18
June	25	9	3	22
July	21	18	14	20
August	22	42	21	24
September	45	46	15	44
October	42	28	11	39
November	39	22	8	36
December	25	23	8	24

10.4.5 Castration practices

Castration is a common practice throughout the region (Table 10.4.5). However, a sizeable (27%) proportion of the households in *kolla* AEZ do not castrate their cattle. Similarly, almost a third of the households in low livestock density areas do not castrate. A higher proportion of households in crop–livestock systems castrate their animals compared with those in pastoral and agro-pastoral systems.

Table 10.4.5. *Castration practice by agro-ecological zones, production systems and livestock densities.*

Categories	Castration practice (%)		
	No. of households	Castration	No castration
Agro-ecological zones			
Dega	376	95	5
Weinadega	894	92	8
Kolla	558	73	27
Livestock densities			
Low	241	69	31
Medium	545	88	12
High	634	91	9
Very high	408	90	10
Production systems			
Crop–livestock	1605	88	12
Agro-pastoral	151	79	21
Pastoral	70	80	20
Overall	1828	87	13

10.4.6 Age of castration

Almost all households castrated their cattle after nine months of age and there was hardly any variation between the agro-ecological zones, livestock densities or production systems (Table 10.4.6).

Table 10.4.6. *Reported age of castrating cattle.*

Categories	No. of households	Age of castration (%)		
		3–6 months	6–9 months	>9 months
Agro-ecological zones				
Dega	344	2	1	98
Weinadega	812	1	1	98
Kolla	392	2	2	96
Livestock densities				
Low	158	<1	<1	99
Medium	496	2	1	97
High	544	1	1	98
Very high	350	3	1	97
Production systems				
Crop–livestock	1379	2	1	97
Agro-pastoral	115	0	0	100
Pastoral	53	0	0	100
Overall	1548	2	1	97

10.4.7 Reasons for castration

The reported reasons for castrating cattle, in their overall order of importance are to:
1. fetch better market prices
2. improve draft power
3. improve temperament and
4. control breeding (Table 10.4.7).

However, in pastoral systems the need to control breeding ranked as the highest.

Table 10.4.7. *Reported reasons for castration.*

Categories	No. of households	Reason for castration (%)			
		Control breeding	Improve draft power	Better temperament	Better price
Agro-ecological zones					
Dega	354	45	84	73	90
Weinadega	807	39	89	58	88
Kolla	399	52	71	60	91
Livestock densities					
Low	160	63	81	74	91
Medium	504	36	77	54	90
High	539	50	89	66	88
Very high	357	39	86	64	90
Production systems					
Crop–livestock	1384	42	85	64	89
Agro-pastoral	120	48	91	51	94
Pastoral	55	82	33	49	93
Overall	1560	44	83	62	89

10.5 Cattle health

10.5.1 Prevalence of cattle diseases

Tables 10.5.1a, b, c and d summarise the range of prevalent animal diseases and disease conditions as reported by 1776 respondents across the region. The major cattle diseases were blackleg, anthrax, trypanosomosis, pasteurellosis, foot-and-mouth disease (FMD), gastro-intestinal disorders and respiratory diseases. Blackleg and anthrax were more common in the *dega* than other AEZs. Trypanosomosis was high in *kolla* and *weinadega* AEZs. However, it was also reported by a sizeable proportion of households from *dega*, which might be due to exposure of animals to adjacent humid lowlands. Skin diseases were not reported from households in the *dega* AEZ. As livestock density increased, the reported trypanosomosis prevalence decreased indicating the limiting role of trypanosomosis on livestock production in areas of the region where livestock density is low. Anthrax was more prevalent in agro-pastoral and pastoral systems than in crop–livestock system. Pasteurellosis and trypanosomosis were more prevalent in the pastoral than in the other production systems.

Table 10.5.1a. *Reported prevalence (percent) of cattle diseases by administrative zones.*

Diseases/disease conditions	Administrative zones (%)												
	Arsi	Bale	Borana	East Hararge	East Shewa	East Wellega	Illubabor	Jimma	North Shewa	West Hararge	West Shewa	West Wellega	Overall
Blackleg	87.1	51.1	57.5	42.4	74.5	72.1	38.9	28.3	101.7	39.4	56.7	17.6	54.7
Anthrax	36.7	20.1	31.8	43.2	78.9	55.8	39.7	16.8	38.3	46.7	49.7	0	37.7
Trypanosomosis	0.0	33.8	38.0	8.6	6.8	63.6	57.9	18.6	0.0	0.7	27.8	99.5	31.8
Pasteurellosis	12.2	3.6	21.2	36.0	44.1	0.0	9.5	1.8	9.2	5.8	26.2	19.6	17.1
Foot-and-mouth disease	19.0	13.7	19.6	12.2	34.2	31.0	4.8	15.9	22.5	9.5	9.6	5.0	16.1
Gastro-intestinal disorders	10.9	12.9	10.6	10.1	2.5	4.7	8.7	13.3	4.2	27.0	3.7	13.6	10.1
Respiratory diseases	6.8	28.1	0.6	3.6	1.2	2.3	2.4	10.6	0.8	0.7	1.1	46.7	9.7
Emergency	0.7	5.0	2.8	6.5	1.2	4.7	0.8	11.5	0.8	62.0	3.7	0.0	7.7
Swelling of body	2.0	3.6	0.0	13.7	4.3	1.6	4.8	8.8	2.5	8.0	20.9	8.5	6.9
Internal parasites	15.6	10.1	2.2	2.9	10.6	14.0	9.5	5.3	5.0	0.0	2.7	3.5	6.5
Contagious bovine pleuro-pneumonia	0.0	0.7	22.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.6	4.7
Malnutrition	1.4	0.0	0.0	3.6	0.6	1.6	7.1	7.1	0.8	24.8	4.3	3.0	4.3
Skin disease	9.5	0.0	2.8	9.4	1.2	0.0	1.6	0.0	0.0	1.5	0.5	1.0	2.3
Abortion/brucellosis	1.4	0.0	3.4	7.2	1.2	0.0	0.0	0.9	0.0	0.0	9.6	0.0	2.2
Injury	0.7	0.0	0.0	0.7	0.0	0.0	3.2	1.8	0.0	0.7	7.5	2.5	1.6
Mastitis	0.7	5.0	2.8	5.8	0.0	0.0	0.8	1.8	0.8	1.5	0.0	0.0	1.5
3-day sickness, *Buta*	0.0	0.0	11.2	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	1.4
Rinderpest	0.0	0.0	3.9	1.4	0.6	0.0	0.0	3.5	0.8	2.2	2.1	0.0	1.2
Botulism	0.0	0.7	3.9	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Foot rot	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.9	0.0	0.0	3.2	0.0	0.5
Rabies	4.8	0.0	0.0		0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.5
External parasites	0.0	0.0	0.6	1.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3
Plant poisoning	1.4	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Lumpy skin disease	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Unknown	40.1	44.6	52.5	38.1	16.8	27.1	57.1	69.0	23.3	35.8	26.2	36.2	38.2
No. of households	147	139	179	139	161	129	126	113	120	137	187	199	1776

Table 10.5.1b. *Reported prevalence of cattle diseases by agro-ecological zones.*

Diseases/disease conditions	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
	No.	%	No.	%	No.	%	No.	%
Blackleg	259	74.2	453	51.5	260	47.4	972	54.7
Anthrax	139	39.8	329	37.4	202	36.9	670	37.7
Trypanosomosis	33	9.5	320	36.4	212	38.7	565	31.8
Pasteurellosis	81	23.2	123	14.0	99	18.1	303	17.1
Foot-and-mouth disease	56	16.0	134	15.2	96	17.5	286	16.1
Gastro-intestinal disorder	27	7.7	85	9.7	67	12.2	179	10.1
Respiratory diseases	32	9.2	73	8.3	67	12.2	172	9.7
Emergency	13	3.7	94	10.7	30	5.5	137	7.7
Swelling of body	13	3.7	74	8.4	35	6.4	122	6.9
Internal parasites	36	10.3	62	7.1	18	3.3	116	6.5
Contagious bovine pleuro-pneumonia	12	3.4	24	2.7	47	8.6	83	4.7
Malnutrition	3	0.9	38	4.3	35	6.4	76	4.3
Skin disease	5	1.4	14	1.6	22	4.0	41	2.3
Abortion/brucellosis	5	1.4	30	3.4	4	0.7	39	2.2
Injury	5	1.4	16	1.8	7	1.3	28	1.6
Mastitis	2	0.6	6	0.7	19	3.5	27	1.5
3-day sickness, *Buta*	0	0.0	7	0.8	17	3.1	24	1.4
Rinderpest	0	0.0	12	1.4	10	1.8	22	1.2
Botulism	0	0.0	2	0.2	15	2.7	17	1.0
Foot rot	0	0.0	6	0.7	2	0.4	8	0.5
Rabies	2	0.6	6	0.7	0	0.0	8	0.5
External parasites	0	0.0	4	0.5	1	0.2	5	0.3
Plant poisoning	2	0.6	0	0.0	3	0.5	5	0.3
Lumpy skin disease	0	0.0	1	0.1	0	0	1	0.1
Unknown	85	24.4	366	41.6	227	41.4	678	38.2
No. of households	349		879		548		1776	

Table 10.5.1c. *Reported prevalence of cattle diseases by livestock densities.*

Diseases/disease conditions	Livestock densities									
	Low		Medium		High		Very high		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
Blackleg	119	49.4	240	45.4	329	54.9	284	69.8	972	54.7
Anthrax	90	37.3	141	26.7	208	34.7	231	56.8	670	37.7
Trypanosomosis	139	57.7	251	47.4	129	21.5	46	11.3	565	31.8
Pasteurellosis	46	19.1	56	10.6	94	15.7	107	26.3	303	17.1
Foot-and-mouth disease	50	20.7	59	11.2	75	12.5	102	25.1	286	16.1
Gastro-intestinal disorder	30	12.4	76	14.4	58	9.7	15	3.7	179	10.1
Respiratory diseases	30	12.4	67	12.7	53	8.8	22	5.4	172	9.7
Emergency	1	0.4	40	7.6	84	14.0	12	2.9	137	7.7
Swelling of body	8	3.3	36	6.8	50	8.3	28	6.9	122	6.9
Internal parasites	19	7.9	24	4.5	40	6.7	33	8.1	116	6.5
Contagious bovine pleuro-pneumonia	19	7.9	37	7.0	26	4.3	1	0.2	83	4.7
Malnutrition	13	5.4	25	4.7	32	5.3	6	1.5	76	4.3
Skin disease	2	0.8	14	2.6	11	1.8	14	3.4	41	2.3
Abortion/brucellosis	0	0.0	21	4.0	5	0.8	13	3.2	39	2.2
Injury	2	0.8	10	1.9	9	1.5	7	1.7	28	1.6
Mastitis	3	1.2	8	1.5	9	1.5	7	1.7	27	1.5
3-day sickness, *Buta*	10	4.1	13	2.5	1	0.2	0	0.0	24	1.4
Rinderpest	0	0.0	11	2.1	5	0.8	6	1.5	22	1.2
Botulism	7	2.9	3	0.6	6	1.0	1	0.2	17	1.0
Foot rot	1	0.4	1	0.2	6	1.0	0	0.0	8	0.5
Rabies			2	0.4	5	0.8	1	0.2	8	0.5
External parasites	1	0.4	2	0.4	0	0.0	2	0.5	5	0.3
Plant poisoning	0	0.0	0	0.0	5	0.8	0	0.0	5	0.3
Lumpy skin disease	0	0.0	0	0.0	1	0.2	0	0.0	1	0.1
Unknown	84	34.9	268	50.7	225	37.6	101	24.8	678	38.2
No. of households	241		529		599		407		1776	

Table 10.5.1d. *Reported prevalence of cattle diseases by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Diseases/disease conditions	No.	%	No.	%	No.	%	No.	%
Blackleg	832	53.2	97	66.4	43	66.2	972	54.8
Anthrax	550	35.2	84	57.5	36	55.4	670	37.8
Trypanosomosis	497	31.8	32	21.9	34	52.3	563	31.7
Pasteurellosis	220	14.1	48	32.9	35	53.8	303	17.1
Foot-and-mouth disease	242	15.5	25	17.1	19	29.2	286	16.1
Gastro-intestinal disorder	161	10.3	15	10.3	3	4.6	179	10.1
Respiratory diseases	168	10.7	3	2.1	1	1.5	172	9.7
Emergency	135	8.6	1	0.7	1	1.5	137	7.7
Swelling of body	114	7.3	8	5.5	0	0.0	122	6.9
Internal parasites	103	6.6	13	8.9	0	0.0	116	6.5
Contagious bovine pleuro-pneumonia	57	3.6	16	11.0	10	15.4	83	4.7
Malnutrition	71	4.5	5	3.4	0	0.0	76	4.3
Skin disease	35	2.2	3	2.1	3	4.6	41	2.3
Abortion/brucellosis	37	2.4	2	1.4	0	0.0	39	2.2
Injury	26	1.7	2	1.4	0	0.0	28	1.6
Mastitis	23	1.5	3	2.1	1	1.5	27	1.5
3-day sickness, *Buta*	13	0.8	10	6.8	1	1.5	24	1.4
Rinderpest	14	0.9	2	1.4	6	9.2	22	1.2
Botulism	8	0.5	5	3.4	4	6.2	17	1.0
Foot rot	7	0.4	0	0.0	1	1.5	8	0.5
Rabies	8	0.5	0	0.0	0	0.0	8	0.5
External parasites	4	0.3	1	0.7	0	0.0	5	0.3
Plant poisoning	2	0.1	3	2.1	0	0.0	5	0.3
Lumpy skin disease	1	0.1	0	0.0	0	0.0	1	0.1
Unknown	593	37.9	68	46.6	14	21.5	675	38.0
No. of households	1563		146		65		1774	

10.5.2 Distance to the nearest veterinary service

On average, 45% of the households trek their animals for over 10 km to take them to nearest veterinary service (Tables 10.5.2a, b, c and d). Borana, East Hararge, Jimma and West Wellega zones reported the highest percentages of households trekking more than 10 km, whereas households in East Wellega reported the least frequent distance of over 10 km to the nearest veterinary service. Eighty-six percent of the households in pastoral areas reported to travel over 10 km to reach the nearest veterinary service.

Table 10.5.2a. *Distance to the nearest veterinary service by administrative zones.*

Administrative zones	No. of households	Distance (%)			
		<1 km	1–5 km	6–10 km	>10 km
Borana	192	3	31	5	60
Bale	154	6	30	16	49
Arsi	149	2	28	33	38
East Shewa	166	9	16	33	42
West Hararge	138	4	42	20	35
East Hararge	140	9	21	11	59
North Shewa	110	6	29	34	32
West Shewa	198	5	35	15	46
East Wellega	125	22	46	21	11
Jimma	137	5	12	29	55
Illubabor	129	5	25	26	44
West Wellega	200	12	21	14	55
Overall	1838	7	28	20	45

Table 10.5.2b. *Distance to the nearest veterinary service by agro-ecological zones.*

Agro-ecological zones	No. of households	Distance (%)			
		<1 km	1–5 km	6–10 km	>10 km
Dega	376	6	34	20	40
Weinadega	898	8	27	21	44
Kolla	564	7	25	18	50
Overall	1838	7	28	20	45

Table 10.5.2c. *Distance to the nearest veterinary service by livestock densities.*

Livestock densities	No.	Distance (%)			
		<1 km	1–5 km	6–10 km	>10 km
Low	251	12	25	10	53
Medium	534	10	29	24	37
High	642	3	32	16	49
Very high	411	7	21	27	45
Overall	1838	7	28	20	45

Table 10.5.2d. *Distance to the nearest veterinary service by production systems.*

Production systems	No.	Distance (%)			
		<1 km	1–5 km	6–10 km	>10 km
Crop–livestock	1617	7	29	21	43
Agro-pastoral	156	6	19	22	53
Pastoral	63	0	14	0	86
Overall	1836	7	28	20	45

10.5.3 Types of veterinary service used

Overall, 92% of the households used governmental veterinary services while 25% used services from drug suppliers and 12% used services from private veterinarians (Tables 10.5.3a, b, c and d). Except for the households in North Shewa, Borana and East Hararge zones, more than 90% of the households in all the remaining zones have used governmental veterinary service. On the other hand, East Wellega, Arsi and Borana reported higher frequencies than average of use of the private veterinary service, and North Shewa, Arsi, West Shewa and East Hararge were the most frequent users of the services from drug suppliers. Private veterinary services were most frequently used in *dega* and *weinadega* than in *kolla* AEZ. Fewer private veterinarians serve the low than higher livestock density areas. Both private veterinarians and veterinary drug suppliers had greater input in agro-pastoral systems than in other production systems.

Table 10.5.3a. *Types of veterinary service used by administrative zones.*

Administrative zones	No. of households	Types of veterinary service (%)			
		Government veterinary service	Private veterinarian	Veterinary drug supplier	Other
Arsi	150	94	31	41	5
Bale	155	94	1	14	0
Borana	190	84	28	18	0
East Hararge	141	84	1	34	0
East Shewa	168	95	16	31	0
East Wellega	128	98	44	33	0
Illubabor	129	93	10	16	0
Jimma	137	99	1	3	0
North Shewa	119	87	9	60	0
West Hararge	138	99	2	5	1
West Shewa	199	93	1	38	1
West Wellega	200	91	9	15	3
Overall	1854	92	12	25	1

Table 10.5.3b. *Types of veterinary service used by agro-ecological zones.*

Agro-ecological zones	No. of households	Types of veterinary service (%)			
		Government veterinary service	Private veterinarian	Veterinary drug supplier	Other
Dega	377	93	18	41	1
Weinadega	915	93	16	21	1
Kolla	562	92	4	21	1
Overall	1854	92	12	25	1

Table 10.5.3c. *Types of veterinary service used by livestock densities.*

Livestock densities	No. of households	Types of veterinary service (%)			
		Government veterinary service	Private veterinarian	Veterinary drug supplier	Other
Low	251	88	4	31	2
Medium	537	88	19	17	1
High	644	98	10	23	1
Very high	422	93	14	37	< 1
Overall	1854	92	12	25	1

Table 10.5.3d. *Types of veterinary service used by production systems.*

Production systems	No. of households	Types of veterinary service (%)			
		Government veterinary service	Private veterinarian	Veterinary drug supplier	Other
Crop–livestock	1633	93	12	25	1
Agro-pastoral	158	88	22	34	0
Pastoral	61	84	5	16	0
Overall	1852	92	12	25	1

10.6 Herd characteristics

Herd characteristics provide indications on the levels of herd performance under the circumstances in which they are kept. Particularly the flow of animals in and out of the household provides preliminary information on herd level production.

10.6.1 Age and sex structures of cattle

Table 10.6.1 shows that age and sex structure of cattle are generally similar across AEZs, livestock density categories and production systems. However, the proportions of adult females were marginally higher in *kolla* and pastoral areas than in other AEZs or production systems. The proportion of adult males increased as livestock density increased, and was markedly higher in the crop–livestock and agro-pastoral systems than in the pastoral system.

Table 10.6.1. *Age and sex structures of cattle by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Total cattle in herds	Cattle types (%)			
			Young males	Young females	Adult males	Adult females
Agro-ecological zones						
Dega	1135	14,518	17.3	18.1	28.5	36.1
Weinadega	2578	26,196	16.0	17.9	30.4	35.7
Kolla	1566	21,380	16.5	17.8	24.3	41.5
Total	5279	62,094	16.5	17.9	27.9	37.8
Livestock densities						
Low	668	9243	18.1	19.4	21.2	41.2
Medium	1579	20,424	16.5	18.6	25.8	39.1
High	1812	18,275	16.5	17.5	30.6	35.4
Very high	1220	14,152	15.4	16.2	31.6	36.8
Total	5279	62,094	16.5	17.9	27.9	37.8
Production systems						
Crop–livestock	4621	49,170	16.6	17.8	29.1	36.5
Agro-pastoral	438	7223	16.2	17.8	27.5	38.6
Pastoral	204	5577	15.6	18.6	17.9	47.9
Total	5263	61,970	16.5	17.9	27.9	37.8

10.6.2 Mortality by age and sex groups

Based on the reported current stock of cattle and numbers of deaths reported over the 12 months prior to the survey, the overall mortality rate for the whole sample herd was 5%, and the aggregate rates for the different age and sex categories ranged from 3% for adult (>3 years of age) males to 13% for young (<3 years of age) males (Table 10.6.2). Variation in mortality rates among the different age and sex groups was considerable across AEZs, livestock densities and production systems, especially for young male cattle. For example, the calculated mortality rate of young males in pastoral areas was as high as 29% compared to 7% for a similar group in the *dega* AEZ and in areas of very high livestock density.

Table 10.6.2. *Calculated mortality rates by age and sex groups by agro-ecological zones, livestock densities and production systems.**

Categories	No. of households	Cattle types (%)							
		Young males		Adult males		Adult females		Overall	
		No.	%	No.	%	No.	%	No.	%
Agro-ecological zones									
Dega	165	180	6.7	83	2.0	134	2.5	397	2.7
Weinadega	433	537	11.4	267	3.2	444	4.5	1248	4.5
Kolla	340	770	17.9	266	4.9	734	7.6	1770	7.6
Total	938	1487	12.7	616	3.4	1312	5.3	3415	5.2
Livestock densities									
Low	174	342	16.9	124	5.9	374	8.9	840	8.3
Medium	299	629	15.8	220	4.0	507	6.0	1356	6.2
High	304	356	10.6	195	3.4	312	4.6	863	4.5
Very high	161	160	6.9	77	1.7	119	2.2	356	2.5
Total	938	1487	12.7	616	3.4	1312	5.3	3415	5.2
Production systems									
Crop–livestock	778	928	10.2	459	3.1	718	3.8	2105	4.1
Agro-pastoral	100	203	14.8	71	3.5	220	7.3	494	6.4
Pastoral	60	356	29.1	86	7.9	374	12.3	816	12.8
Total	938	1487	12.7	616	3.4	1312	5.3	3415	5.2

* Because of large missing data, female young cattle of less than three years old are not included in this table.

10.6.3 Acquisition of cattle during the previous 12 months

Tables 10.6.3a, b and c show proportions of cattle that entered the households during the previous 12 months. Overall, 9% of the cattle in sample herds had entered the households during the previous 12 months (about 4% each from males and females). The majority of these (88%) were in the form of birth. The contribution of birth was slightly higher in *dega* than in other AEZs. Likewise, entries by birth were relatively high in low livestock density areas. Other modes of entry were similar across the different categories.

Table 10.6.3a. *Proportion of cattle that entered the households during the previous 12 months by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Type of entry	No.	%*	No.	%	No.	%	No.	%
Male cattle								
Born	605	4.2	972	3.7	842	3.9	2419	3.9
Bought	99	0.7	139	0.5	115	0.5	353	0.6
Donated	3	<0.1	14	0.1	4	<0.1	21	0.0
Exchanged	3	<0.1	5	<0.1	2	<0.1	10	0.0
Sub-total	710	4.9	1130	4.3	963	4.5	2803	4.5
Female cattle								
Born	616	4.2	994	3.8	811	3.8	2421	3.9
Bought	58	0.4	126	0.5	63	0.3	247	0.4
Donated	4	<0.1	19	0.1	2	<0.1	25	<0.1
Exchanged	3	<0.1	12	<0.1	3	<0.1	18	<0.1
Sub-total	681	4.7	1151	4.4	879	4.1	2711	4.4
Male and female cattle								
Born	1221	8.4	1966	7.5	1653	7.7	4840	7.8
Bought	157	1.1	265	1.0	178	0.8	600	1.0
Donated	7	<0.1	33	0.1	6	<0.1	46	0.1
Exchanged	6	<0.1	17	<0.1	5	<0.1	28	<0.1
Sub-total	1391	9.6	2281	8.7	1842	8.6	5514	8.9
Total cattle	14,518		26,196		21,380		62,094	
No. of households	1135		2578		1566		5279	

* Percent = No. of cattle entered/Total cattle*100%

Table 10.6.3b. *Proportion of cattle that entered the households during the previous12 months by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Type of entry	No.	%*	No.	%	No.	%	No.	%	No.	%
Male cattle										
Born	457	4.9	773	3.8	688	3.8	501	3.5	2419	3.9
Bought	41	0.4	86	0.4	128	0.7	98	0.7	353	0.6
Donated	4	<0.1	5	<0.1	3	<0.1	9	0.1	21	<0.1
Exchanged	1	<0.1	3	<0.1	6	<0.1	0	0.0	10	<0.1
Sub-total	503	5.4	867	4.2	825	4.5	608	4.3	2803	4.5
Female cattle										
Born	500	5.4	726	3.6	681	3.7	514	3.6	2421	3.9
Bought	24	0.3	79	0.4	91	0.5	53	0.4	247	0.4
Donated	2	<0.1	7	<0.1	6	<0.1	10	0.1	25	<0.1
Exchanged	3	<0.1	12	0.1	2	<0.1	1	<0.1	18	<0.1
Sub-total	529	5.7	824	4.0	780	4.3	578	4.1	2711	4.4
Male and female cattle										

cont'd...

Table 10.6.3b. cont'd.

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Type of entry	No.	%*	No.	%	No.	%	No.	%	No.	%
Born	957	10.4	1499	7.3	1369	7.5	1015	7.2	4840	7.8
Bought	65	0.7	165	0.8	219	1.2	151	1.1	600	1.0
Donated	6	0.1	12	0.1	9	<0.1	19	0.1	46	0.1
Exchanged	4	<0.1	15	0.1	8	<0.1	1	<0.1	28	<0.1
Sub-total	1032	11.2	1691	8.3	1605	8.8	1186	8.4	5514	8.9
Total cattle	9243		20,424		18,275		14,152		62,094	
No. of households	668		1579		1812		1220		5279	

* Percent = No. of cattle entered/Total cattle*100%.

Table 10.6.3c. *Proportion of cattle that entered the households during the previous 12 months by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Type of entry	No.	%*	No.	%	No.	%	No.	%
Male cattle								
Born	1953	4.0	262	3.6	202	3.6	2417	3.9
Bought	307	0.6	39	0.5	7	0.1	353	0.6
Donated	14	0.0	5	0.1	2	0.0	21	0.0
Exchanged	9	<0.1	1	<0.1	0	0.0	10	<0.1
Sub-total	2283	4.6	307	4.3	211	3.8	2801	4.5
Female cattle								
Born	1969	4.0	288	4.0	164	2.9	2421	3.9
Bought	211	0.4	35	0.5	1	0.0	247	0.4
Donated	13	0.0	10	0.1	2	0.0	25	0.0
Exchanged	17	0.0	0	0.0	1	0.0	18	0.0
Sub-total	2210	4.5	333	4.6	168	3.0	2711	4.4
Male and female cattle								
Born	3922	8.0	550	7.6	366	6.6	4838	7.8
Bought	518	1.1	74	1.0	8	0.1	600	1.0
Donated	27	0.1	15	0.2	4	0.1	46	0.1
Exchanged	26	0.1	1	<0.1	1	<0.1	28	<0.1
Sub-total	4493	9.1	640	8.9	379	6.8	5512	8.9
Total cattle	49,170		7223		5577		61,970	
No. of households	4621		438		204		5263	

* Percent = No. of cattle entered/Total cattle*100%.

10.6.4 Disposal of cattle during the previous 12 months

Tables 10.6.4a, b and c show percentage of cattle that exited the herds during the previous 12 months. On average, about 11% of the cattle (5.4% males and 5.2% females) in sample herds were disposed during the previous 12 months. These were due to death in 55% of the cases

in males and 70% of the cases in females. Disposal by death was highest in the *kolla* AEZ, in the pastoral system and in low livestock density areas (possibly associated with drought and a higher reported prevalence of animal diseases). Disposal through sales was slightly higher in the pastoral than in agro-pastoral and crop–livestock systems, indicating the stronger role of cattle income generation in the pastoral community.

Table 10.6.4a. *Proportion of cattle that exited the households' herd during the previous 12 months by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Type of exit	No.	%	No.	%	No.	%	No.	%
No. of households	293		675		425		1393	
Male cattle								
Sold	347	2.2	585	2.0	470	1.9	1402	2.0
Slaughtered	19	0.1	37	0.1	46	0.2	102	0.1
Exchanged	2	0.0	16	0.1	11	0.0	29	0.0
Died	251	1.6	786	2.7	1036	4.2	2073	3.0
Stolen	3	0.0	8	0.0	10	0.0	21	0.0
Donated	18	0.1	83	0.3	41	0.2	142	0.2
Sub-total	640	4.1	1515	5.2	1614	6.5	3769	5.4
Female cattle								
Sold	168	1.1	295	1.0	333	1.3	796	1.1
Slaughtered	16	0.1	25	0.1	31	0.1	72	0.1
Exchanged	2	0.0	11	0.0	8	0.0	21	0.0
Died	289	1.8	803	2.8	1406	5.7	2498	3.6
Stolen	2	0.0	5	0.0	5	0.0	12	0.0
Donated	30	0.2	85	0.3	64	0.3	179	0.3
Sub-total	507	3.2	1224	4.2	1847	7.4	3578	5.2
Overall								
Sold	515	3.3	880	3.0	803	3.2	2198	3.2
Slaughtered	35	0.2	62	0.2	77	0.3	174	0.3
Exchanged	4	0.0	27	0.1	19	0.1	50	0.1
Died	540	3.4	1589	5.5	2442	9.8	4571	6.6
Stolen	5	0.0	13	0.0	15	0.1	33	0.0
Donated	48	0.3	168	0.6	105	0.4	321	0.5
Sub-total	1147	7.3	2739	9.5	3461	13.9	7347	10.6
Total (current + disposed)	15,665		28,935		24,841		69,441	
Current total cattle	14,518		26,196		21,380		62,094	
Total disposed cattle	1147		2739		3461		7347	

Table 10.6.4b. *Proportion of cattle that exited the households' herds during the previous 12 months by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Type of exit	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	205		419		471		298		1393	
Male cattle										
Sold	251	2.3	404	1.7	442	2.2	305	2.0	1402	2.0
Slaughtered	14	0.1	25	0.1	50	0.2	13	0.1	102	0.1
Exchanged	5	0.0	9	0.0	6	0.0	9	0.1	29	0.0
Died	446	4.1	901	3.9	495	2.5	231	1.5	2073	3.0
Stolen	0	0.0	9	0.0	10	0.0	2	0.0	21	0.0
Donated	15	0.1	13	0.1	24	0.1	90	0.6	142	0.2
Sub-total	731	6.7	1361	5.9	1027	5.1	650	4.3	3769	5.4
Female cattle										
Sold	188	1.7	271	1.2	199	1.0	138	0.9	796	1.1
Slaughtered	7	0.1	14	0.1	44	0.2	7	0.0	72	0.1
Exchanged	8	0.1	5	0.0	4	0.0	4	0.0	21	0.0
Died	629	5.8	1086	4.7	552	2.7	231	1.5	2498	3.6
Stolen	0	0.0	7	0.0	2	0.0	3	0.0	12	0.0
Donated	27	0.2	19	0.1	41	0.2	92	0.6	179	0.3
Sub-total	859	7.9	1402	6.0	842	4.2	475	3.1	3578	5.2
Overall										
Sold	439	4.1	675	2.9	641	3.2	443	2.9	2198	3.2
Slaughtered	21	0.2	39	0.2	94	0.5	20	0.1	174	0.3
Exchanged	13	0.1	14	0.1	10	0.0	13	0.1	50	0.1
Died	1075	9.9	1987	8.6	1047	5.2	462	3.0	4571	6.6
Stolen	0	0.0	16	0.1	12	0.1	5	0.0	33	0.0
Donated	42	0.4	32	0.1	65	0.3	182	1.2	321	0.5
Sub-total	1590	14.7	2763	11.9	1869	9.3	1125	7.4	7347	10.6
Total (current + disposed)	10,833		23,187		20,144		15,277		69,441	
Current total cattle	9243		20,424		18,275		14,152		62,094	
Total disposed cattle	1590		2763		1869		1125		7347	

Table 10.6.4c. *Proportion of cattle that exited the households' herds during the previous12 months by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Type of exit	No.	%	No.	%	No.	%	No.	%
No. of households	1197		129		66		1392	
Male cattle								
Sold	1064	2.0	182	2.2	155	2.2	1401	2.0
Slaughtered	65	0.1	12	0.1	25	0.4	102	0.1
Exchanged	19	0.0	10	0.1	0	0.0	29	0.0
Died	1379	2.6	266	3.2	428	6.0	2073	3.0
Stolen	16	0.0	4	0.0	1	0.0	21	0.0
Donated	47	0.1	74	0.9	21	0.3	142	0.2
Sub-total	2590	4.8	548	6.6	630	8.8	3768	5.4
Female cattle								
Sold	553	1.0	108	1.3	135	1.9	796	1.1
Slaughtered	56	0.1	5	0.1	11	0.2	72	0.1
Exchanged	17	0.0	3	0.0	1	0.0	21	0.0
Died	1440	2.7	317	3.8	741	10.4	2498	3.6
Stolen	9	0.0	3	0.0	0	0.0	12	0.0
Donated	80	0.1	64	0.8	35	0.5	179	0.3
Sub-total	2155	4.0	500	6.0	923	12.9	3578	5.2
Overall								
Sold	1617	3.0	290	3.5	290	4.1	2197	3.2
Slaughtered	121	0.2	17	0.2	36	0.5	174	0.3
Exchanged	36	0.1	13	0.2	1	0.0	50	0.1
Died	2819	5.2	583	7.0	1169	16.4	4571	6.6
Stolen	25	0.0	7	0.1	1	0.0	33	0.0
Donated	127	0.2	138	1.7	56	0.8	321	0.5
Sub-total	4745	8.8	1048	12.7	1553	21.8	7346	10.6
Total (current + disposed)	53,915		8271		7130		69,316	
Current total cattle	49,170		7223		5577		61,970	
Total disposed cattle	4745		1048		1553		7346	

10.6.5 Reasons for death of cattle

In their order of importance, diseases, predators, accidents and drought were the major causes for death of cattle during the 12 months prior to the survey (Table 10.6.5). Unknown causes accounted for 13% of the reported deaths of cattle. Predators were more common causes of death in *kolla* than in other AEZs while accidents appeared to be more common in *dega* and *weinadega* than in *kolla*. Proportion of losses due to predators decreased with increasing livestock density. Predators and drought caused more proportional deaths in pastoral than in other production systems.

Table 10.6.5. *Proportion of reported reasons for death of cattle by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Total deaths	Reason for death (%)					
			Predators	Disease	Accident	Poisoning	Drought	Others
Agro-ecological zones								
Dega	200	291	5.5	55.3	15.8	2.7	3.8	16.8
Weinadega	533	755	8.7	58.3	11.5	1.3	6.2	13.9
Kolla	377	644	16.6	50.6	6.1	1.7	14.3	10.7
Overall	1110	1690	11.2	54.9	10.2	1.7	8.9	13.2
Livestock densities								
Low	192	327	16.2	49.2	6.1	1.8	13.5	13.1
Medium	351	528	13.1	58.3	9.3	0.8	8.5	10.0
High	369	561	9.8	53.1	11.8	1.2	8.0	16.0
Very high	198	274	4.4	58.4	13.5	4.4	5.8	13.5
Overall	1110	1690	11.2	54.9	10.2	1.7	8.9	13.2
Production systems								
Crop–livestock	942	1387	9.1	56.8	11.2	1.7	6.7	14.4
Agro-pastoral	107	174	14.4	50.0	8.0	2.3	17.2	8.0
Pastoral	60	128	28.9	40.6	1.6	0.8	21.1	7.0
Overall	1109	1689	11.1	54.9	10.2	1.7	8.9	13.2

10.6.6 Fertility rate

Table 10.6.6 shows that the overall fertility rates calculated as the average number of calves born to cows in the herds was 45%. This rate was lower in pastoral areas, but this might have been affected by the relatively small sample size in this category.

Table 10.6.6. *Calculated fertility rate by livestock densities and production systems.*

Categories	No. of households	No. of calves born	No. of cows	Fertility rate (%)
Livestock densities				
Low	241	924	1650	56.0
Medium	527	1449	3746	39.0
High	582	1226	2527	49.0
Very high	360	900	1980	46.0
Overall	1710	4499	9903	45.0
Production systems				
Crop–livestock	1490	3613	7761	47.0
Agro-pastoral	146	523	1135	46.0
Pastoral	69	361	989	37.0
Overall	1705	4497	9885	45.0

10.6.7 Reported lactation performance

The overall reported average milk off-take/day per cow was 1.4 (sd = 0.9) litres with values ranging from 0.3 to 8 litres (Table 10.6.7a). Mean milk off-take per day was highest in *dega* (1.7 litres) and very high livestock density areas (1.7 litres) compared to other AEZs and livestock density areas. The variation was less among production systems. The reported mean frequency of milking (Table 10.6.7b) per cow per day was 2 (sd = 0.2).

The overall reported average lactation length was 8.9 (sd = 3.0) months, with values ranging from 1 to 18 months (Table 10.6.7c). This information should be handled with caution as it is based on reported averages.

Calf rearing practice up to weaning is given in Table 10.6.7d. Restricted suckling is practised by about 90% of the households with the rest 10% practising unrestricted suckling. Restricted suckling is practised virtually by all households (99%) in pastoral areas and this relates to the role of milk in the diet of pastoralists.

Table 10.6.7e shows that in over 85% of the households, the average weaning age of calves was greater than 6 months. Important variations were noted by production systems. For example, weaning over 6 months of age was practised by more than 97% of the households in agro-pastoral systems compared to 87 and 71% for the households in crop–livestock and pastoral systems, respectively.

Table 10.6.7a. *Reported average milk off-take (l/day per cow) by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Average milk yield (litres)				
		Mean	sd	Minimum	Maximum	Range
Agro-ecological zones						
Dega	398	1.7	1.2	0.5	8	7.5
Weinadega	923	1.4	0.9	0.3	8	7.7
Kolla	574	1.4	0.7	0.3	7	6.7
Overall	1895	1.4	0.9	0.3	8	7.7
Livestock densities						
Low	251	1.4	0.6	0.3	4	3.7
Medium	535	1.2	0.7	0.3	7	6.7
High	649	1.4	0.9	0.5	8	7.5
Very high	460	1.7	1.2	0.3	8	7.7
Overall	1895	1.4	0.9	0.3	8	7.7
Production systems						
Crop–livestock	1654	1.4	1.0	0.3	8	7.7
Agro-pastoral	173	1.4	0.6	0.5	4	3.5
Pastoral	68	1.6	0.5	0.5	3	2.5
Overall	1895	1.4	0.9	0.3	8	7.7

Table 10.6.7b. *Reported frequency of milking by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Milking frequency				
		Mean	sd	Minimum	Maximum	Range
Agro-ecological zones						
Dega	397	2	0.1	1	2	1
Weinadega	918	2	0.3	1	4	3
Kolla	570	2	0.2	1	4	3
Overall	1885	2	0.2	1	4	3
Livestock densities						
Low	250	2	0.1	1	2	1
Medium	532	2	0.2	1	4	3
High	645	2	0.3	1	4	3
Very high	458	2	0.2	1	4	3
Overall	1885	2	0.2	1	4	3
Production systems						
Crop–livestock	1645	2	0.2	1	4	3
Agro-pastoral	172	2	0.2	1	4	3
Pastoral	68	2	0.4	1	4	3
Overall	1885	2	0.2	1	4	3

Table 10.6.7c. *Reported average lactation length in months by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Average lactation length (months)				
		Mean	sd	Minimum	Maximum	Range
Agro-ecological zones						
Dega	388	9.1	3.1	2	18	16
Weinadega	930	8.7	2.9	1	18	17
Kolla	573	8.9	3.0	2	18	17
Overall	1891	8.9	3.0	1	18	17
Livestock densities						
Low	249	9.6	3.4	3	18	15
Medium	532	8.7	2.9	1	18	17
High	656	8.9	3.0	2	18	16
Very high	454	8.6	2.8	2	18	16
Overall	1891	8.9	3.0	1	18	17
Production systems						
Crop–livestock	1655	8.8	3.0	1	18	17
Agro-pastoral	172	9.3	2.5	5	18	13
Pastoral	64	8.3	2.9	3	18	15
Overall	1891	8.9	3.0	1	18	17

Table 10.6.7d. *Type of calf rearing practices (up to weaning) by agro-ecological zones, livestock densities and production systems.*

Categories	Total animals calved	Calf rearing practices (%)		
		Unrestricted suckling	Restricted suckling	Bucket feeding
Agro-ecological zones				
Dega	405	12.3	85.9	1.7
Weinadega	972	12.6	87.3	<1.0
Kolla	599	4.7	95.3	0.0
Overall	1976	10.1	89.5	<1.0
Livestock densities				
Low	257	4.3	95.7	0.0
Medium	553	15.6	84.4	0.0
High	696	10.6	88.2	1.1
Very high	470	6.2	93.8	0.0
Overall	1976	10.1	89.5	<1.0
Production systems				
Crop–livestock	1735	10.6	88.9	<1.0
Agro-pastoral	171	8.8	91.2	0.0
Pastoral	70	1.4	98.6	0.0
Overall	1976	10.1	89.5	<1.0

Table 10.6.7e. *Reported average age at weaning for calves (months) by agro-ecological zones, livestock densities and production systems.*

Categories	Total number of calves	Weaning age (%)			
		<3 months	3–4 months	5–6 months	>6 months
Agro-ecological zones					
Dega	410	0.0	2.2	15.1	82.7
Weinadega	975	0.2	1.2	10.9	87.7
Kolla	608	0.8	3.8	12.2	83.2
Overall	1993	0.4	2.2	12.1	85.3
Livestock densities					
Low	257	0.0	3.5	12.8	83.7
Medium	557	0.4	1.6	11	87.1
High	701	0.7	1.7	12.6	85.0
Very high	478	0.0	2.9	12.6	84.5
Overall	1993	0.4	2.2	12.1	85.3
Production systems					
Crop–livestock	1750	0.4	2.1	12.9	84.7
Agro-pastoral	174	0.0	0.6	2.3	97.1
Pastoral	69	0.0	10.1	18.8	71.0
Overall	1993	0.4	2.2	12.1	85.3

10.6.8 Reported reproductive performance

The overall reported age at sexual maturity for males and females was 39.9 (sd = 8.2) and 39.6 (sd = 7.9) months, respectively (Table 10.6.8a). Age at sexual maturity for males was reported to be higher in pastoral herds compared to those in other production systems. The average reported age at first parturition was 46.9 (sd = 7.4) months (Table 10.6.8b), which is slightly less than what can be expected from the reported age of sexual maturity. There was little variations by AEZs, livestock densities and production systems.

The overall reported calving interval was 18.6 (sd = 5.2) months (Tables 10.6.8c). An overall reported calving interval was shorter in pastoral (15.5 months) than in other production systems.

Table 10.6.8a. *Reported average age at sexual maturity (months) by AEZs, livestock densities and production systems.*

Categories	Sex	No. of households	Age of sexual maturity (months)				
			Mean	sd	Minimum	Maximum	Range
Agro-ecological zones							
Dega	Male	333	38.5	8.0	18	48	30
	Female	349	38.6	7.7	17	48	31
Weinadega	Male	821	39.5	8.4	15	48	33
	Female	822	39.4	8.2	15	48	33
Kolla	Male	526	41.3	7.7	15	48	33
	Female	530	40.7	7.5	18	48	30
Overall	Male	1680	39.9	8.2	15	48	33
	Female	1701	39.6	7.9	15	48	33
Livestock densities							
Low	Male	221	39.8	8.3	19	48	29
	Female	236	40.3	7.4	18	48	30
Medium	Male	481	40.3	7.9	15	48	33
	Female	465	40.2	7.2	15	48	33
High	Male	579	40.1	8.1	15	48	33
	Female	581	39.8	8.3	15	48	33
Very high	Male	399	39.1	8.4	18	48	30
	Female	419	38.5	8.4	18	48	30
Overall	Male	1680	39.9	8.2	15	48	33
	Female	1701	39.6	7.9	15	48	33
Production systems							
Crop–livestock	Male	1503	39.4	8.1	15	48	33
	Female	1491	39.3	7.9	15	48	33
Agro-pastoral	Male	121	42.5	8.7	20	48	28
	Female	142	41.7	8.4	18	48	30
Pastoral	Male	56	45.6	4.5	36	48	12
	Female	68	43.3	6.7	24	48	24
Overall	Male	1680	39.9	8.2	15	48	33
	Female	1701	39.6	7.9	15	48	33

Table 10.6.8b. *Reported average age at first calving (months) by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Age at 1st parturition (months)				
		Mean	sd	Minimum	Maximum	Range
Agro-ecological zones						
Dega	264	45.2	7.4	28	57	29
Weinadega	588	47.0	7.2	23	57	34
Kolla	402	47.8	7.6	24	57	33
Overall	1254	46.9	7.4	23	57	34
Livestock densities						
Low	192	49.4	6.8	24	57	33
Medium	366	48.2	6.4	23	57	34
High	408	45.9	7.5	23	57	34
Very high	288	45.0	8.2	26	57	31
Overall	1254	46.9	7.4	23	57	34
Production systems						
Crop–livestock	1107	46.6	7.2	23	57	34
Agro-pastoral	97	48.4	9.3	26	57	31
Pastoral	50	51.0	6.2	30	57	27
Overall	1254	46.9	7.4	23	57	34

Table 10.6.8c. *Reported average calving interval (months) by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Calving interval (months)				
		Mean	sd	Minimum	Maximum	Range
Agro-ecological zones						
Dega	356	19.4	5.7	12	36	24
Weinadega	863	18.5	4.9	12	36	24
Kolla	525	18.0	5.2	12	36	24
Overall	1744	18.6	5.2	12	36	24
Livestock densities						
Low	241	19.0	5.8	12	36	24
Medium	472	17.8	4.7	12	36	24
High	612	18.7	5.4	12	36	24
Very high	419	18.9	4.9	12	36	24
Overall	1744	18.6	5.2	12	36	24
Production systems						
Crop–livestock	1531	18.6	5.2	12	36	24
Agro-pastoral	149	19.0	5.1	12	36	24
Pastoral	64	15.5	3.9	12	24	12
Overall	1744	18.6	5.2	12	36	24

10.7 Cattle trait preferences

As well as collecting details on production characteristics, farmers were asked to rank a range of cattle traits as 'not important', 'poor', 'average' and 'good'. The following tables summarise the results across all breed types. Tables 10.7a, b and c show percentage of households considering certain traits of their cattle as 'good'. On average, the majority of households described work/traction, temperament, coat colour, body size, meat and walkability as 'good' traits compared with disease, cold and drought tolerances, horns and milk yield which received the lowest ratings. Disease tolerance was poorly rated throughout all AEZs. On the other hand, cold tolerance was rated as 'good' by 56% of the households in the prevailing cool tropical climate in the *dega* AEZ compared with lower ratings in other AEZs. In pastoral systems, body size, meat production, coat colour, walkability, growth rate, fertility, milk yield and temperament were all rated highly by a larger percentages of households than in other production systems. Disease tolerance, however, was still rated low. As judged from the low preference rates for selected traits, households in crop–livestock systems were generally less happy than those in other systems about the quality of those choice traits possessed by their cattle, except for work/traction and temperament.

Table 10.7a. *Traits of cattle considered as good by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
No. of households	1108		2523		1508		5139	
Work	910	82.1	1874	74.3	1144	75.9	3928	76.4
Temperament	798	72.0	1926	76.3	1146	76.0	3870	75.3
Coat colour	733	66.2	1712	67.9	1115	73.9	3560	69.3
Size	766	69.1	1533	60.8	1121	74.3	3420	66.5
Meat	709	64.0	1300	51.5	926	61.4	2935	57.1
Walkability	596	53.8	1201	47.6	1045	69.3	2842	55.3
Growth rate	563	50.8	1051	41.7	920	61.0	2534	49.3
Longevity	570	51.4	1086	43.0	793	52.6	2449	47.7
Fertility	505	45.6	992	39.3	833	55.2	2330	45.3
Heat tolerance	493	44.5	886	35.1	836	55.4	2215	43.1
Cold tolerance	619	55.9	876	34.7	568	37.7	2063	40.1
Milk yield	420	37.9	840	33.3	716	47.5	1976	38.5
Horns	368	33.2	770	30.5	568	37.7	1706	33.2
Drought	273	24.6	631	25.0	681	45.2	1585	30.8
Disease tolerance	326	29.4	495	19.6	461	30.6	1282	24.9

* Percent preference = No. of households responding good/Total respondents*100%.

Table 10.7b. *Traits of cattle considered as good by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%	No.	%
No. of households	650		1533		1749		1207		5139	
Work	462	71.1	1123	73.3	1376	78.7	967	80.1	3928	76.4
Temperament	531	81.7	1059	69.1	1368	78.2	912	75.6	3870	75.3
Coat colour	425	65.4	966	63.0	1270	72.6	899	74.5	3560	69.3
Size	444	68.3	923	60.2	1161	66.4	892	73.9	3420	66.5
Meat	437	67.2	969	63.2	998	57.1	531	44.0	2935	57.1
Walkability	440	67.7	786	51.3	871	49.8	745	61.7	2842	55.3
Growth rate	383	58.9	697	45.5	792	45.3	662	54.8	2534	49.3
Longevity	359	55.2	699	45.6	700	40.0	691	57.2	2449	47.7
Fertility	342	52.6	617	40.2	727	41.6	644	53.4	2330	45.3
Heat tolerance	371	57.1	513	33.5	718	41.1	613	50.8	2215	43.1
Cold tolerance	255	39.2	523	34.1	750	42.9	535	44.3	2063	40.1
Milk yield	337	51.8	543	35.4	675	38.6	421	34.9	1976	38.5
Horns	238	36.6	403	26.3	564	32.2	501	41.5	1706	33.2
Drought	220	33.8	481	31.4	423	24.2	461	38.2	1585	30.8
Disease tolerance	128	19.7	338	22.0	461	26.4	355	29.4	1282	24.9

* Percent preference = No. of households responding good/Total respondents*100%.

Table 10.7c. *Traits of cattle considered as good by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
No. of households	4498		437		204		5139	
Work	3438	76.4	384	87.9	106	52.0	3928	76.4
Temperament	3394	75.5	320	73.2	156	76.5	3870	75.3
Coat colour	3093	68.8	293	67.0	174	85.3	3560	69.3
Size	2905	64.6	320	73.2	195	95.6	3420	66.5
Meat	2377	52.8	373	85.4	185	90.7	2935	57.1
Walkability	2301	51.2	367	84.0	174	85.3	2842	55.3
Growth rate	2121	47.2	250	57.2	163	79.9	2534	49.3
Longevity	2067	46.0	276	63.2	106	52.0	2449	47.7
Fertility	1924	42.8	245	56.1	161	78.9	2330	45.3
Heat tolerance	1847	41.1	278	63.6	90	44.1	2215	43.1
Cold tolerance	1786	39.7	211	48.3	66	32.4	2063	40.1
Milk yield	1576	35.0	240	54.9	160	78.4	1976	38.5
Horns	1425	31.7	186	42.6	95	46.6	1706	33.2
Drought	1218	27.1	271	62.0	96	47.1	1585	30.8
Disease tolerance	1090	24.2	153	35.0	39	19.1	1282	24.9

* Percent preference = No. of households responding good/Total respondents*100%.

Tables 10.7d, e and f summarise the reported primary reasons for choosing a breeding bull. Irrespective of the AEZs, livestock densities and production systems, body size, coat colour, character and performance were the main reasons for choosing a breeding bull, in that order. Colour appeared to be of increasing importance with increasing livestock density and character was more important in crop–livestock than in other systems. Tables 10.7g, h and i show primary criteria used for the choice of breeding bull. In general, performance, size and availability were the most important traits compared to horns, coat colour and temperament (character). There are slight variations in the primary criteria used for the choice of breeding bulls by AEZs, livestock densities and production systems. For example, horns had more emphasis as primary criteria for choosing a breeding bull in agro-pastoral and pastoral systems than in crop–livestock systems.

Table 10.7d. *Criteria used to choose breeding bulls by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	319		811		526		1656	
Size	309	96.9	739	91.1	498	94.7	1546	93.4
Coat colour	228	71.5	567	69.9	345	65.6	1140	68.8
Horns	34	10.7	96	11.8	63	12.0	193	11.7
Character	186	58.3	550	67.8	314	59.7	1050	63.4
Availability	10	3.1	28	3.5	29	5.5	67	4.0
Performance	173	54.2	400	49.3	300	57.0	873	52.7

Table 10.7e. *Criteria used to choose breeding bulls by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	224		506		569		357		1656	
Size	210	93.8	475	93.9	523	91.9	338	94.7	1546	93.4
Coat colour	130	58.0	326	64.4	415	72.9	269	75.4	1140	68.8
Horns	17	7.6	55	10.9	74	13.0	47	13.2	193	11.7
Character	142	63.4	343	67.8	377	66.3	188	52.7	1050	63.4
Availability	13	5.8	34	6.7	16	2.8	4	1.1	67	4.0
Performance	141	62.9	259	51.2	273	48.0	200	56.0	873	52.7

Table 10.7f. *Criteria used to choose breeding bulls by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	1456		137		61		1654	
Size	1357	93.2	129	94.2	58	95.1	1544	93.3
Coat colour	1003	68.9	92	67.2	44	72.1	1139	68.8
Horns	182	12.5	8	5.8	3	4.9	193	11.7
Character	963	66.1	59	43.1	27	44.3	1049	63.4
Availability	46	3.2	12	8.8	9	14.8	67	4.1
Performance	731	50.2	100	73.0	41	67.2	872	52.7

Table 10.7g. *Percentage of households with primary rankings of criteria to choose breeding bulls by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.*	%**	No.	%	No.	%	No.	%
Size	309	56.0	739	50.7	498	56.2	1546	53.6
Coat colour	228	10.5	567	14.6	345	8.4	1140	11.9
Horns	34	5.9	96	5.2	63	11.1	193	7.3
Character	186	14.0	550	17.6	314	9.2	1050	14.5
Availability	10	40.0	28	46.4	29	31.0	67	38.8
Performance	173	51.4	400	59.0	300	55.7	873	56.4
Overall	940	33.8	2380	34.0	1549	33.6	4869	33.8

* No. = Number of households with rankings 1 up to 3 on criterion X.
** Percent = Households with primary ranking (of criterion X) relative to households with different rankings of the same criterion*100%.

Table 10.7h. *Percentage of households with primary rankings to choose breeding bulls by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.*	%**	No.	%	No.	%	No.	%	No.	%
Size	210	42.4	475	58.9	523	57.0	338	47.6	1546	53.6
Coat colour	130	12.3	326	12.0	415	12.3	269	11.2	1140	11.9
Horns	17	29.4	55	3.6	74	9.5	47	0.0	193	7.3
Character	142	9.9	343	13.4	377	17.2	188	14.4	1050	14.5
Availability	13	61.5	34	26.5	16	50.0	4	25.0	67	38.8
Performance	141	64.5	259	50.6	273	50.2	200	66.5	873	56.4
Overall	653	34.2	1492	34.0	1678	33.7	1046	33.7	4869	33.8

* No. = Number of households with rankings 1 up to 3 on criterion X.
** Percent = Households with primary ranking (of criterion X) relative to households with different rankings of the same criterion*100%.

Table 10.7i. *Percentage of households with primary rankings to choose breeding bulls by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.*	%**	No.	%	No.	%	No.	%
Size	1357	55.1	129	37.2	58	53.4	1544	53.6
Coat colour	1003	12.6	92	9.8	44	2.3	1139	11.9
Horns	182	5.5	8	37.5	3	33.3	193	7.3
Character	963	15.2	59	6.8	27	7.4	1049	14.5
Availability	46	41.3	12	33.3	9	33.3	67	38.8
Performance	731	54.7	100	67.0	41	58.5	872	56.3
Overall	4282	33.8	400	33.8	182	34.1	4864	33.8

* No. = Number of households with rankings 1 up to 3 on criterion X.
** Percent = Households with primary ranking (of criterion X) relative to households with different rankings of the same criterion*100%.

Table 10.7j shows the relative importance of certain traits taken into consideration when disposing cattle. Overall, age was the major criterion considered for deciding on disposal of cattle although there are some differences between the various categories. Other traits considered for disposal, in their order of importance, include temperament, performance, health and body size. In general, fertility was less considered during disposing cattle, except in the crop–livestock production system. Temperament was considered more important trait in areas of low livestock density than in other livestock density categories. Body condition was considered more important in areas of very high livestock density. Likewise, body size, health and temperament were very important traits in pastoral systems, as was performance in agro-pastoral systems and fertility in crop–livestock system.

Table 10.7j. *Traits taken into consideration when disposing cattle by agro-ecological zones, production systems and livestock densities.*

		Reason (%)							
Categories	No. of households	Size	Colour	Tempera-ment	Health	Con-dition	Perform-ance	Age	Fertility
Agro-ecological zones									
Dega	85	41	31	49	42	28	38	85	21
Weinadega	207	36	17	47	42	30	49	83	20
Kolla	82	49	33	48	56	40	48	76	34
Livestock densities									
Low	32	38	31	59	47	31	41	75	47
Medium	124	44	18	48	44	31	41	85	24
High	148	41	26	47	43	25	50	79	23
Very high	70	31	27	44	50	47	50	83	11
Production systems									
Crop–livestock	344	39	23	47	43	44	31	46	82
Agro-pastoral	18	44	39	50	56	50	56	72	28
Pastoral	12	67	33	58	67	42	33	75	67
Overall	374	40	24	48	45	32	46	82	23

10.8 Sale of cattle

10.8.1 Outlets for selling cattle

The outlets used for selling cattle during the 12 months prior to the survey are shown in Table 10.8.1. Irrespective of the AEZs, livestock densities and production systems, animals are sold directly through markets. Less than 10% of the households had experience of selling cattle via traders/butchers.

Table 10.8.1. *Outlets for selling cattle by agro-ecological zones, production systems and livestock densities.*

Categories	No. of households	Market (%)	Traders/butchers (%)
Agro-ecological zones			
Dega	291	98	10
Weinadega	702	98	7
Kolla	425	98	8
Livestock densities			
Low	191	96	6
Medium	442	98	11
High	469	98	9
Very high	316	99	2
Production systems			
Crop–livestock	1224	98	8
Agro-pastoral	131	98	8
Pastoral	61	100	5
Overall	1418	98	8

10.8.2 Reasons for selling cattle

The reported reasons for selling cattle are shown in Table 10.8.2. Irrespective of the AEZs, livestock densities and production systems, cattle are sold mostly (74%) for cash, and rarely (4%) solely for culling/disposal reasons.

Table 10.8.2. *Reasons for selling cattle by agro-ecological zones, production systems and livestock densities.*

Categories	No. of households	Reason (%)		
		Cash	Culling/disposal	Both
Agro-ecological zones				
Dega	310	72	3	25
Weinadega	736	71	5	24
Kolla	446	81	3	16
Livestock densities				
Low	200	83	2	14
Medium	459	72	2	26
High	508	71	4	25
Very high	325	78	6	16
Production systems				
Crop–livestock	1293	73	4	24
Agro-pastoral	134	86	7	8
Pastoral	63	81	0	19
Overall	1492	74	4	22

11 Sheep

This chapter is based on data collected from 3364 sheep-owning households sampled from across the Oromiya Regional State. These households had a current sheep stock of over 25 thousand heads. All of these households could be identified to particular categories in agro-ecological zones (AEZs) as well as livestock densities. However, only about 55% of these households could be identified by any one of the three production system categories. Data on sheep mortality were received from only 1044 households. Accordingly, the subsequent tables will show different numbers of sample households. As for cattle, goats and secondary species in the report, numerous tables accommodate multiple responses to particular questions, and hence the respective percentage values may not add up to 100%.

11.1 Sheep ownership

Ownership patterns of sheep among family members are shown in Tables 11.1.1, 11.1.2 and 11.1.3. Across AEZs, production systems and livestock density categories, heads of households or the head together with the spouse mostly own sheep. The spouse alone and other members of the family, including sons, daughters and other members, also own some sheep.

Table 11.1.1. *Family members sheep ownership by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Types of owners	No.	%	No.	%	No.	%	No.	%
Head of household	673	41.7	78	54.5	32	46.4	783	42.9
Spouse	181	11.2	9	6.3	1	1.4	191	10.5
Head and spouse	789	48.9	45	31.5	18	26.1	852	46.7
Son	271	16.8	17	11.9	8	11.6	296	16.2
Daughter	119	7.4	1	0.7	2	2.9	122	6.7
Family	164	10.2	21	14.7	21	30.4	206	11.3
No. of households	1614		143		69		1826	

Table 11.1.2. *Family members sheep ownership by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Types of owners	No.	%	No.	%	No.	%	No.	%	No.	%
Head of household	90	39.1	286	52.3	220	35	188	44.7	784	42.9
Spouse	14	6.1	78	14.3	68	10.8	32	7.6	192	10.5
Head and spouse	116	50.4	185	33.8	355	56.4	197	46.8	853	46.7
Son	34	14.8	84	15.4	94	14.9	85	20.2	297	16.3
Daughter	9	3.9	53	9.7	41	6.5	19	4.5	122	6.7
Family	38	16.5	61	11.2	71	11.3	36	8.6	206	11.3
No. of households	230		547		629		421		1827	

Table 11.1.3. *Family members sheep ownership by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Types of owners	No.	%	No.	%	No.	%	No.	%
Head of household	155	40.3	349	38.3	280	52.7	784	42.9
Spouse	44	11.4	108	11.9	40	7.5	192	10.5
Head and spouse	232	60.3	448	49.2	173	32.6	853	46.7
Son	90	23.4	146	16.0	61	11.5	297	16.3
Daughter	28	7.3	72	7.9	22	4.1	122	6.7
Family	29	7.5	87	9.5	90	16.9	206	11.3
No. of households	385		911		531		1827	

11.2 Household activities

Details of the division of labour in sheep husbandry by sex and age of family members within productions systems are summarised in Table 11.2. Selling and purchasing of sheep is mostly the responsibility of males above 15 years of age. These are also responsible for breeding, health care and feeding activities whereas their female counterparts are responsible for milking, shearing, preparation and selling of dairy products and feeding the sheep flock. Young males and females under 15 years of age are responsible mainly for herding and feeding.

11.3 Housing

Table 11.3.1 shows types of housing for sheep. In general, sheep are housed mainly within the family houses, especially in the *weinadega* and *dega* AEZs. Separate houses throughout all AEZs and kraals in the *kolla* AEZ are used often to house sheep. Important differences were observed by production systems in which 60% of the households use the family house in the crop–livestock system whereas in the pastoral system only 4% of the households share housing with their sheep. In medium to high livestock density areas on average 60% of the households share housing with their sheep, whereas in areas with low livestock density the corresponding figure is only 32%. Tables 11.3.2, 11.3.3 and 11.3.4 show the types of materials used for housing sheep. Earthen material and thatch grass and bush are primarily used for roofing sheep houses. Iron sheet and wood were also used. The wall of the sheep house is mostly built using wood with or without earthen material. Where a floor is constructed, albeit rarely and mostly only in crop–livestock system, it is usually built with stones/bricks, followed by wood and earth. Wood is the only material used for making the walls of sheep houses in agro-pastoral and pastoral systems.

Table 11.2. *Division of sheep raising activities among age and gender groups by production systems.*

Activities	No. of households	Males				Females			
		<15 years old		>15 years old		<15 years old		>15 years old	
		No.	%	No.	%	No.	%	No.	%
Crop–livestock									
Purchasing	1610	27	1.7	1531	95.1	13	0.8	374	23.2
Selling	1622	42	2.6	1545	95.3	20	1.2	416	25.6
Herding	1595	1091	68.4	811	50.8	535	33.5	527	33.0
Breeding	1477	443	30.0	1285	87.0	187	12.7	602	40.8
Caring for sick	1567	244	15.6	1464	93.4	149	9.5	704	44.9
Feeding	1553	677	43.6	1139	73.3	392	25.2	953	61.4
Milking	142	9	6.3	15	10.6	19	13.4	127	89.4
Shearing	34	3	8.8	17	50.0	6	17.6	20	58.8
Making dairy products	56	3	5.4	7	12.5	7	12.5	49	87.5
Selling dairy products	40	0	0.0	9	22.5	4	10.0	30	75.0
Agro-pastoral									
Purchasing	136	1	0.7	130	95.6	0	0.0	13	9.6
Selling	144	3	2.1	138	95.8	0	0.0	17	11.8
Herding	144	116	80.6	34	23.6	64	44.4	29	20.1
Breeding	141	34	24.1	126	89.4	22	15.6	50	35.5
Caring for sick	144	23	16.0	131	91.0	10	6.9	51	35.4
Feeding	142	60	42.3	89	62.7	39	27.5	98	69.0
Milking	35	4	11.4	3	8.6	5	14.3	29	82.9
Shearing	17	0	0.0	6	35.3	0	0.0	11	64.7
Making dairy products	19	0	0.0	1	5.3	1	5.3	18	94.7
Selling dairy products	9	0	0.0	1	11.1	0	0.0	9	100.0
Pastoral									
Purchasing	62	0	0.0	61	98.4	1	1.6	4	6.5
Selling	69	0	0.0	68	98.6	0	0.0	6	8.7
Herding	68	62	91.2	21	30.9	53	77.9	28	41.2
Breeding	60	31	51.7	43	71.7	28	46.7	33	55.0
Caring for sick	68	26	38.2	62	91.2	23	33.8	48	70.6
Feeding	69	29	42.0	33	47.8	25	36.2	63	91.3
Milking	33	17	51.5	6	18.2	20	60.6	27	81.8
Shearing	2	0	0.0	0	0.0	0	0.0	2	100.0
Making dairy products	9	0	0.0	1	11.1	5	55.6	9	100.0
Selling dairy products	8	0	0.0	1	12.5	3	37.5	8	100.0

Table 11.3.1. *Types of sheep housing.*

Categories	No. of HHs	Family house		Separate		Veranda		Kraal		Yard		Other	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Agro-ecological zones													
Dega	393	225	57.3	155	39.4	8	2.0	4	1.0	12	3.1	0	0.0
Weinadega	915	608	66.4	278	30.4	22	2.4	33	3.6	23	2.5	5	0.5
Kolla	533	208	39.0	211	39.6	15	2.8	138	25.9	6	1.1	0	0.0
Overall	1841	1041	56.5	644	35.0	45	2.4	175	9.5	41	2.2	5	0.3
Livestock densities													
Low	229	73	31.9	127	55.5	2	0.9	46	20.1	6	2.6	0	0.0
Medium	549	344	62.7	179	32.6	9	1.6	42	7.7	0	0.0	0	0.0
High	638	372	58.3	215	33.7	24	3.8	42	6.6	34	5.3	5	0.8
Very high	425	252	59.3	123	28.9	10	2.4	45	10.6	1	0.2	0	0.0
Overall	1841	1041	56.5	644	35.0	45	2.4	175	9.5	41	2.2	5	0.3
Production systems													
Crop–livestock	1626	979	60.2	570	35.1	45	2.8	72	4.4	36	2.2	5	0.3
Agro-pastoral	144	58	40.3	49	34.0	0	0.0	46	0.0	4	0.0	0	0.0
Pastoral	69	3	4.3	25	36.2	0	0.0	56	0.0	1	0.0	0	0.0
Overall	1841	1036	56.3	644	35.0	45	2.4	174	9.5	41	2.2	5	0.3

Table 11.3.2. *Types of materials used for housing sheep by agro-ecological zones.*

Housing material	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
	No.	%	No.	%	No.	%	No.	%
Roof								
Iron sheet	43	11.2	181	20.4	71	13.8	295	16.5
Grass/bushes	326	85.1	681	76.6	308	59.7	1315	73.5
Wood	44	11.5	113	12.7	105	20.3	262	14.7
Stone/brick	0	0.0	2	0.2	7	1.4	9	0.5
Earth	346	90.3	847	95.3	493	95.5	1686	94.3
No. of households	383		889		516		1788	
Wall								
Grass/bushes	7	1.8	7	0.8	1	0.2	15	0.8
Wood	369	96.3	884	98.3	493	95.5	1746	97.1
Stone/brick	27	7.0	13	1.4	20	3.9	60	3.3
Earth	68	17.8	139	15.5	96	18.6	303	16.9
No. of households	383		899		516		1798	
Floor								
Grass/bushes	0	0.0	3	6.0	0	0.0	3	2.2
Wood	1	2.1	13	26.0	15	38.5	29	21.3
Stone/brick	43	91.5	33	66.0	9	23.1	85	62.5
Earth	3	6.4	0	0.0	14	35.9	17	12.5
Concrete	1	2.1	1	2.0	1	2.6	3	2.2
No. of households	47		50		39		136	

Table 11.3.3. *Types of materials used for housing sheep by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Housing material	No.	%	No.	%	No.	%	No.	%	No.	%
Roof										
Iron sheet	36	16.7	83	15.2	111	18.0	65	15.8	295	16.5
Grass/bushes	134	62.3	418	76.6	466	75.6	297	72.3	1315	73.5
Wood	26	12.1	88	16.1	62	10.1	86	20.9	262	14.7
Stone/brick	7	3.3	2	0.4	0	0.0	0	0.0	9	0.5
Earth	202	94.0	521	95.4	594	96.4	369	89.8	1686	94.3
No. of households	215		546		616		411		1788	
Wall										
Grass/bushes	5	2.2	0	0.0	4	0.7	6	1.4	15	0.8
Wood	212	94.6	540	98.7	594	96.9	400	96.6	1746	97.1
Stone/brick	7	3.1	4	0.7	31	5.1	18	4.3	60	3.3
Earth	7	3.1	66	12.1	121	19.7	109	26.3	303	16.9
No. of households	224		547		613		414		1798	
Floor										
Grass/bushes	3	13.0	0	0.0	0	0.0	0	0.0	3	2.2
Wood	8	34.8	17	56.7	2	6.3	2	3.9	29	21.3
Stone/brick	5	21.7	8	26.7	27	84.4	45	88.2	85	62.5
Earth	7	30.4	3	10.0	3	9.4	4	7.8	17	12.5
Concrete	0	0.0	2	6.7	1	3.1	0	0.0	3	2.2
No. of households	23		30		32		51		136	

11.4 Feed and supplementation

Tables 11.4.1, 11.4.2 and 11.4.3 present reported grazing/feeding practices by season. Irrespective of the AEZs, production systems or livestock densities herded grazing is the most common practice, followed by unherded (particularly in the dry season) and tethered (particularly in the wet season). Animals were rarely kept in stall/yards or paddocks. Herded grazing is more common in the pastoral and crop–livestock systems than the agro-pastoral system. Tethering, stall/yard and paddock feeding was not practised in the pastoral system.

Table 11.3.4. *Type of materials used for housing sheep by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Housing material	No.	%	No.	%	No.	%	No.	%
Roof								
Iron sheet	288	18.2	5	3.6	1	1.6	294	16.5
Grass/bushes	1214	76.7	90	64.7	11	17.2	1315	73.6
Wood	239	15.1	11	7.9	12	18.8	262	14.7
Stone/brick	9	0.6	0	0.0	0	0.0	9	0.5
Earth	1484	93.7	136	97.8	64	100.0	1684	94.3
No. of households	1583		139		64		1786	
Wall								
Grass/bushes	15	0.9	0	0.0	0	0.0	15	0.8
Wood	1543	97.6	137	99.3	64	100.0	1744	97.8
Stone/brick	59	3.7	1	0.7	0	0.0	60	3.4
Earth	303	19.2	0	0.0	0	0.0	303	17.0
No. of households	1581		138		64		1783	
Floor								
Grass/bushes	3	2.3	0	0.0	0	0.0	3	2.2
Wood	29	22.0	0	0.0	0	0.0	29	21.3
Stone/brick	82	62.1	3	100.0	0	0.0	85	62.5
Earth	17	12.9	0	0.0	0	0.0	17	12.5
Concrete	2	1.5	0	0.0	1	100.0	3	2.2
No. of households	132		3		1		136	

Table 11.4.1. *Grazing practices by season and agro-ecological zones.*

		Agro-ecological zones							
		Dega		*Weinadega*		*Kolla*		Overall	
Grazing season	Grazing type	No.	%	No.	%	No.	%	No.	%
Dry	Unherded	108	27.6	338	37.0	132	24.8	578	31.4
	Herded	292	74.5	555	60.7	405	76.0	1252	68.1
	Paddock	15	3.8	4	0.4	11	2.1	30	1.6
	Tethered	21	5.4	81	8.9	12	2.3	114	6.2
	Stall/yard	11	2.8	13	1.4	10	1.9	34	1.8
No. of households		392		914		533		1839	
Wet	Unherded	21	5.4	44	4.8	49	9.2	114	6.2
	Herded	357	91.1	783	86.0	467	87.6	1607	87.6
	Paddock	22	5.6	26	2.9	8	1.5	56	3.1
	Tethered	41	10.5	230	25.3	34	6.4	305	16.6
	Stall/yard	13	3.3	20	2.2	10	1.9	43	2.3
No. of households		392		910		533		1835	
Overall		784		1824		1066		3674	

Table 11.4.2. *Grazing practices by season and livestock densities.*

Grazing season	Grazing type	Livestock densities									
		Low		Medium		High		Very high		Overall	
		No.	%	No.	%	No.	%	No.	%	No.	%
Dry	Unherded	52	22.6	209	38.1	191	29.9	126	29.8	578	31.4
	Herded	181	78.7	337	61.5	445	69.7	289	68.3	1252	68.1
	Paddock	7	3.0	11	2.0	7	1.1	5	1.2	30	1.6
	Tethered	8	3.5	29	5.3	42	6.6	35	8.3	114	6.2
	Stall/yard	2	0.9	3	0.5	10	1.6	19	4.5	34	1.8
No. of households		230		548		638		423		1839	
Wet	Unherded	14	6.1	61	11.1	32	5.0	7	1.7	114	6.2
	Herded	214	93.0	437	79.6	565	89.1	391	92.7	1607	87.6
	Paddock	8	3.5	11	2.0	25	3.9	12	2.8	56	3.1
	Tethered	18	7.8	119	21.7	99	15.6	69	16.4	305	16.6
	Stall/yard	1	0.4	4	0.7	14	2.2	24	5.7	43	2.3
No. of households		230		549		634		422		1835	
Overall		460		1097		1272		845		3674	

Table 11.4.3. *Grazing practices by season and production systems.*

Grazing season	Grazing type	Production systems							
		Crop–livestock		Agro-pastoral		Pastoral		Overall	
		No.	%	No.	%	No.	%	No.	%
Dry	Unherded	526	32.4	49	34.0	2	2.9	577	31.4
	Herded	1088	67.0	95	66.0	68	98.6	1251	68.1
	Paddock	29	1.8	1	0.7	–	–	30	1.6
	Tethered	113	7.0	1	0.7	–	–	114	6.2
	Stall/yard	34	2.1	–	–	–	–	34	1.9
No. of households		1624		144		69		1837	
Wet	Unherded	83	5.1	30	20.8	1	1.4	114	6.2
	Herded	1426	88.0	112	77.8	68	98.6	1606	87.6
	Paddock	49	3.0	7	4.9	–	–	56	3.1
	Tethered	293	18.1	11	7.6	–	–	304	16.6
	Stall/yard	43	2.7	–	–	–	–	43	2.3
No. of households		1620		144		69		1833	
Overall		3244		288		138		3670	

Tables 11.4.4, 11.4.5 and 11.4.6 show supplementation given to sheep by season. Sheep are supplemented with minerals and vitamins, roughage/crop residues and concentrates in that order. In general, roughage/crop residue supplementation is higher during the dry than during the wet season, especially in the *kolla* AEZ. In contrast, mineral/vitamins supplementation is more frequent during the wet season than during the dry season. Higher proportions of the households in the low and medium livestock

density categories have supplemented minerals/vitamins during wet season than those in the high and very high livestock densities. Roughage/residues or concentrates supplementation is not practised in the pastoral production system.

Table 11.4.4. *Households supplementing sheep with different feeds by season and agro-ecological zones.*

Season and supplementation regime	Agro-ecological zones					
	Dega		*Weinadega*		*Kolla*	
	No.	%	No.	%	No.	%
Dry season						
Roughage/residue	144	41.5	389	48.9	214	50.5
Minerals/vitamins	299	86.2	641	80.5	315	74.3
Concentrates	42	12.1	68	8.5	20	4.7
No. of households	347		796		424	
Wet season						
Roughage/residue	116	34.7	321	40.8	117	24.6
Minerals/vitamins	311	93.1	735	93.5	441	92.8
Concentrates	35	10.5	50	6.4	17	3.6
No. of households	334		786		475	
Overall	681		1582		899	

Table 11.4.5. *Households supplementing sheep with different feeds by season and livestock densities.*

Season and supplementation regime	Livestock densities							
	Low		Medium		High		Very high	
	No.	%	No.	%	No.	%	No.	%
Dry season								
Roughage/residue	77	41.8	198	39.8	263	47.2	209	63.5
Minerals/vitamins	175	95.1	448	90.1	438	78.6	194	59.0
Concentrates	7	3.8	35	7.0	46	8.3	42	12.8
No. of households	184		497		557		329	
Wet season								
Roughage/residue	52	24.1	172	34.5	187	33.0	143	45.7
Minerals/vitamins	214	99.1	481	96.4	532	93.8	260	83.1
Concentrates	8	3.7	28	5.6	26	4.6	40	12.8
No. of households	216		499		567		313	

Table 11.4.6. *Households supplementing sheep with different feeds by season and production systems.*

Season and supplementation regime	Production systems					
	Crop–livestock		Agro-pastoral		Pastoral	
	No.	%	No.	%	No.	%
Dry						
Roughage/residue	702	50.0	42	37.5	1	2.0
Minerals/vitamins	1122	79.9	83	74.1	49	100.0
Concentrates	127	9.0	2	1.8	–	–
No. of households	1404		112		49	
Wet						
Roughage/residue	508	36.7	45	31.7	–	–
Minerals/Vitamins	1289	93.1	130	91.5	67	100.0
Concentrates	96	6.9	5	3.5	–	–
No. of households	1385		142		67	
Overall	2789		254		116	

Adult male and female sheep tend to be more frequently supplemented than young sheep across AEZs, livestock densities and production systems (Tables 11.4.7, 11.4.8 and 11.4.9). Except in the pastoral production system, where adult male sheep are ranked first for receiving feed supplements, adult female sheep generally receive priority for feed supplementation (Tables 11.4.10, 11.4.11 and 11.4.12).

Table 11.4.7. *Feed supplementation by type of animal and agro-ecological zones.*

Supplemented sheep types	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
	No.	%	No.	%	No.	%	No.	%
Adult male	305	91.3	689	95.2	429	96.8	1423	94.8
Adult female	327	97.9	709	97.9	431	97.3	1467	97.7
Young sheep	300	89.8	625	86.3	362	81.7	1287	85.7
No. of households	334		724		443		1501	

Table 11.4.8. *Feed supplementation by type of animal and livestock densities.*

Supplemented sheep type	Livestock densities									
	Low		Medium		High		Very high		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
Adult male	182	94.8	435	95.0	509	93.1	297	97.7	1423	94.8
Adult female	191	99.5	454	99.1	531	97.1	291	95.7	1467	97.7
Young sheep	165	85.9	410	89.5	449	82.1	263	86.5	1287	85.7
No. of households	192		458		547		304		1501	

Table 11.4.9. *Feed supplementation by type of animal and production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Supplemented sheep type	No.	%	No.	%	No.	%	No.	%
Adult male	1226	94.5	133	96.4	64	100.0	1423	94.9
Adult female	1268	97.7	135	97.8	64	100.0	1467	97.8
Young sheep	1122	86.4	115	83.3	49	76.6	1286	85.7
No. of households	1298		138		64		1500	

Table 11.4.10. *Type of sheep ranked as No. 1 for supplementation by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Supplemented sheep type	No.	%	No.	%	No.	%	No.	%
Adult male	134	40.1	260	35.9	225	50.8	619	41.2
Adult female	181	54.2	449	62.0	208	47.0	838	55.8
Young animal	46	13.8	70	9.7	43	9.7	159	10.6
No. of households	334		724		443		1501	

Table 11.4.11. *Type of sheep ranked as No. 1 for supplementation by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Supplementation	No.	%	No.	%	No.	%	No.	%	No.	%
Adult male	80	41.7	167	36.5	238	43.5	134	44.1	619	41.2
Adult female	103	53.6	302	65.9	277	50.6	156	51.3	838	55.8
Young animal	13	6.8	41	9.0	61	11.2	44	14.5	159	10.6
No. of households	192		458		547		304		1501	

Table 11.4.12. *Type of sheep ranked as No. 1 for supplementation by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Supplemented sheep type	No.	%	No.	%	No.	%	No.	%
Adult male	502	38.7	74	53.6	43	67.2	619	41.3
Adult female	738	56.9	77	55.8	23	35.9	838	55.9
Young animal	108	8.3	45	32.6	6	9.4	159	10.6
No. of households	1298		138		64		1500	

11.5 Watering

Tables 11.5.1, 11.5.2 and 11.5.3 show sources of water by season, AEZs, livestock densities and production systems. Rivers are in general the most important sources of water during both wet and dry seasons for crop–livestock system households, followed by rain and springs. Boreholes/wells (particularly in the dry season) and dams/ponds (particularly in the wet season) were more important sources of water for pastoral and agro-pastoral production systems. Rivers are more important sources in *dega* and *weinadega* AEZs, whereas dams/ponds are more important water sources in the *kolla* AEZ. Bore-

holes/wells are particularly important sources of water in low livestock density areas during the dry season.

Table 11.5.1. *Source of water for sheep by season and agro-ecological zones.*

Season and source of water	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
	No.	%	No.	%	No.	%	No.	%
Dry								
Borehole/well	20	5.1	77	8.7	120	22.9	217	12.1
Dam/pond	31	7.9	42	4.8	75	14.3	148	8.2
River	313	79.8	620	70.2	276	52.8	1209	67.2
Spring	57	14.5	161	18.2	95	18.2	313	17.4
Piped	10	2.6	36	4.1	32	6.1	78	4.3
Rain	2	0.5	4	0.5	2	0.4	8	0.4
No. of households	392		883		523		1798	
Wet								
Borehole/well	12	3.2	31	3.5	46	9.1	89	5.1
Dam/pond	15	4.0	67	7.7	183	36.0	265	15.1
River	234	62.6	516	59.0	182	35.8	932	53.1
Spring	54	14.4	141	16.1	89	17.5	284	16.2
Piped	10	2.7	20	2.3	22	4.3	52	3.0
Rain	133	35.6	241	27.6	175	34.4	549	31.3
No. of households	374		874		508		1756	

Table 11.5.2. *Source of water for sheep by season and livestock densities.*

Season and source of water	Livestock densities									
	Low		Medium		High		Very high		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
Dry										
Borehole/well	54	24.5	88	16.2	49	7.7	26	6.5	217	12.1
Dam/pond	17	7.7	36	6.6	63	9.9	32	8.0	148	8.2
River	127	57.7	363	67.0	469	74.0	250	62.2	1209	67.2
Spring	40	18.2	69	12.7	127	20.0	77	19.2	313	17.4
Piped	12	5.5	13	2.4	6	0.9	47	11.7	78	4.3
Rain	–	–	1	0.2	3	0.5	4	1.0	8	0.4
No. of households	220		542		634		402		1798	
Wet										
Borehole/well	13	6.1	27	5.3	31	5.1	18	4.3	89	5.1
Dam/pond	58	27.1	46	9.0	79	12.9	82	19.6	265	15.1
River	104	48.6	322	63.1	378	61.7	128	30.5	932	53.1
Spring	38	17.8	76	14.9	113	18.4	57	13.6	284	16.2
Piped	9	4.2	4	0.8	8	1.3	31	7.4	52	3.0
Rain	50	23.4	114	22.4	185	30.2	200	47.7	549	31.3
No. of households	214		510		613		419		1756	

Table 11.5.3. *Source of water for sheep by season and production systems.*

Season and source of water	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
	No.	%	No.	%	No.	%	No.	%
Dry								
Borehole/well	111	7.0	49	36.0	57	82.6	217	12.1
Dam/pond	92	5.8	33	24.3	23	33.3	148	8.2
River	1132	71.2	57	41.9	19	27.5	1208	67.3
Spring	299	18.8	13	9.6	1	1.4	313	17.4
Piped	58	3.6	8	5.9	11	15.9	77	4.3
Rain	6	0.4	1	0.7	1	1.4	8	0.4
No. of households	1591		136		69		1796	
Wet								
Borehole/well	74	4.7	3	2.3	12	20.7	89	5.1
Dam/pond	154	9.8	55	42.3	55	94.8	264	15.0
River	885	56.5	33	25.4	14	24.1	932	53.1
Spring	271	17.3	13	10.0	–	–	284	16.2
Piped	46	2.9	6	4.6	–	–	52	3.0
Rain	465	29.7	57	43.8	27	46.6	549	31.3
No. of households	1567		130		58		1755	

The reported distance to nearest watering point (Tables 11.5.4, 11.5.5 and 11.5.6) was less than a kilometre for three-quarters of the households (including those in which sheep received water at the household) during wet season but this fell to two-thirds during the dry season. Irrespective of season a greater proportion of sheep in areas of low livestock density travel longer distances than sheep in areas with medium to very high livestock densities. During the dry season two-thirds of the sheep owned by households in pastoral areas have to travel to more than 5 km to reach to the nearest watering point, and about a half of these, to more than 10 km.

Tables 11.5.7, 11.5.8 and 11.5.9 present reported quality of water used for sheep by season, AEZs and livestock densities. In general, over half of the households in the *weina-dega* and *kolla* AEZs (slightly less than half in the *dega* AEZ) access muddy water during the wet season. However, these proportions reduce during the dry season and more than 80% of the households in all AEZs have access to good quality water. Smelly water was more frequently reported in the *kolla* AEZ where livestock use common watering points.

Table 11.5.4. *Distance to the nearest watering point for sheep by season and agro-ecological zones.*

Season and distance to watering point	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
	No.	%	No.	%	No.	%	No.	%
Dry								
Watered at home	19	4.9	90	9.9	75	14.1	184	10.1
<1 km	237	60.6	548	60.6	170	31.9	955	52.2
1–5 km	130	33.2	259	28.6	151	28.3	540	29.5
6–10 km	10	2.6	22	2.4	65	12.2	97	5.3
>10 km	0	0	12	1.3	101	18.9	113	6.2
No. of households	391		905		533		1829	
Wet								
Watered at home	22	6.2	105	11.9	72	14.2	199	11.4
<1 km	243	68.6	608	68.9	277	54.5	1128	64.7
1–5 km	89	25.1	182	20.6	145	28.5	416	23.9
6–10 km	4	1.1	10	1.1	26	5.1	40	2.3
>10 km	0	0.0	0	0.0	8	1.6	8	0.5
No. of households	354		882		508		1744	

Table 11.5.5. *Distance to the nearest watering point for sheep by season and livestock densities.*

Season and distance of watering point	Livestock densities									
	Low		Medium		High		Very high		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
Dry										
Watered at home	33	14.4	49	9.0	42	6.6	60	14.4	184	10.1
<1 km	88	38.4	340	62.3	364	57.1	163	39.2	955	52.2
1–5 km	56	24.5	148	27.1	180	28.2	156	37.5	540	29.5
6–10 km	26	11.4	22	4.0	38	6.0	11	2.6	97	5.3
>10 km	36	15.7	21	3.8	26	4.1	30	7.2	113	6.2
No. of households	229		546		638		416		1829	
Wet										
Watered at home	22	10.6	57	11.2	52	8.6	68	16.2	199	11.4
<1 km	107	51.7	356	69.9	408	67.1	257	61.2	1128	64.7
1–5 km	67	32.4	105	20.6	143	23.5	101	24.0	416	23.9
6–10 km	7	3.4	14	2.8	11	1.8	8	1.9	40	2.3
>10 km	7	3.4	1	0.2	0	0.0	0	0.0	8	0.5
No. of households	207		509		608		420		1744	

Table 11.5.6. *Distance to the nearest watering point for sheep by season and production systems.*

Season and distance of watering point	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
	No.	%	No.	%	No.	%	No.	%
Dry								
Watered at home	150	9.2	20	14.6	13	19.1	183	10.0
<1 km	920	56.7	32	23.4	3	4.4	955	52.3
1–5 km	493	30.4	29	21.2	18	26.5	540	29.6
6–10 km	54	3.3	22	16.1	20	29.4	96	5.3
>10 km	42	2.6	45	32.8	26	38.2	113	6.2
No. of households	1622		137		68		1827	
Wet								
Watered at home	195	12.5	2	1.6	1	1.8	198	11.4
<1 km	1017	65.2	79	62.7	32	56.1	1128	64.8
1–5 km	365	23.4	29	23.0	21	36.8	415	23.8
6–10 km	21	1.3	17	13.5	2	3.5	40	2.3
>10 km	5	0.3	1	0.8	2	3.5	8	0.5
No. of households	1559		126		57		1742	

Table 11.5.7. *Quality of water for sheep during the wet and dry seasons by agro-ecological zones.*

Season and quality of water	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
	No.	%	No.	%	No.	%	No.	%
Dry								
Good/clear	324	82.9	799	88.1	431	80.7	1554	84.8
Muddy	64	16.4	112	12.3	97	18.2	273	14.9
Salty	1	0.3	12	1.3	27	5.1	40	2.2
Smelly	18	4.6	31	3.4	44	8.2	93	5.1
No. of households	391		907		534		1832	
Wet								
Good/clear	228	61.3	375	42.0	224	43.3	827	46.4
Muddy	170	45.7	533	59.7	317	61.3	1020	57.2
Salty	0	0.0	11	1.2	13	2.5	24	1.3
Smelly	10	2.7	26	2.9	44	8.5	80	4.5
No. of households	372		893		517		1782	

Table 11.5.8. *Quality of water for sheep during the wet and dry seasons by livestock densities.*

Season and quality of water	Livestock densities									
	Low		Medium		High		Very high		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
Dry										
Good/clear	225	98.3	433	79.0	527	82.5	369	88.7	1554	84.8
Muddy	10	4.4	109	19.9	119	18.6	35	8.4	273	14.9
Salty	9	3.9	2	0.4	17	2.7	12	2.9	40	2.2
Smelly	5	2.2	32	5.8	25	3.9	31	7.5	93	5.1
No. of households	229		548		639		416		1832	
Wet										
Good/clear	109	48.9	250	48.1	290	46.7	178	42.6	827	46.4
Muddy	126	56.5	281	54.0	368	59.3	245	58.6	1020	57.2
Salty	13	5.8	–	–	–	–	11	2.6	24	1.3
Smelly	40	17.9	16	3.1	11	1.8	13	3.1	80	4.5
No. of households	223		520		621		418		1782	

Table 11.5.9. *Quality of water for sheep during the wet and dry seasons by production systems.*

Season and quality of water	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
	No.	%	No.	%	No.	%	No.	%
Dry								
Good/clear	1386	85.3	112	81.8	54	78.3	1552	84.8
Muddy	239	14.7	15	10.9	19	27.5	273	14.9
Salty	9	0.6	17	12.4	14	20.3	40	2.2
Smelly	63	3.9	16	11.7	14	20.3	93	5.1
No. of households	1624		137		69		1830	
Wet								
Good/clear	777	48.7	41	32.0	8	13.8	826	46.4
Muddy	876	55.0	95	74.2	48	82.8	1019	57.2
Salty	11	0.7	7	5.5	6	10.3	24	1.3
Smelly	44	2.8	18	14.1	18	31.0	80	4.5
No. of households	1594		128		58		1780	

11.6 Reproduction

The reported levels of controlled mating sheep are summarised in Tables 11.6.1, 11.6.2 and 11.6.3. In general, over three-quarters of the households do not control mating of their sheep, particularly in the *dega* AEZ.

Table 11.6.1. *Type of sheep mating used by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Mating type	No.	%	No.	%	No.	%	No.	%
Controlled	32	10.9	97	29.9	81	26.3	210	22.7
Uncontrolled	261	89.1	227	70.1	227	73.7	715	77.3
No. of households	293		324		308		925	

Table 11.6.2. *Type of sheep mating by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Mating type	No.	%	No.	%	No.	%	No.	%	No.	%
Controlled	28	21.1	39	18.9	81	22.9	62	26.6	210	22.7
Uncontrolled	105	78.9	167	81.1	272	77.1	171	73.4	715	77.3
No. of households	133		206		353		233		925	

Table 11.6.3. *Type of sheep mating used by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Mating type	No.	%	No.	%	No.	%	No.	%
Controlled	179	23.8	23	21.7	8	12.5	210	22.8
Uncontrolled	573	76.2	83	78.3	56	87.5	712	77.2
No. of households	752		106		64		922	

About two-thirds of the households had used their own bred rams for breeding in the previous 12 months. Other sources of rams were from flocks of their neighbours (over a third of households in *dega* and *weinadega* AEZs and crop–livestock system) and markets (Tables 11.6.4, 11.6.5 and 11.6.6). Eighty-four percent of households in pastoral system used their own rams for breeding compared with an average of 69% in crop–livestock and agro-pastoral systems. But these figures do not relate to whether breeding rams used for mating were actively purposively selected in the communities.

Lambs were born in every month of the year across AEZs, and most frequently between September and November (Tables 11.6.7, 11.6.8 and 11.6.9). However, the trend was different in different production systems, and the frequency of lambing was highest between January and May among pastoralists.

Table 11.6.4. *Source of ram during the last 12 months by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Source of ram	No.	%	No.	%	No.	%	No.	%
Own-bred	273	73.2	602	68.6	317	62.4	1192	67.8
Bought	54	14.5	153	17.4	123	24.2	330	18.8
Donated	2	0.5	7	0.8	12	2.4	21	1.2
Borrowed	7	1.9	24	2.7	9	1.8	40	2.3
Neighbour	160	42.9	311	35.5	97	19.1	568	32.3
Communal	11	2.9	37	4.2	7	1.4	55	3.1
Unknown	31	8.3	57	6.5	18	3.5	106	6.0
No. of households	373		877		508		1758	

Table 11.6.5. *Source of ram during the last 12 months by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Source of ram	No.	%	No.	%	No.	%	No.	%	No.	%
Own-bred	157	72.0	340	63.4	404	66.2	291	73.9	1192	67.8
Bought	43	19.7	106	19.8	118	19.3	63	16.0	330	18.8
Donated	3	1.4	7	1.3	9	1.5	2	0.5	21	1.2
Borrowed	2	0.9	14	2.6	9	1.5	15	3.8	40	2.3
Neighbour	41	18.8	154	28.7	214	35.1	159	40.4	568	32.3
Communal	5	2.3	26	4.9	9	1.5	15	3.8	55	3.1
Unknown	1	0.5	16	3.0	51	8.4	38	9.6	106	6.0
No. of households	218		536		610		394		1758	

Table 11.6.6. *Source of ram during the last 12 months by production systems.*

	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Source of ram	No.	%	No.	%	No.	%	No.	%
Own-bred	1032	66.8	100	70.9	56	83.6	1188	67.7
Bought	297	19.2	25	17.7	8	11.9	330	18.8
Donated	12	0.8	5	3.5	4	6.0	21	1.2
Borrowed	33	2.1	6	4.3	1	1.5	40	2.3
Neighbour	534	34.5	29	20.6	3	4.5	566	32.3
Communal	48	3.1	4	2.8	3	4.5	55	3.1
Unknown	106	6.9	–	–	–	–	106	6.0
No. of households	1546		141		67		1754	

Table 11.6.7. *Monthly distribution of lambing by agro-ecological zones.*

Lambing month	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
	No.	%	No.	%	No.	%	No.	%
January	48	13.8	129	16.4	57	12.3	234	14.6
February	42	12.1	120	15.2	55	11.9	217	13.6
March	62	17.8	153	19.4	101	21.8	316	19.8
April	97	27.9	153	19.4	135	29.2	385	24.1
May	88	25.3	130	16.5	106	22.9	324	20.3
June	130	37.4	204	25.9	96	20.7	430	26.9
July	3	18.1	203	25.8	116	25.1	382	23.9
August	6	19.0	217	27.6	135	29.2	418	26.2
September	124	35.6	351	44.6	212	45.8	687	43.0
October	124	35.6	298	37.9	174	37.6	596	37.3
November	109	31.3	240	30.5	162	35.0	511	32.0
December	68	19.5	155	19.7	77	16.6	300	18.8
No. of households	348		787		463		1598	

Table 11.6.8. *Monthly distribution of lambing by livestock densities.*

Lambing month	Livestock densities									
	Low		Medium		High		Very high		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
January	40	21.2	66	13.9	81	14.4	7	2.6	34	14.6
February	42	22.2	68	14.3	76	13.5	31	8.3	217	13.6
March	61	32.3	80	16.8	114	20.3	61	16.4	316	19.8
April	63	33.3	106	22.3	123	21.9	93	25.0	385	24.1
May	56	29.6	84	17.7	114	20.3	70	18.8	324	20.3
June	50	26.5	124	26.1	149	26.5	107	28.8	430	26.9
July	28	14.8	113	23.8	126	22.4	115	30.9	382	23.9
August	34	18.0	114	24.0	129	23.0	141	37.9	418	26.2
September	61	32.3	224	47.2	240	42.7	162	43.5	687	43.0
October	47	24.9	190	40.0	210	37.4	149	40.1	596	37.3
November	46	24.3	163	34.3	200	35.6	102	27.4	511	32.0
December	27	14.3	85	17.9	134	23.8	54	14.5	300	18.8
No. of households	189		475		562		372		1598	

Table 11.6.9. *Monthly distribution of lambing by production systems.*

Lambing month	Crop–livestock		Agro-pastoral		Pastoral		Overall	
	No.	%	No.	%	No.	%	No.	%
January	202	14.4	12	9.4	19	29.7	233	14.6
February	172	12.3	23	18.0	21	32.8	216	13.6
March	257	18.3	33	25.8	26	40.6	316	19.8
April	319	22.8	38	29.7	27	42.2	384	24.1
May	277	19.8	27	21.1	19	29.7	323	20.3
June	397	28.3	25	19.5	8	12.5	430	27.0
July	339	24.2	33	25.8	9	14.1	381	23.9
August	361	25.7	42	32.8	13	20.3	416	26.1
September	606	43.2	62	48.4	16	25.0	684	42.9
October	534	38.1	38	29.7	24	37.5	596	37.4
November	468	33.4	26	20.3	16	25.0	510	32.0
December	275	19.6	16	12.5	8	12.5	299	18.8
No. of households	1402		128		64		1594	

Castration is a common practice throughout the region (Table 11.6.10). The proportion decreased, however, from 76% in *dega* to 58% in *kolla* AEZ. A higher proportion of households (85%) in the pastoral system castrate their sheep compared with those in crop–livestock and agro-pastoral systems. Castration is practised after six months of age consistently across the agro-ecological zones, livestock densities and production systems (Table 11.6.11). The reported reasons for castrating sheep in order of importance are to: improve meat quality, earn better prices, improve temperament and control mating (Tables 11.6.12, 11.6.13 and 11.6.14). Two-thirds of households in the crop–livestock system reported that castration improved ram temperament and one-third that they castrated males also to control breeding. In contrast, 60% of pastoralists use castration to control mating and only a third, half the proportion of crop–livestock farmers, castrated to improve temperament.

Male and female lambs were reported to reach sexual maturity on average by about eight months of age. In pastoral areas, however, this was reported to average about 13 months. The ranges of values reported were very wide (Table 11.6.15).

The reported age at first parturition (Table 12.7.16) was 14 months. In pastoral areas, however, this was reported to average about 17 months. The ranges of values reported were very wide. Lambing interval was reported to be close to nine months (Table 12.7.17). There was a slight variation by AEZs, livestock densities and production systems. Fertility rate (Table 11.6.18) was calculated by dividing the total number of lambs born over the last 12 months by the number of ewes reported to be in the flock expressed as a percentage. The average fertility rate was highest in *kolla* AEZ (63%) and in agro-pastoral areas (72%).

Lamb rearing practice up to weaning is summarised in Table 11.6.19. Lamb rearing through unrestricted suckling is practised by nearly 90% of the households in crop–livestock systems. In pastoral systems, however, 75% of the households restricted suckling.

Table 11.6.10. *Sheep castration practice across the different categories.*

Categories	No. of households	Sheep castration practice			
		Yes		No	
		No.	%	No.	%
Agro-ecological zones					
Dega	378	289	76.5	89	23.5
Weinadega	842	531	63.1	311	36.9
Kolla	516	301	58.3	215	41.7
Overall	1736	1121	64.6	615	35.4
Livestock densities					
Low	220	117	53.2	103	46.8
Medium	516	353	68.4	163	31.6
High	610	387	63.4	223	36.6
Very high	390	264	67.7	126	32.3
Overall	1736	1121	64.6	615	35.4
Production systems					
Crop–livestock	1531	972	63.5	559	36.5
Agro-pastoral	136	92	67.6	44	32.4
Pastoral	65	55	84.6	10	15.4
Overall	1732	1119	64.6	613	35.4

Table 11.6.11. *Reported age of sheep castration across the different categories.*

Categories	No. of households	Age at castration					
		<3 months		3–6 months		>6 months	
		No.	%	No.	%	No.	%
Agro-ecological zones							
Dega	276	2	0.7	6	2.2	269	97.5
Weinadega	532	1	0.2	17	3.2	515	96.8
Kolla	297	1	0.3	16	5.4	280	94.3
Overall	1105	4		39		1064	
Livestock densities							
Low	112	0	0.0	1	0.9	111	99.1
Medium	348	1	0.3	8	2.3	339	97.4
High	387	2	0.5	13	3.4	373	96.4
Very high	258	1	0.4	17	6.6	241	93.4
Overall	1105	4		39		1064	
Production systems							
Crop–livestock	963	4	0.4	35	3.6	926	96.2
Agro-pastoral	87	0	0.0	3	3.4	84	96.6
Pastoral	53	0	0.0	1	1.9	52	98.1
Overall	1103	4		39		1062	

Table 11.6.12. *Reported reasons for sheep castration by agro-ecological zones.*

Reason for castration	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
	No.	%	No.	%	No.	%	No.	%
Control breeding	106	36.3	224	41.2	123	40.7	453	39.8
Improve meat quality	266	91.1	532	97.8	286	94.7	1084	95.3
Better temperament	203	69.5	353	64.9	152	50.3	708	62.2
Better price	276	94.5	508	93.4	270	89.4	1054	92.6
Others	4	1.4	–	–	–	–	4	0.4
No. of households	292		544		302		1138	

Table 11.6.13. *Reported reasons for sheep castration by livestock densities.*

Reason for castration	Livestock densities									
	Low		Medium		High		Very high		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
Control breeding	67	58.8	109	30.2	201	50.4	76	28.8	453	39.8
Improve meat quality	111	97.4	352	97.5	376	94.2	245	92.8	1084	95.3
Better temperament	71	62.3	217	60.1	256	64.2	164	62.1	708	62.2
Better price	95	83.3	336	93.1	369	92.5	254	96.2	1054	92.6
Others	–	–	1	–	3	0.8	–	–	4	0.4
No. of households	114		361		399		264		1138	

Table 11.6.14. *Reported reason for sheep castration by production systems.*

Reason for castration	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
	No.	%	No.	%	No.	%	No.	%
Control breeding	374	37.7	46	51.1	33	60.0	453	39.9
Improve meat quality	939	94.8	88	97.8	55	100.0	1082	95.2
Better temperament	646	65.2	45	50.0	16	29.1	707	62.2
Better price	917	92.5	88	97.8	47	85.5	1052	92.6
Others	4	0.4	0	0.0	0	0.0	4	0.4
No. of households	991		90		55		1136	

Table 11.6.15. *Average age at sexual maturity (months) of sheep across different categories.*

Categories	Sex	No. of households	Age of sexual maturity				
			Mean	Std	Min	Max	Range
Agro-ecological zones							
Dega	Male	397	8.2	3.5	3.0	24	21.0
	Female	402	8.3	3.6	4.0	24	20.0
Weinadega	Male	927	7.7	3.1	3.0	36	33.0
	Female	935	7.9	3.3	3.0	36	33.0
Kolla	Male	545	8.9	5.1	3.0	36	33.0
	Female	549	8.8	4.9	3.0	36	33.0
Overall	Male	1869	8.2	3.9	3.0	36	33.0
	Female	1886	8.3	3.9	3.0	36	33.0
Livestock densities							
Low	Male	231	10.0	6.4	3.0	36	33.0
	Female	231	9.7	6.3	4.0	36	32.0
Medium	Male	549	8.1	3.6	3.0	36	33.0
	Female	554	8.2	3.7	3.5	36	32.5
High	Male	651	8.1	3.7	3.0	24	21.0
	Female	655	8.3	3.6	3.0	24	21.0
Very high	Male	438	7.4	2.1	3.0	18	15.0
	Female	446	7.5	2.5	3.0	24	21.0
Overall	Male	1869	8.2	3.9	3.0	36	33.0
	Female	1886	8.3	3.9	3.0	36	33.0
Production systems							
Crop–livestock	Male	1654	7.8	3.6	3.0	36	33.0
	Female	1671	7.9	3.6	3.0	36	33.0
Agro-pastoral	Male	146	9.4	4.5	3.0	24	21.0
	Female	146	9.5	4.8	3.0	36	33.0
Pastoral	Male	69	13.2	6	6.0	36	30.0
	Female	69	13.1	5.7	6.0	36	30.0
Overall	Male	1869	8.2	3.9	3.0	36	33.0
	Female	1886	8.3	3.9	3.0	36	33.0

Table 11.6.16. *Average age at first parturition (months) of sheep by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Age at 1st parturition (months)				
		Mean	Std	Min	Max	Range
Agro-ecological zones						
Dega	385	13.7	3.4	8	30.0	22.0
Weinadega	834	13.7	3.2	8	30.0	22.0
Kolla	491	14.1	4.0	8	30.0	22.0
Overall	1710	13.8	3.5	8	30.0	22.0
Livestock densities						
Low	209	14.8	4.6	8	30.0	22.0
Medium	510	13.5	3.2	8	30.0	22.0
High	594	14.0	3.7	8	30.0	22.0
Very high	397	13.5	2.6	8	28.5	20.5
Overall	1710	13.8	3.5	8	30.0	22.0
Production systems						
Crop–livestock	1512	13.6	3.3	8	30.0	22.0
Agro-pastoral	134	14.6	4.0	9	30.0	21.0
Pastoral	64	17.4	4.9	8	30.0	22.0
Overall	1710	13.8	3.5	8	30.0	22.0

Table 11.6.17. *Average lambing interval (months) of sheep by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Lambing interval (months)				
		Mean	Std	Min	Max	Range
Agro-ecological zones						
Dega	356	8.9	2.5	6	24	18
Weinadega	872	9.2	3.0	6	23	17
Kolla	490	9.2	3.2	6	24	18
Overall	1718	9.2	3.0	6	24	18
Livestock densities						
Low	204	8.5	2.7	6	20	14
Medium	484	9.8	3.4	6	23	17
High	621	9.2	3.0	6	24	18
Very high	409	8.6	2.4	6	22	16
Overall	1718	9.2	3.0	6	24	18
Production systems						
Crop–livestock	1532	9.2	3.1	6	24	18
Agro-pastoral	132	9.1	2.5	6	24	18
Pastoral	54	8.6	2.2	6	16	10
Overall	1718	9.2	3.0	6	24	18

Table 11.6.18. *Sheep fertility rates by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households*	No. of lambs born	No. of ewes	Fertility (%)**
Agro-ecological zones				
Dega	884	1756	3992	44.0
Weinadega	1572	2681	4668	57.4
Kolla	859	1859	2937	63.3
Overall	3315	6296	11597	54.3
Livestock densities				
Low	393	828	1462	56.6
Medium	1002	1982	3307	59.9
High	1105	1869	3852	48.5
Very high	815	1617	2976	54.3
Overall	3315	6296	11,597	54.3
Production systems				
Crop–livestock	2945	5264	10,016	52.6
Agro-pastoral	216	517	723	71.5
Pastoral	154	515	858	60.0
Overall	3315	6296	11,597	54.3

* No of households who have ewes.
** Fertility = Lambs born/No. of ewes*100%.

Table 11.6.19. *Type of lamb rearing up to weaning by agro-ecological zones, livestock densities and production systems.*

	Unrestricted suckling		Restricted suckling		Bucket feeding		
Categories	No.	%	No.	%	No.	%	Total
Agro-ecological zones							
Dega	296	82.7	61	17.0	1	0.3	358
Weinadega	796	93.4	56	6.6	0	0.0	852
Kolla	371	74.1	130	25.9	0	0.0	501
Overall	1463	85.5	247	14.4	1	0.1	1711
Livestock densities							
Low	176	81.9	39	18.1	0	0.0	215
Medium	439	86.6	68	13.4	0	0.0	507
High	529	88.5	69	11.5	0	0.0	598
Very high	319	81.6	71	18.2	1	0.3	391
Overall	1463	85.5	247	14.4	1	0.1	1711
Production systems							
Crop–livestock	1344	88.6	172	11.3	1	0.1	1517
Agro-pastoral	103	79.2	27	20.8	0	0.0	130
Pastoral	16	25.0	48	75.0	0	0.0	64
Overall	1463	85.5	247	14.4	1	0.1	1711

11.7 Sheep health

Tables 11.7.1 and 11.7.2 show types of veterinary services used by administrative zones, AEZs, livestock densities and production systems. On average, 84% of the households use governmental veterinary services, 13% use private veterinary services and 28% use drug stores. East Wellega, Arsi and Borana administrative zones reported higher frequency in the use of private veterinary services whereas North Shewa, Arsi and West Shewa were the most users of the services from drug suppliers. Fewer private veterinarians serve the low livestock density areas and pastoralists compared with higher livestock density areas and other production systems.

Close to half of the households trekked their sheep on foot for over 10 km to take them to nearest veterinary service (Tables 11.7.3 and 11.7.4). Arsi, Borana, Jimma, East Hararge and East Shewa administrative zones reported more frequent long distances to the nearest veterinary services. More than 90% of the households in pastoral areas had to travel over 10 km to reach to the nearest veterinary service.

Tables 11.7.5, 11.7.6, 11.7.7 and 11.7.8 show a range of sheep diseases and disease conditions prevalent in the region. According to their frequency of occurrence, enteritis, liver fluke and/or haemonchosis, respiratory diseases, pasteurellosis were reported as the major sheep diseases in the region. These were followed by foot-and-mouth disease (FMD), orf, coenurosis, anthrax, contagious caprine pleuro-pneumonia (CCPP) and skin diseases. Disease occurrence varied by AEZs. For example, liver fluke and/or haemonchosis were more prevalent in *dega* than in other AEZs. CCPP was commonly reported from pastoral areas. Trypanosomosis was reported infrequently and only from households in the *kolla* and *weinadega* AEZs.

Table 11.7.1. *Types of veterinary services used for sheep by administrative zones.*

Administrative zones	No. of households	Government services		Private services		Drug suppliers	
		No.	%	No.	%	No.	%
Arsi	147	125	85.0	47	32.0	65	44.2
Bale	114	101	88.6	0	0.0	30	26.3
Borana	184	132	71.7	43	23.4	39	21.2
East Hararge	129	111	86.0	1	0.8	35	27.1
East Shewa	152	140	92.1	9	5.9	38	25.0
East Wellega	126	117	92.9	56	44.4	43	34.1
Illubabor	123	96	78.0	16	13.0	35	28.5
Jimma	117	106	90.6	1	0.9	15	12.8
North Shewa	110	79	71.8	14	12.7	71	64.5
West Hararge	139	135	97.1	4	2.9	9	6.5
West Shewa	179	144	80.4	7	3.9	74	41.3
West Wellega	190	152	80.0	17	8.9	34	17.9
Overall	1710	1438	84.1	215	12.6	488	28.5

Table 11.7.2. *Types of veterinary services by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Government services		Private services		Drug suppliers	
		No.	%	No.	%	No.	%
Agro-ecological zones							
Dega	370	298	80.5	64	17.3	173	46.8
Weinadega	866	743	85.8	135	15.6	208	24.0
Kolla	491	413	84.1	19	3.9	117	23.8
Overall	1727	1454	84.2	218	12.6	498	28.8
Livestock densities							
Low	209	154	73.7	9	4.3	85	40.7
Medium	519	408	78.6	108	20.8	112	21.6
High	587	532	90.6	56	9.5	159	27.1
Very high	412	360	87.4	45	10.9	142	34.5
Overall	1727	1454	84.2	218	12.6	498	28.8
Production systems							
Crop–livestock	1532	1288	84.1	192	12.5	451	29.4
Agro-pastoral	132	108	81.8	24	18.2	41	31.1
Pastoral	57	52	91.2	2	3.5	6	10.5
Overall	1721	1448	84.1	218	12.7	498	28.9

Table 11.7.3. *Distance to the nearest veterinary services for sheep by administrative zones.*

Administrative zones	No. of households	Distance to the nearest veterinary service							
		<1 km		1–5 km		6–10 km		>10 km	
		No.	%	No.	%	No.	%	No.	%
Arsi	147	3	2.0	33	22.4	49	33.3	62	42.2
Bale	114	8	7.0	39	34.2	26	22.8	41	36.0
Borana	184	3	1.6	37	20.1	21	11.4	123	66.8
East Hararge	129	11	8.5	28	21.7	18	14.0	72	55.8
East Shewa	152	11	7.2	24	15.8	46	30.3	71	46.7
East Wellega	126	22	17.5	60	47.6	29	23.0	15	11.9
Illubabor	123	5	4.1	33	26.8	31	25.2	54	43.9
Jimma	117	2	1.7	22	18.8	13	11.1	80	68.4
North Shewa	110	6	5.5	33	30	38	34.5	33	30.0
West Hararge	139	20	14.4	40	28.8	22	15.8	57	41.0
West Shewa	179	19	10.6	55	30.7	30	16.8	75	41.9
West Wellega	190	20	10.5	37	19.5	39	20.5	94	49.5
Overall	1710	130	7.6	441	25.8	362	21.2	777	45.4

Table 11.7.4. *Distance to nearest veterinary services for sheep by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	<1 km		1–5 km		6–10 km		>10 km	
		No.	%	No.	%	No.	%	No.	%
Agro-ecological zones									
Dega	368	31	8.4	111	30.2	81	22.0	145	39.4
Weinadega	857	67	7.8	228	26.6	211	24.6	351	41.0
Kolla	509	32	6.3	110	21.6	73	14.3	294	57.8
Overall	1734	130	7.5	449	25.9	365	21.0	790	45.6
Livestock densities									
Low	215	26	12.1	46	21.4	24	11.2	119	55.3
Medium	530	40	7.5	161	30.4	118	22.3	211	39.8
High	585	36	6.2	165	28.2	114	19.5	270	46.2
Very high	404	28	6.9	77	19.1	109	27.0	190	47.0
Overall	1734	130	7.5	449	25.9	365	21.0	790	45.6
Production systems									
Crop–livestock	1532	120	7.8	427	27.9	340	22.2	645	42.1
Agro-pastoral	135	9	6.7	17	12.6	22	16.3	87	64.4
Pastoral	62	0	0.0	3	4.8	2	3.2	57	91.9
Overall	1729	129	7.5	447	25.9	364	21.1	789	45.6

Table 11.7.5. *Reported prevalence of sheep diseases by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Diseases	No.	%	No.	%	No.	%	No.	%
Enteritis	87	26.1	262	32.8	146	30.7	495	30.8
Fasciolosis/haemonchosis	172	51.7	210	26.3	75	15.8	457	28.4
Respiratory diseases	85	25.5	183	22.9	79	16.6	347	21.6
Pasteurellosis	31	9.3	182	22.8	129	27.2	342	21.3
Foot-and-mouth disease	16	4.8	77	9.6	46	9.7	139	8.6
Orf	3	0.9	79	9.9	50	10.5	132	8.2
Gid/coenurosis	51	15.3	57	7.1	20	4.2	128	8.0
Anthrax	6	1.8	57	7.1	53	11.2	116	7.2
Contagious caprine pleuro-pneumonia	3	0.9	34	4.3	66	13.9	103	6.4
Skin diseases	12	3.6	28	3.5	62	13.1	102	6.3
Black leg	17	5.1	54	6.8	11	2.3	82	5.1
Internal parasites	13	3.9	31	3.9	24	5.1	68	4.2
Emaciation	1	0.3	29	3.6	30	6.3	60	3.7
Trypanosomosis	0	0.0	33	4.1	19	4.0	52	3.2
Sheep and goat pox	0	0.0	40	5.0	5	1.1	45	2.8
Lameness	0	0.0	16	2.0	21	4.4	37	2.3
Bloat	9	2.7	12	1.5	11	2.3	32	2.0
External parasites	0	0.0	16	2.0	10	2.1	26	1.6
Foot rot	1	0.3	16	2.0	3	0.6	20	1.2
Oestrosis/nasal bot	10	3.0	2	0.3	8	1.7	20	1.2
Sudden death	3	0.9	10	1.3	5	1.1	18	1.1
Colic	4	1.2	8	1.0	1	0.2	13	0.8
Blue tongue	1	0.3	9	1.1	0	0.0	10	0.6
Abscess	0	0.0	3	0.4	3	0.6	6	0.4
Eye disease	0	0.0	1	0.1	5	1.1	6	0.4
Peste des petits ruminants	0	0.0	7	0.9	0	0.0	7	0.4
Abortion	0	0.0	5	0.6	0	0.0	5	0.3
Anaplasmosis	0	0.0	0	0.0	1	0.2	1	0.1
Cowdriosis	0	0.0	1	0.1	0	0.0	1	0.1
Haematuria	0	0.0	0	0.0	2	0.4	2	0.1
Rabies	0	0.0	1	0.1	0	0.0	1	0.1
Unidentified	128	38.4	247	30.9	175	36.8	550	34.2
No. of households	333		800		475		1608	

Table 11.7.6. *Reported prevalence of sheep diseases by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Diseases	No.	%	No.	%	No.	%	No.	%	No.	%
Enteritis	59	28.6	196	39.4	153	29.7	87	22.3	495	30.8
Fasciolosis/haemonchosis	24	11.7	129	26.0	164	31.8	140	35.9	457	28.4
Respiratory diseases	41	19.9	111	22.3	131	25.4	64	16.4	347	21.6
Pasteurellosis	50	24.3	129	26.0	112	21.7	51	13.1	342	21.3
Foot-and-mouth disease	8	3.9	43	8.7	29	5.6	59	15.1	139	8.6
Orf	40	19.4	43	8.7	31	6.0	18	4.6	132	8.2
Gid/coenurosis	4	1.9	44	8.9	49	9.5	31	7.9	128	8.0
Anthrax	33	16.0	19	3.8	1	0.2	63	16.2	116	7.2
Contagious caprine pleuro-pneumonia	24	11.7	36	7.2	26	5.0	17	4.4	103	6.4
Skin diseases	21	10.2	14	2.8	37	7.2	30	7.7	102	6.3
Black leg	3	1.5	10	2.0	10	1.9	59	15.1	82	5.1
Internal parasites	5	2.4	27	5.4	24	4.7	12	3.1	68	4.2
Emaciation	17	8.3	10	2.0	19	3.7	14	3.6	60	3.7
Trypanosomosis	19	9.2	26	5.2	7	1.4	0	0.0	52	3.2
Sheep and goat pox	0	0.0	20	4.0	2	0.4	23	5.9	45	2.8
Lameness	15	7.3	14	2.8	4	0.8	4	1.0	37	2.3
Bloat	3	1.5	10	2.0	13	2.5	6	1.5	32	2.0
External parasites	1	0.5	8	1.6	12	2.3	5	1.3	26	1.6
Foot rot	2	1.0	0	0.0	10	1.9	8	2.1	20	1.2
Oestrosis/nasal bot	2	1.0	6	1.2	11	2.1	1	0.3	20	1.2
Sudden death	0	0.0	2	0.4	13	2.5	3	0.8	18	1.1
Colic	0	0.0	1	0.2	7	1.4	5	1.3	13	0.8
Blue tongue	0	0.0	8	1.6	2	0.4	0	0.0	10	0.6
Abscess	3	1.5	3	0.6	0	0.0	0	0.0	6	0.4
Eye disease	2	1.0	1	0.2	0	0.0	3	0.8	6	0.4
Peste des petits ruminants	0	0.0	0	0.0	0	0.0	7	1.8	7	0.4
Abortion	0	0.0	5	1.0	0	0.0	0	0.0	5	0.3
Anaplasmosis	1	0.5	0	0.0	0	0.0	0	0.0	1	0.1
Cowdriosis	1	0.5	0	0.0	0	0.0	0	0.0	1	0.1
Haematuria	2	1.0	0	0.0	0	0.0	0	0.0	2	0.1
Rabies	0	0.0	1	0.2	0	0.0	0	0.0	1	0.1
Unidentified	85	41.3	185	37.2	157	30.5	123	31.5	550	34.2
No. of households	206		497		515		390		1608	

Table 11.7.7. *Reported prevalence of sheep diseases by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Diseases	No.	%	No.	%	No.	%	No.	%
Enteritis	459	32.5	28	21.1	7	11.3	494	30.8
Fasciolosis/haemonchosis	441	31.2	14	10.5	1	1.6	456	28.4
Respiratory diseases	320	22.7	27	20.3	0	0.0	347	21.6
Pasteurellosis	301	21.3	24	18.0	17	27.4	342	21.3
Foot-and-mouth disease	134	9.5	2	1.5	2	3.2	138	8.6
Orf	123	8.7	8	6.0	1	1.6	132	8.2
Gid/coenurosis	122	8.6	6	4.5	0	0.0	128	8.0
Anthrax	88	6.2	24	18.0	4	6.5	116	7.2
Contagious caprine pleuro-pneumonia	20	1.4	43	32.3	40	64.5	103	6.4
Skin diseases	72	5.1	20	15.0	10	16.1	102	6.3
Black leg	69	4.9	13	9.8	0	0.0	82	5.1
Internal parasites	58	4.1	4	3.0	6	9.7	68	4.2
Emaciation	29	2.1	12	9.0	19	30.6	60	3.7
Trypanosomosis	50	3.5	2	1.5	0	0.0	52	3.2
Sheep and goat pox	42	3.0	3	2.3	0	0.0	45	2.8
Lameness	16	1.1	7	5.3	14	22.6	37	2.3
Bloat	29	2.1	1	0.8	2	3.2	32	2.0
External parasites	26	1.8	0	0.0	0	0.0	26	1.6
Foot rot	18	1.3	1	0.8	1	1.6	20	1.2
Oestrosis/nasal bot	19	1.3	0	0.0	1	1.6	20	1.2
Sudden death	18	1.3	0	0.0	0	0.0	18	1.1
Colic	13	0.9	0	0.0	0	0.0	13	0.8
Blue tongue	10	0.7	0	0.0	0	0.0	10	0.6
Abscess	5	0.4	0	0.0	1	1.6	6	0.4
Eye disease	6	0.4	0	0.0	0	0.0	6	0.4
Peste des petits ruminants	1	0.1	6	4.5	0	0.0	7	0.4
Abortion	5	0.4	0	0.0	0	0.0	5	0.3
Anaplasmosis	0	0.0	1	0.8	0	0.0	1	0.1
Cowdriosis	1	0.1	0	0.0	0	0.0	1	0.1
Haematuria	0	0.0	0	0.0	2	3.2	2	0.1
Rabies	1	0.1	0	0.0	0	0.0	1	0.1
Unidentified	446	31.6	80	60.2	24	38.7	550	34.2
No. of households	1412		133		62		1607	

Table 11.7.8. *Reported prevalence of sheep diseases by administrative zones (%).*

Diseases	Arsi	Bale	Borana	East Hararge	East Shewa	East Wellega	Illubabor	Jimma	North Shewa	West Hararge	West Shewa	West Wellega	Overall
No. of households	141	100	180	132	151	122	105	93	113	126	160	185	1608
Enteritis	27.7	8.0	13.9	46.2	19.2	39.3	41.0		13.3	73.8	29.4	47.0	30.8
Fasciolosis/ haemonchosis	72.3	12.0	5.0	21.2	17.2	23.0	13.3	17.2	65.5	28.6	49.4	17.8	28.4
Respiratory disease	7.8	48.0	11.7	6.1	21.2	14.8	27.6	46.2	18.6	50.8	32.5	0.0	21.6
Pasteurellosis	0.0	0.0	23.3	28.8	11.3	29.5	26.7	48.4	22.1	11.1	13.1	41.1	21.3
Foot-and-mouth disease	0.0	0.0	5.6	11.4	27.8	2.5	17.1	3.2	6.2	0.0	7.5	15.7	8.6
Orf	0.0	7.0	0.0	5.3	2.0	22.1	2.9	10.8	0.9	3.2	16.3	23.8	8.2
Gid/coenurosis	22.7	0.0	0.0	9.8	9.9	15.6	16.2	3.2	3.5	9.5	8.1	0.0	8.0
Anthrax	7.1	0.0	0.0	24.2	21.9	9.8	0.0	0.0	9.7	2.4	0.0	8.1	7.2
Contagious caprine pleuro-pneumonia	0.0	0.0	47.2	0.0	11.3	0.0	0.0	1.1	0.0	0.0	0.0	0.0	6.4
Skin disease	5.0	0.0	14.4	14.4	13.2	5.7	1.9	0.0	0.0	9.5	1.9	0.0	6.3
Black leg	0.0	0.0	0.0	3.0	17.9	1.6	6.7	0.0	23.9	3.2	6.9	0.0	5.1
Internal parasite	4.3	0.0	10.0	4.5	0.7	3.3	10.5	6.5	0.9	3.2	1.3	4.9	4.2
Emaciation	0.0	0.0	13.3	1.5	6.6	4.9	7.6	0.0	3.5	2.4	0.0	1.6	3.7
Trypanosomes	0.0	8.0	0.0	0.0	0.0	15.6	0.0	0.0	0.0	0.0	0.0	13.5	3.2
Sheep and goat pox	0.0	0.0	9.4	0.0	15.2	0.8	0.0	0.0	1.8	0.0	0.0	1.1	2.8
Lameness	0.0	0.0	11.7	0.0	2.6	7.4	0.0	3.2	0.0	0.0	0.0	0.0	2.3
Bloat	0.0	0.0	2.2	0.0	2.6	0.0	0.0	6.5	5.3	1.6	0.0	5.4	2.0
External parasite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.5	0.0	0.8	0.0	2.7	1.6
Foot rot	0.0	0.0	0.0	5.3	4.0	0.8	0.0	0.0	0.9	0.8	1.3	1.1	1.2
Oestrosis/nasal bot	0.0	0.0	8.9	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.2
Sudden death	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.9	7.9	1.9	0.0	1.1
Colic	0.0	0.0	0.0	1.5	0.0	0.0	1.9	1.1	0.0	0.0	4.4	0.5	0.8

cont'd...

Table 11.7.8. cont'd.

Diseases	Arsi	Bale	Borana	East Hararge	East Shewa	East Wellega	Illubabor	Jimma	North Shewa	West Hararge	West Shewa	West Wellega	Overall
Blue tongue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	4.3	0.6
Abscess	0.0	0.0	0.0	0.8	0.0	0.8	0.0	0.0	0.0	0.0	0.0	1.1	0.4
Eye disease	0.0	0.0	0.0	1.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.4
Peste des petits ruminants	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Abortion	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.5	0.3
Anaplasasmosis	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Cowdriosis	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Haematuria	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Rabies	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Unidentified	53.9	100.0	60.0	18.9	31.8	15.6	15.2	25.8	7.1	17.5	25.0	34.6	34.2

11.8 Age and sex structure

Table 11.8.1 shows that age and sex structure of sheep are generally similar across AEZs, livestock densities and production systems. Overall, adult females constitute 45% of the average flock, followed by young females (21%), young males (19%) and adult males (14%).

Table 11.8.1. *Age and sex structure of sheep by agro-ecological zones, livestock densities and production systems.*

			Sheep types			
Categories	No. of households	Total no. of sheep	Young male (%)	Young female (%)	Adut male (%)	Adult female (%)
Agro-ecological zones						
Dega	888	8478	19.0	21.9	11.8	47.2
Weinadega	1591	10,474	19.2	21.8	14.4	44.6
Kolla	885	6614	19.1	20.4	16.0	44.5
Total	3364	25,566	19.1	21.5	13.9	45.4
Livestock densities						
Low	404	3387	21.5	23.6	11.7	43.2
Medium	1037	7538	20.0	23.0	13.1	43.9
High	1117	8029	18.0	20.9	13.0	48.1
Very high	806	6612	18.3	19.4	17.2	45.1
Total	3364	25,566	19.1	21.5	13.9	45.4
Production systems						
Crop–livestock	2990	22,062	19.2	21.7	13.7	45.4
Agro-pastoral	214	1591	17.7	21.2	15.7	45.4
Pastoral	154	1873	19.3	19.8	15.1	45.8
Total	3358	25,526	19.1	21.5	13.9	45.4

11.9 Mortality

Based on the reported current stock of sheep and numbers of deaths reported over the 12 months period prior to the survey, the overall mortality rate for the whole sample flock was 15%. This ranges from 7% for adult females in the *dega* AEZ to 40% for adult males in the pastoral production system. Considerable variations in mortality rates were observed among different classification variables (age, sex, AEZs, livestock density and production system categories) (Table 11.9.1).

Table 11.9.2 shows reported causes of death in sheep. Diseases accounted for 59% of all deaths followed by predators (20%), accident (7%), drought (4%) and poisoning (<1%). Up to 10% of the deaths were with unknown causes. There was little variation on the causes of death by AEZs, livestock densities and production systems. However, death

from drought was highest in pastoral than in other production systems. Death from predators is more common in pastoral areas and in areas of low livestock density.

Table 11.9.1. *Calculated mortality rate (%*) of sheep by age and sex groups and agro-ecological zones, livestock densities and production systems.*

		Sheep type dead									
		Young male		Young female		Adult male		Adult female		Overall	
Categories	No. of households	No.	%	No.	%	No.	%	No.	%	No.	%
Agro-ecological zones											
Dega	220	254	13.6	180	8.8	174	14.8	299	6.9	907	9.7
Weinadega	519	481	19.3	381	14.3	315	17.3	565	10.8	1742	14.3
Kolla	305	505	28.5	325	19.4	397	27.2	671	18.6	1898	22.3
Overall	1044	1240	20.2	886	13.9	886	19.9	1535	11.7	4547	15.1
Livestock densities											
Low	147	211	22.4	139	14.8	160	28.8	256	14.9	766	18.4
Medium	318	542	26.5	336	16.2	406	29.1	655	16.5	1939	20.5
High	344	292	16.8	215	11.4	201	16.1	357	8.5	1065	11.7
Very high	235	195	13.9	196	13.2	119	9.5	267	8.2	777	10.5
Overall	1044	1240	20.2	886	13.9	886	19.9	1535	11.7	4547	15.1
Production systems											
Crop–livestock	902	839	16.5	687	12.6	543	15.2	964	8.8	3033	12.1
Agro-pastoral	91	171	37.7	104	23.6	153	38.1	272	27.3	700	30.6
Pastoral	51	230	38.9	95	20.4	190	40.2	299	25.8	814	30.3
Overall	1044	1240	20.3	886	13.9	886	19.9	1535	11.7	4547	15.1

* Percent mortality = Animals dead/(Current average stock + Animals dead)*100%.

Table 11.9.2. *Reported causes of sheep death by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Total reported cases	Causes of death (%)					
			Predators	Disease	Accident	Poisoning	Drought	Unknown
Agro-ecological zones								
Dega	220	328	19.5	53.4	7.9	1.2	3.7	14.3
Weinadega	523	722	18.1	61.5	8.0	0.4	2.6	9.3
Kolla	308	437	22.7	59.0	3.0	0.5	7.1	7.8
Overall	1051	1487	19.8	59.0	6.5	0.6	4.2	10.0
Livestock densities								
Low	147	222	28.4	57.2	2.7	0.5	3.6	7.7
Medium	323	481	25.6	58.2	6.4	0.2	4.0	5.6
High	346	453	13.2	60.0	7.3	1.1	4.2	14.1
Very high	235	331	14.5	59.8	8.2	0.6	4.8	12.1
Overall	1051	1487	19.8	59.0	6.5	0.6	4.2	10.0
Production systems								
Crop–livestock	910	1277	18.7	58.7	7.4	0.6	3.4	11.1
Agro-pastoral	88	121	24.0	63.6	0.8	0.8	5.8	5.0
Pastoral	51	86	29.1	55.8	1.2	0.0	14.0	0.0
Overall	1049	1484	19.7	59.0	6.5	0.6	4.2	10.0

11.10 Acquisition and disposal of sheep

Tables 11.10.1, 11.10.2 and 11.10.3 show numbers of sheep that entered flocks during the previous 12 months. On average, 19% of both male and female sheep in the flock had entered over the previous 12 months, 93% of which were born in the households. Entry by birth was higher in the *weinadega* than in *kolla* and *dega* AEZs. Likewise, entry by birth was highest in agro-pastoral system followed by crop–livestock and pastoral systems.

Tables 11.10.4, 11.10.5 and 11.10.6 show percentage of sheep that were disposed from flocks during the previous 12 months. On average, 14% of male and 13.5% of female sheep were disposed, of which respectively 50% and 71% were due to death. Disposal due to slaughter is more common in pastoral than in agro-pastoral and crop–livestock systems.

Table 11.10.1. *Sheep acquisition patterns during the past 12 months by type of entry, sex and agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Type of acquisition	No.	%*	No.	%	No.	%	No.	%
Male sheep								
Born	831	8.0	1238	9.1	900	7.9	2969	8.4
Bought	21	0.2	132	1.0	49	0.4	202	0.6
Donated	2	0.0	5	0.0	10	0.1	17	0.0
Exchanged	0	0.0	2	0.0	8	0.1	10	0.0
Sub-total	854	8.2	1377	10.1	967	8.5	3198	9.0
Female sheep								
Born	854	8.2	1330	9.7	915	8.1	3099	8.8
Bought	59	0.6	126	0.9	32	0.3	217	0.6
Donated	8	0.1	6	0.0	7	0.1	21	0.1
Exchanged	0	0.0	8	0.1	2	0.0	10	0.0
Sub-total	921	8.9	1470	10.8	956	8.4	3347	9.5
Male and female sheep								
Born	1685	16.3	2568	18.8	1815	16.0	6068	17.2
Bought	80	0.8	258	1.9	81	0.7	419	1.2
Donated	10	0.1	11	0.1	17	0.1	38	0.1
Exchanged	0	0.0	10	0.1	10	0.1	20	0.1
Sub-total	1775	17.1	2847	20.9	1923	17.0	6545	18.5
Total sheep in households	10,358		13,642		11,340		35,340	
No. of households	360		789		434		1583	

* Percent = Number entered/Total number of sheep in flock during the year (including disposal)*100%.

Table 11.10.2. *Sheep acquisition patterns during the past 12 months by type of entry, sex and livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Type of acquisition	No.	%*	No.	%	No.	%	No.	%	No.	%
Male sheep										
Born	429	9.4	939	7.5	864	8.6	737	8.9	2969	8.4
Bought	17	0.4	33	0.3	45	0.4	107	1.3	202	0.6
Donated	2	0.0	9	0.1	3	0.0	3	0.0	17	0.0
Exchanged	0	0.0	10	0.1	0	0.0	0	0.0	10	0.0
Sub-total	448	9.8	991	8.0	912	9.1	847	10.3	3198	9.1
Female sheep										
Born	397	8.7	1031	8.3	888	8.8	783	9.5	3099	8.8
Bought	32	0.7	43	0.3	61	0.6	81	1.0	217	0.6
Donated	4	0.1	5	0.0	9	0.1	3	0.0	21	0.1
Exchanged	1	0.0	6	0.0	3	0.0	0	0.0	10	0.0
Sub-total	434	9.5	1085	8.7	961	9.6	867	10.5	3347	9.5
Male and female sheep										
Born	826	18.0	1970	15.8	1752	17.5	1520	18.4	6068	17.2
Bought	49	1.1	76	0.6	106	1.1	188	2.3	419	1.2
Donated	6	0.1	14	0.1	12	0.1	6	0.1	38	0.1
Exchanged	1	0.0	16	0.1	3	0.0	0	0.0	20	0.1
Sub-total	882	19.3	2076	16.7	1873	18.7	1714	20.7	6545	18.6
Total sheep in households	4578		12,459		10,040		8263		35,240	
No. of households	195		468		542		378		1583	

* Percent = Number entered/Total number of sheep in flock during the year (including disposal)*100%.

Table 11.10.3. *Sheep acquisition patterns during the past 12 months by type of entry, sex and production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Type of acquisition	No.	%*	No.	%	No.	%	No.	%
Male sheep								
Born	2485	9.0	251	9.8	229	4.5	2965	8.4
Bought	194	0.7	8	0.3	0	0.0	202	0.6
Donated	10	0.0	0	0.0	7	0.1	17	0.0
Exchanged	2	0.0	8	0.3	0	0.0	10	0.0
Sub-total	2691	9.7	267	10.4	236	4.6	3194	9.0
Female sheep								
Born	2557	9.3	253	9.8	286	5.6	3096	8.8
Bought	200	0.7	13	0.5	4	0.1	217	0.6
Donated		0.1	0	0.0	4	0.1	21	0.1
Exchanged	179	0.0	0	0.0	1	0.0	10	0.0
Sub-total	2783	10.1	266	10.4	295	5.8	3344	9.5
Male and female sheep								
Born	5042	18.3	504	19.6	515	10.1	6061	17.2
Bought	394	1.4	21	0.8	4	0.1	419	1.2
Donated	27	0.1	0	0.0	11	0.2	38	0.1
Exchanged	11	0.0	8	0.3	1	0.0	20	0.1
Sub-total	5474	19.8	533	20.7	531	10.4	6538	18.5
Total sheep in households	27,611		2570		5123		35,304	
No. of households	1393		127		61		1581	

*Percent = Number entered/Total number of sheep in flock during the year (including disposal)*100%.

Table 11.10.4. *Sheep disposal patterns during the past 12 months by type of disposal, sex and agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Total disposal	
Type of disposal	No.	%*	No.	%	No.	%	No.	%
Male sheep								
Sold	572	5.5	815	6.0	469	4.1	1856	5.2
Slaughtered	112	1.1	218	1.6	238	2.1	568	1.6
Exchanged	0	0.0	0	0.0	3	0.0	3	0.0
Died	317	3.1	687	5.0	1510	13.3	2514	7.1
Stolen	16	0.2	13	0.1	6	0.1	35	0.1
Donated	3	0.0	4	0.0	51	0.4	58	0.2
Sub-total	1020	9.8	1737	12.7	2277	20.1	5034	14.2
Female sheep		0.0		0.0		0.0		0.0
Sold	327	3.2	471	3.5	260	2.3	1058	3.0
Slaughtered	41	0.4	80	0.6	84	0.7	205	0.6
Exchanged	0	0.0	3	0.0	7	0.1	10	0.0
Died	462	4.5	866	6.3	2058	18.1	3386	9.6
Stolen	19	0.2	15	0.1	11	0.1	45	0.1
Donated	18	0.2	5	0.0	29	0.3	52	0.1
Sub-total	867	8.4	1440	10.5	2449	21.6	4756	13.5
Overall		0.0		0.0		0.0		0.0
Sold	899	8.7	1286	9.4	729	6.4	2914	8.2
Slaughtered	153	1.5	298	2.2	322	2.8	773	2.2
Exchanged	0	0.0	3	0.0	10	0.1	13	0.0
Died	779	7.5	1553	11.4	3568	31.5	5900	16.7
Stolen	35	0.3	28	0.2	17	0.1	80	0.2
Donated	21	0.2	9	0.1	80	0.7	110	0.3
Sub-total	1887	18.2	3177	23.3	4726	41.7	9790	27.7
Total sheep during the year	10,365		13,651		11,340		35,356	
Current total sheep	8478		10,474		6614		25,566	
Total disposed sheep	1887		3177		4726		9790	
No. of households	320		703		371		1394	

*Percent = Number of disposal/Total number of sheep in flock during the year (including disposal)*100%.

Table 11.10.5. *Sheep disposal patterns during the past 12 months by type of disposal, sex and livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Total disposal	
Type of disposal	No.	%*	No.	%	No.	%	No.	%	No.	%
Male sheep										
Sold	236	5.2	564	4.5	584	5.8	472	5.7	1856	5.2
Slaughtered	93	2.0	186	1.5	167	1.7	122	1.5	568	1.6
Exchanged	3	0.1	0	0.0	0	0.0	0	0.0	3	0.0
Died	298	6.5	1551	12.4	374	3.7	291	3.5	2514	7.1
Stolen	4	0.1	9	0.1	17	0.2	5	0.1	35	0.1
Donated	3	0.1	43	0.3	4	0.0	8	0.1	58	0.2
Sub-total	637	13.9	2353	18.9	1146	11.4	898	10.9	5034	14.2
Female sheep		0.0		0.0		0.0		0.0		0.0
Sold	99	2.2	387	3.1	316	3.1	256	3.1	1058	3.0
Slaughtered	15	0.3	75	0.6	47	0.5	68	0.8	205	0.6
Exchanged	5	0.1	3	0.0	2	0.0	0	0.0	10	0.0
Died	415	9.1	2088	16.8	476	4.7	407	4.9	3386	9.6
Stolen	8	0.2	4	0.0	19	0.2	14	0.2	45	0.1
Donated	12	0.3	15	0.1	7	0.1	18	0.2	52	0.1
Sub-total	554	12.1	2572	20.6	867	8.6	763	9.2	4756	13.5
Overall		0.0		0.0		0.0		0.0		0.0
Sold	335	7.3	951	7.6	900	9.0	728	8.8	2914	8.2
Slaughtered	108	2.4	261	2.1	214	2.1	190	2.3	773	2.2
Exchanged	8	0.2	3	0.0	2	0.0	0	0.0	13	0.0
Died	713	15.6	3639	29.2	850	8.5	698	8.4	5900	16.7
Stolen	12	0.3	13	0.1	36	0.4	19	0.2	80	0.2
Donated	15	0.3	58	0.5	11	0.1	26	0.3	110	0.3
Sub-total	1191	26.0	4925	39.5	2013	20.0	1661	20.1	9790	27.7
Total sheep during the year	4578		12,463		10,042		8273		35,356	
Current total sheep	3387		7538		8029		6612		25,566	
Total disposed sheep	1191		4925		2013		1661		9790	
No. of households	184		403		496		311		1394	

* Percent = Number of disposal/Total number of sheep in flock during the year (including disposal)*100%.

Table 11.10.6. *Sheep disposal patterns during the past 12 months by type of disposal, sex and production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Total disposal	
Type of disposal	No.	%*	No.	%	No.	%	No.	%
Male sheep								
Sold	1501	5.4	162	6.3	190	3.7	1853	5.2
Slaughtered	352	1.3	55	2.1	161	3.1	568	1.6
Exchanged	0	0.0	0	0.0	3	0.1	3	0.0
Died	1149	4.2	237	9.2	1128	22.0	2514	7.1
Stolen	35	0.1	0	0.0	0	0.0	35	0.1
Donated	15	0.1	2	0.1	41	0.8	58	0.2
Sub-total	3052	11.1	456	17.7	1523	29.7	5031	14.2
Female sheep		0.0		0.0		0.0		0.0
Sold	856	3.1	86	3.3	112	2.2	1054	3.0
Slaughtered	131	0.5	19	0.7	55	1.1	205	0.6
Exchanged	5	0.0	0	0.0	5	0.1	10	0.0
Died	1436	5.2	417	16.2	1533	29.9	3386	9.6
Stolen	44	0.2	1	0.0	0	0.0	45	0.1
Donated	30	0.1	0	0.0	22	0.4	52	0.1
Sub-total	2502	9.1	523	20.4	1727	33.7	4752	13.5
Overall		0.0		0.0		0.0		0.0
Sold	2357	8.5	248	9.6	302	5.9	2907	8.2
Slaughtered	483	1.7	74	2.9	216	4.2	773	2.2
Exchanged	5	0.0	0	0.0	8	0.2	13	0.0
Died	2585	9.4	654	25.4	2661	51.9	5900	16.7
Stolen	79	0.3	1	0.0	0	0.0	80	0.2
Donated	45	0.2	2	0.1	63	1.2	110	0.3
Sub-total	5554	20.1	979	38.1	3250	63.4	9783	27.7
Total sheep during the year	27,616		2570		5123		35,309	
Current total sheep	22,062		1591		1873		25,526	
Total disposed sheep	5554		979		3250		9783	
No. of households	1228		108		56		1392	

* Percent = Number of disposal/Total number of sheep in flock during the year (including disposal)*100%.

11.11 Milk production

About 4.5% of sheep owning households in Oromiya Regional State use their sheep for milk production. More importantly these households are spread across all AEZs, production systems and livestock density categories. The reported average daily milk off-take was 0.4 litre per ewe (Table 11.11.1) for an average lactation length of 3.6 months (Table

11.11.2). Average milk off-takes and lactation lengths were similar across AEZs, livestock densities and production systems. The average frequency of milking was 1.4 times per day, with little variation between AEZs, livestock densities and production systems (Table 11.11.3).

Table 11.11.4 shows reported average weaning age of sheep. Half of the households reported to wean lambs between 3 and 4 months of age, with another 30% weaning between 5 and 6 months of age. Pastoralists tended to wean lambs earlier than crop–livestock and agro-pastoral farmers.

Male and female lambs were reported to reach sexual maturity on average by about eight months of age. In pastoral areas, however, this was reported to average about 13 months. The ranges of values reported were very wide (Table 11.11.5).

Table 11.11.1. *Reported average milk off-take (litres/day) from sheep by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Average daily milk yield (litres)				
		Mean	Std	Min	Max	Range
Agro-ecological zones						
Dega	70	0.4	0.1	0.20	0.67	0.47
Weinadega	17	0.3	0.1	0.16	0.50	0.34
Kolla	63	0.3	0.2	0.12	1.00	0.88
Overall	150	0.4	0.2	0.12	1.00	0.88
Livestock densities						
Low	24	0.3	0.2	0.12	0.75	0.63
Medium	36	0.4	0.2	0.13	1.00	0.88
High	48	0.4	0.1	0.20	0.67	0.47
Very high	42	0.4	0.1	0.16	0.50	0.34
Overall	150	0.4	0.2	0.12	1.00	0.88
Production systems						
Crop–livestock	98	0.4	0.2	0.12	0.75	0.63
Agro-pastoral	26	0.3	0.2	0.13	1.00	0.88
Pastoral	26	0.3	0.1	0.13	0.50	0.38
Overall	150	0.4	0.2	0.12	1.00	0.88

Table 11.11.2. *Reported average lactation length (months) of sheep by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Average lactation length (months)				
		Mean	Std	Min	Max	Range
Agro-ecological zones						
Dega	68	3.6	1.1	1	6	5
Weinadega	16	3.0	0.9	2	5	3
Kolla	63	3.6	1.4	1	6	5
Overall	147	3.5	1.2	1	6	5
Livestock densities						
Low	24	3.3	1.0	2	6	4
Medium	34	3.7	1.4	1	6	5
High	48	3.2	1.4	1	6	5
Very high	41	3.9	0.8	3	6	3
Overall	147	3.5	1.2	1	6	5
Production systems						
Crop–livestock	95	3.4	1.1	1	6	5
Agro-pastoral	26	4.1	1.5	1	6	5
Pastoral	26	3.5	1.4	1	6	5
Overall	147	3.5	1.2	1	6	5

Table 11.11.3. *Reported frequency of milking per day by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Milking frequency				
		Mean	Std	Min	Max	Range
Agro-ecological zones						
Dega	69	1.1	0.5	1	4	3
Weinadega	17	1.3	0.5	1	2	1
Kolla	62	1.7	0.5	1	2	1
Overall	148	1.4	0.5	1	4	3
Livestock densities						
Low	23	1.5	0.5	1	2	1
Medium	36	1.8	0.5	1	3	2
High	48	1.3	0.4	1	2	1
Very high	41	1.1	0.5	1	4	3
Overall	148	1.4	0.5	1	4	3
Production systems						
Crop–livestock	97	1.3	0.5	1	4	3
Agro-pastoral	26	1.7	0.5	1	2	1
Pastoral	25	1.5	0.5	1	2	1
Overall	148	1.4	0.5	1	4	3

Table 11.11.4. *Reported average weaning age of sheep by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Reported weaning age			
		<3 months	3–4 months	5–6 months	>6 months
Agro-ecological zones					
Dega	354	2.3	46.9	36.4	14.4
Weinadega	839	3.8	48.2	32.1	16.0
Kolla	513	7.2	58.7	22.6	11.5
Overall	1706	4.5	51.1	30.1	14.3
Livestock densities					
Low	221	4.1	56.6	29.4	10.0
Medium	485	3.9	51.5	31.8	12.8
High	592	4.1	42.2	32.3	21.5
Very high	408	6.1	60.3	25.5	8.1
Overall	1706	4.5	51.1	30.1	14.3
Production systems					
Crop–livestock	1510	4.7	48.8	31.5	15.0
Agro-pastoral	131	1.5	65.6	24.4	8.4
Pastoral	65	6.2	73.8	9.2	10.8
Overall	1706	4.5	51.1	30.1	14.3

Table 11.11.5. *Reported average age at sexual maturity (months) of sheep by agro-ecological zones, livestock densities and production systems.*

Categories	Sex	No. of households	Age of sexual maturity (months)				
			Mean	Std	Min	Max	Range
Agro-ecological zones							
Dega	Male	400	8.4	4.6	2.0	60.0	58.0
	Female	04	8.5	4.7	4.0	60.0	56.0
Weinadega	Male	930	7.8	3.8	2.0	68.0	66.0
	Female	936	8.0	3.5	3.0	48.0	45.0
Kolla	Male	546	8.9	5.1	2.0	36.0	34.0
	Female	549	8.8	4.9	3.0	36.0	33.0
Overall	Male	1876	8.2	4.4	2.0	68.0	66.0
	Female	1889	8.3	4.2	3.0	60.0	57.0
Livestock densities							
Low	Male	231	10.0	6.4	3.0	36.0	33.0
	Female	231	9.7	6.3	4.0	36.0	32.0
Medium	Male	551	8.1	3.6	2.0	36.0	34.0
	Female	554	8.2	3.7	3.5	36.0	32.5
High	Male	655	8.3	4.5	2.0	60.0	58.0
	Female	658	8.5	4.6	3.0	60.0	57.0
Very high	Male	439	7.5	3.6	3.0	68.0	65.0
	Female	446	7.5	2.5	3.0	24.0	21.0

cont'd...

Table 11.11.5. cont'd.

Categories	Sex	No. of households	Age of sexual maturity (months)				
			Mean	Std	Min	Max	Range
Overall	Male	1876	8.2	4.4	2.0	68.0	66.0
	Female	1889	8.3	4.2	3.0	60.0	57.0
Production systems							
Crop–livestock	Male	1661	7.9	4.2	2.0	68.0	66.0
	Female	1674	8.0	4.0	3.0	60.0	57.0
Agro-pastoral	Male	146	9.4	4.5	3.0	24.0	21.0
	Female	146	9.5	4.8	3.0	36.0	33.0
Pastoral	Male	69	13.2	6.0	6.0	36.0	30.0
	Female	69	13.1	5.7	6.0	36.0	30.0
Overall	Male	1876	8.2	4.4	2.0	68.0	66.0
	Female	1889	8.3	4.2	3.0	60.0	57.0

11.12 Sheep trait preferences

Farmers' preferences for sheep traits were assessed based on their evaluation of certain sheep traits as 'not important', 'poor', 'average' and 'good'. Over half the households described meat, colour, body size, temperament, growth rate and fertility as 'good' traits (Tables 11.12.1, 11.12.2 and 11.12.3). In contrast, disease tolerance, horns, milk yield and wool were considered less important. Cold tolerance was more frequently considered 'good' in *dega* than in other AEZs. In pastoral areas, fat, meat and body size were particularly highly rated.

The criteria for choosing a breeding ram are summarised in Tables 11.12.4, 11.12.5 and 11.12.6. In general, size, colour, temperament and performance in that order were the main criteria used when choosing a ram for breeding. When the households were asked to identify the most important criteria they use in choosing their breeding ram, this order changes. The overall frequencies show that primary criteria used for the choice of breeding rams are reported as performance and availability of ram (Tables 11.12.7, 11.12.8 and 11.12.9). Temperament, colour and horns were rated less frequently. There are slight variations on primary criteria used for the choice of breeding ram by AEZs, livestock densities and production systems.

Tables 11.12.10, 11.12.11 and 11.12.12 summarise the reported criteria used for disposing of sheep. In general, old age, body size, fertility, poor health and poor performance were the most important reasons for disposing sheep. The reported primary criteria used for the disposal of sheep are also summarised in Tables 11.12.13, 11.12.14 and 11.12.15. In general, old age, performance, health and fertility were more frequently identified as primary criteria for sheep disposal, compared to size, character, body condition and colour. There were some variations in the primary criteria used for disposing of sheep by AEZs, livestock densities and production systems.

Table 11.12.1. *Traits of sheep considered as good by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Meat	667	77.4	1075	70.0	646	75.8	2388	73.5
Coat colour	567	65.8	1036	67.5	632	74.2	2235	68.8
Size	601	69.7	939	61.2	630	73.9	2170	66.8
Temperament	522	60.6	1005	65.5	600	70.4	2127	65.5
Growth rate	532	61.7	791	51.5	570	66.9	1893	58.3
Fertility	483	56.0	703	45.8	530	62.2	1716	52.8
Cold tolerance	492	57.1	652	42.5	328	38.5	1472	45.3
Fat	368	42.7	546	35.6	536	62.9	1450	44.6
Longevity	417	48.4	549	35.8	423	49.6	1389	42.8
Heat tolerance	345	40.0	422	27.5	412	48.4	1179	36.3
Distance	336	39.0	418	27.2	415	48.7	1169	36.0
Drought tolerance	226	26.2	345	22.5	367	43.1	938	28.9
Disease tolerance	170	19.7	243	15.8	231	27.1	644	19.8
Horns	193	22.4	167	10.9	123	14.4	483	14.9
Milk yield	135	15.7	86	5.6	148	17.4	369	11.4
Wool	28	3.2	106	6.9	86	10.1	220	6.8
No. of households	862		1535		852		3249	

* Percent = No. of HHs responding good for a given trait/Total no. of households who rated traits as good*100%.

Table 11.12.2. *Traits of sheep considered as good by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%	No.	%
Meat	327	83.4	760	76.0	798	74.6	503	63.9	2388	73.5
Coat colour	254	64.8	630	63.0	781	73.0	570	72.4	2235	68.8
Size	281	71.7	588	58.8	747	69.8	554	70.4	2170	66.8
Temperament	285	72.7	590	59.0	749	70.0	503	63.9	2127	65.5
Growth rate	258	65.8	522	52.2	617	57.7	496	63.0	1893	58.3
Fertility	230	58.7	461	46.1	532	49.7	493	62.6	1716	52.8
Cold tolerance	166	42.3	371	37.1	536	50.1	399	50.7	1472	45.3
Fat	214	54.6	444	44.4	487	45.5	305	38.8	1450	44.6
Longevity	170	43.4	409	40.9	423	39.5	387	49.2	1389	42.8
Heat tolerance	222	56.6	261	26.1	371	34.7	325	41.3	1179	36.3
Distance	179	45.7	357	35.7	360	33.6	273	34.7	1169	36.0
Drought tolerance	119	30.4	331	33.1	261	24.4	227	28.8	938	28.9
Disease tolerance	59	15.1	192	19.2	223	20.8	170	21.6	644	19.8
Horns	41	10.5	98	9.8	207	19.3	137	17.4	483	14.9
Milk yield	69	17.6	94	9.4	120	11.2	86	10.9	369	11.4
Wool	21	5.4	55	5.5	60	5.6	84	10.7	220	6.8
No. of households	392		1000		1070		787		3249	

*Percent = No. of HHs responding good for a given trait/Total no. of households who rated traits as good*100%.

Table 11.12.3. *Traits of sheep considered as good by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Meat	2058	71.4	191	90.1	139	90.3	2388	73.5
Coat colour	1984	68.8	147	69.3	104	67.5	2235	68.8
Size	1879	65.2	152	71.7	139	90.3	2170	66.8
Temperament	1878	65.1	146	68.9	103	66.9	2127	65.5
Growth rate	1637	56.8	141	66.5	115	74.7	1893	58.3
Fertility	1472	51.1	133	62.7	111	72.1	1716	52.8
Cold tolerance	1320	45.8	97	45.8	55	35.7	1472	45.3
Fat	1159	40.2	147	69.3	144	93.5	1450	44.6
Longevity	1194	41.4	116	54.7	79	51.3	1389	42.8
Heat tolerance	999	34.7	115	54.2	65	42.2	1179	36.3
Distance	992	34.4	97	45.8	80	51.9	1169	36.0
Drought tolerance	733	25.4	119	56.1	86	55.8	938	28.9
Disease tolerance	552	19.1	62	29.2	30	19.5	644	19.8
Horns	421	14.6	40	18.9	22	14.3	483	14.9
Milk yield	272	9.4	40	18.9	57	37.0	369	11.4
Wool	194	6.7	21	9.9	5	3.2	220	6.8
No. of households	2883		212		154		3249	

* Percent = No. of households responding good for a given trait/Total no. of households who rated traits as good*100%.

Table 11.12.4. *Criteria used to choose breeding ram by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Body size	316	96.0	738	92.9	433	91.9	1487	93.3
Colour	283	86.0	629	79.2	321	68.2	1233	77.4
Horns	48	14.6	55	6.9	51	10.8	154	9.7
Temperament	136	41.3	466	58.7	266	56.5	868	54.5
Availability	7	2.1	28	3.5	39	8.3	74	4.6
Performance	179	54.4	406	51.1	259	55.0	844	52.9
No. of households	329		794		471		1594	

* Percent = (No. of households reporting the criterion/Total no. of households that identified the criteria)*100%.

Table 11.12.5. *Criteria used to choose breeding ram by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%	No.	%
Body size	177	93.2	456	92.9	510	90.7	344	98.0	1487	93.3
Colour	113	59.5	346	70.5	465	82.7	309	88.0	1233	77.4
Horns	17	8.9	33	6.7	63	11.2	41	11.7	154	9.7
Temperament	122	64.2	288	58.7	325	57.8	133	37.9	868	54.5
Availability	13	6.8	26	5.3	19	3.4	16	4.6	74	4.6
Performance	117	61.6	285	58.0	263	46.8	179	51.0	844	52.9
No. of households	190		491		562		351		1594	

* Percent = No. of households reporting the criterion/Total no of households that identified the criteria*100%.

Table 11.12.6. *Criteria used to choose breeding ram by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Body size	1316	93.2	115	94.3	56	93.3	1487	93.3
Colour	1116	79.0	86	70.5	31	51.7	1233	77.4
Horns	147	10.4	4	3.3	3	5.0	154	9.7
Temperament	785	55.6	49	40.2	34	56.7	868	54.5
Availability	53	3.8	14	11.5	7	11.7	74	4.6
Performance	711	50.4	94	77.0	39	65.0	844	52.9
No. of households	1412		122		60		1594	

* Percent = No. of households reporting the criterion/Total no. of households that identified the criteria*100%.

Table 11.12.7. *Primary criteria used to choose breeding ram by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Body size	316	59.5	738	51.2	433	59.6	1487	55.4
Colour	283	13.1	629	13.0	321	12.8	1233	13.0
Horns	48	4.2	55	0.0	51	7.8	154	3.9
Temperament	136	9.6	466	18.5	266	5.6	868	13.1
Availability	7	57.1	28	28.6	39	46.2	74	40.5
Performance	179	46.9	406	58.6	259	50.2	844	53.6

* Percent = (Households with primary ranking (of criterion X) relative to households with rankings 1 to 3 of the same criterion)*100%.

Table 11.12.8. *Primary criteria used to choose breeding ram by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%	No.	%
Body size	177	45.2	456	62.9	510	56.1	344	49.7	1487	55.4
Colour	113	9.7	346	9.8	465	15.9	309	13.3	1233	13.0
Horns	17	11.8	33	3.0	63	3.2	41	2.4	154	3.9
Temperament	122	9.8	288	10.1	325	17.2	133	12.8	868	13.1
Availability	13	53.8	26	11.5	19	73.7	16	37.5	74	40.5
Performance	117	65.0	285	47.4	263	49.0	179	62.6	844	53.6

* Percent = (Households with primary ranking (of criterion X) relative to households with rankings 1 to 3 of the same criterion)*100%.

Table 11.12.9. *Primary criteria used to choose breeding ram by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Body size	1316	56.2	115	46.1	56	57.1	1487	55.4
Colour	1116	14.0	86	3.5	31	3.2	1233	13.0
Horns	147	4.1	4	0.0	3	0.0	154	3.9
Temperament	785	14.1	49	6.1	34	0.0	868	13.1
Availability	53	49.1	14	14.3	7	28.6	74	40.5
Performance	711	51.8	94	64.9	39	59.0	844	53.6

* Percent = Households with primary ranking (of criterion X) relative to households with rankings 1 to 3 of the same criterion*100%.

Table 11.12.10. *Criteria used for the disposal of sheep by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Body size	45	36.3	94	33.5	67	48.2	206	37.9
Colour	25	20.2	45	16.0	18	12.9	88	16.2
Character	32	25.8	41	14.6	47	33.8	120	22.1
Health	44	35.5	103	36.7	50	36.0	197	36.2
Body condition	19	15.3	46	16.4	20	14.4	85	15.6
Performance	19	15.3	124	44.1	33	23.7	176	32.4
Old age	92	74.2	132	47.0	89	64.0	313	57.5
Fertility	61	49.2	90	32.0	55	39.6	206	37.9
No. of households	124		281		139		544	

* Percent = No. of households reporting the criterion/Total households that identified criteria for disposal*100%.

Table 11.12.11. *Criteria used for the disposal of sheep by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%	No.	%
Body size	34	59.6	69	41.6	64	28.1	39	41.9	206	37.9
Colour	3	5.3	25	15.1	34	14.9	26	28.0	88	16.2
Character	27	47.4	20	12.0	61	26.8	12	12.9	120	22.1
Health	14	24.6	65	39.2	81	35.5	37	39.8	197	36.2
Body condition	4	7.0	31	18.7	34	14.9	16	17.2	85	15.6
Performance	7	12.3	66	39.8	71	31.1	32	34.4	176	32.4
Old age	49	86.0	83	50.0	130	57.0	51	54.8	313	57.5
Fertility	28	49.1	66	39.8	83	36.4	29	31.2	206	37.9
No. of households	57		166		228		93		544	

* Percent = No. of households reporting the criterion/Total households that identified criteria for disposal*100%.

Table 11.12.12. *Criteria used for the disposal of sheep by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Body size	176	35.4	6	50	24	68.6	206	37.9
Colour	86	17.3	2	16.7	0	0.0	88	16.2
Character	107	21.5	2	16.7	11	31.4	120	22.1
Health	182	36.6	6	50	9	25.7	197	36.2
Body condition	79	15.9	2	16.7	4	11.4	85	15.6
Performance	170	34.2	5	41.7	1	2.9	176	32.4
Old age	281	56.5	2	16.7	30	85.7	313	57.5
Fertility	180	36.2		25	23	65.7	206	37.9
No. of households	497		12		35		544	

* Percent = No. of households reporting the criterion/Total households that identified criteria for disposal*100%.

Table 11.12.13. *Primary criteria used for the disposal of sheep by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Size	45	35.6	94	24.5	67	31.3	206	29.1
Colour	25	20.0	45	22.2	18	11.1	88	19.3
Character	32	12.5	41	29.3	47	25.5	120	23.3
Health	44	20.5	103	52.4	50	22.0	197	37.6
Body condition	19	15.8	46	19.6	20	35.0	85	22.4
Performance	19	31.6	124	52.4	33	54.5	176	50.6
Old age	92	66.3	132	53.0	89	49.4	313	55.9
Fertility	61	24.6	90	37.8	55	43.6	206	35.4
Overall	337	35.3	675	41.0	379	36.7	1391	38.5

* Percent = Households with primary ranking (of criterion X) relative to households with rankings 1 to 3 of the same criterion*100%.

Table 11.12.14. *Primary criteria used for the disposal of sheep by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%	No.	%
Body size	34	8.8	69	26.1	64	40.6	39	33.3	206	60
Colour	3	0.0	25	0.0	34	29.4	26	26.9	88	17
Character	27	40.7	20	5.0	61	24.6	12	8.3	120	28
Health	14	28.6	65	49.2	81	34.6	37	27.0	197	74
Body condition	4	25.0	31	12.9	34	29.4	16	25.0	85	19
Performance	7	57.1	66	43.9	71	54.9	32	53.1	176	89
Old age	49	57.1	83	72.3	130	51.5	51	39.2	313	175
Fertility	28	21.4	66	25.8	83	36.1	29	69.0	206	73
Overall	166	34.3	425	37.9	558	40.3	242	38.0	1391	535

* Percent = Households with primary ranking (of criterion X) relative to households with rankings 1 to 3 of the same criterion*100%.

Table 11.12.15. *Primary criteria used for the disposal of sheep by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
Body size	176	29.5	6	50.0	24	20.8	206	29.1
Colour	86	19.8	2	0.0	0	0.0	88	19.3
Character	107	20.6	2	0.0	11	54.5	120	23.3
Health	182	39.0	6	33.3	9	11.1	197	37.6
Body condition	79	22.8	2	0.0	4	25.0	85	22.4
Performance	170	50.0	5	60.0	1	100.0	176	50.6
Old age	281	56.9	2	50.0	30	46.7	313	55.9
Fertility	180	35.0	3	100.0	23	30.4	206	35.4
Overall	1261	38.7	28	42.9	102	34.3	1391	38.5

* Percent = Households with primary ranking (of criterion X) relative to households with rankings 1 to 3 of the same criterion*100%.

11.13 Sale of sheep

The reported market outlets for selling sheep during the 12 months prior to the survey are shown in Table 11.13.1. Irrespective of the AEZs, livestock densities and production systems, sheep are mostly sold directly into markets and only about one-fifth of the households experienced selling sheep via traders/butchers.

The reported reasons for selling sheep are shown in Table 11.13.2. Irrespective of the AEZs, livestock densities and production systems, sheep are sold mostly for cash. In only 16% of all households were sheep sold for culling/disposal reasons.

Table 11.13.1. *Market outlets for sale of sheep.*

Categories	No. of households	Market		Local/traders	
		No.	%	No.	%
Agro-ecological zones					
Dega	333	330	99.1	82	24.6
Weinadega	744	718	96.5	142	19.1
Kolla	374	350	93.6	77	20.6
Overall	1451	1398	96.3	301	20.7
Livestock densities					
Low	168	162	96.4	31	18.5
Medium	448	442	98.7	128	28.6
High	499	463	92.8	124	24.8
Very high	336	331	98.5	18	5.4
Overall	1451	1398	96.3	301	20.7
Production systems					
Crop–livestock	1302	1254	96.3	263	20.2
Agro-pastoral	102	100	98.0	24	23.5
Pastoral	45	42	93.3	14	31.1
Overall	1449	1396	96.3	301	20.8
Overall reasons of sales	1451	1398	96.3	301	20.7

Table 11.13.2. *Reasons for sale of sheep.*

Categories	No. of households	Cash		Culling/disposal		Both	
		No.	%	No.	%	No.	%
Agro-ecological zones							
Dega	333	330	99.1	60	18.0	57	17.1
Weinadega	751	746	99.3	147	19.6	142	18.9
Kolla	377	373	98.9	28	7.4	24	6.4
Overall	1461	1449	99.2	235	16.1	223	15.3
Livestock densities							
Low	172	171	99.4	15	8.7	14	8.1
Medium	453	448	98.9	88	19.4	83	18.3
High	501	496	99.0	100	20.0	95	19.0
Very high	335	334	99.7	32	9.6	31	9.3
Overall	1451	1449	99.9	235	16.2	223	15.4
Production systems							
Crop–livestock	1312	1301	99.2	219	16.7	208	15.9
Agro-pastoral	102	101	99.0	6	5.9	5	4.9
Pastoral	45	45	100.0	10	22.2	10	22.2
Overall	1459	1447	99.2	228	15.6	223	15.3
Overall reasons for sales	1461	1449	99.2	235	16.1	223	15.3

12 Goat

Data from a total of 3105 goat-owning households with a total current holding of over 28 thousand goats was used for this analysis. All of these households could be identified to particular categories in agro-ecological zones (AEZs) as well as livestock densities. However, only about 60% of these households could be identified by any one of the three production systems. In the same manner, responses on goat mortalities were received from only 1124 households. The subsequent tables thus show different numbers of sample households. Numerous tables accommodate multiple responses to particular questions, and hence the respective percentage values may not add up to 100%.

12.1 Goat ownership

Ownership patterns of goats among family members are shown in Tables 12.1.1, 12.1.2 and 12.1.3. Across AEZs, production systems and livestock density categories, the head of household, the head together with the spouse or the spouse mostly own goats. Other members of the family and other relatives are also reported to own goats.

Table 12.1.1. *Goat ownership by production systems.*

Owners in households	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
	No.	%	No.	%	No.	%	No.	%
Head of household	690	42.4	75	50.7	24	36.4	789	42.8
Spouse	167	10.3	10	6.8	1	1.5	178	9.7
Head and spouse	823	50.5	50	33.8	23	34.8	896	48.6
Son	282	17.3	13	8.8	21	31.8	316	17.1
Daughter	87	5.3	7	4.7	2	3.0	96	5.2
Family	139	8.5	33	22.3	19	28.8	191	10.4
No. of households	1629		148		66		1843	

Table 12.1.2. *Goat ownership by livestock densities.*

Owners in households	Livestock densities									
	Low		Medium		High		Very high		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
Head of household	98	40.3	311	57.1	200	31.3	183	43.5	792	42.8
Spouse	25	10.3	50	9.2	72	11.3	32	7.6	179	9.7
Head and spouse	118	48.6	187	34.3	376	58.8	217	51.5	898	48.6
Son	38	15.6	113	20.7	103	16.1	64	15.2	318	17.2
Daughter	11	4.5	41	7.5	39	6.1	6	1.4	97	5.2
Family	33	13.6	44	8.1	78	12.2	36	8.6	191	10.3
No. of households	243		545		640		421		1849	

Table 12.1.3. *Goat ownership by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Owners in households	No.	%	No.	%	No.	%	No.	%
Head of household	157	40.8	359	40.0	276	48.8	792	42.8
Spouse	54	14.0	73	8.1	52	9.2	179	9.7
Head and spouse	225	58.4	477	53.1	196	34.6	898	48.6
Son	67	17.4	164	18.3	87	15.4	318	17.2
Daughter	14	3.6	59	6.6	24	4.2	97	5.2
Family	28	7.3	64	7.1	99	17.5	191	10.3
No. of households	385		898		566		1849	

12.2 Household activities

Table 12.2 summarises the reported patterns of division of labour in goat husbandry by sex and age of family members by production systems. The marketing (both selling and purchasing) of goats is the responsibility of males and females above 15 years of age. These are also responsible for herding, breeding, caring for sick goats, feeding, milking and handling of dairy products. Young males and females under 15 years of age are also involved in herding, caring for sick, breeding, milking and feeding. In the pastoral system, activities such as herding, milking, breeding, caring for sick goats, feeding and handling dairy products are more frequently performed by males and females under 15 years of age compared to those of the same age groups in other production systems.

12.3 Goat housing

Well over half of the households in the *dega* and *weinadega* AEZs, where mixed crop–livestock agriculture is practised and where livestock density is from medium to very high, keep their goats within the family house (Table 12.3.1). Separate houses, kraal, veranda and yard are also used to house goats. In the pastoral production system only a few proportion of the households use the family house to keep goats during the night, and instead use kraal enclosures (88%).

Tables 12.3.2, 12.3.3 and 12.3.4 show type of materials used for housing goats. Earthen material, thatch grass and bush are used for roofing goat houses. Iron sheet and wood are also used for roofing, but to a much lesser extent. The wall of goat house is mostly built using wood with or without earthen material. The floor is mostly built by stones/bricks followed by wood and earth. Floor making was reported only in crop–livestock system. In the agro-pastoral and pastoral systems, wood is the only material used for making both roof and wall.

Table 12.2. *Division of goat raising activities among age and gender groups by production systems.*

Production systems	No. of households	Male age group				Female age group			
		<15 years old		>15 years old		<15 years old		>15 years old	
		No.	%	No.	%	No.	%	No.	%
Crop–livestock system									
Purchasing	1638	42	2.6	1634	99.8	8	0.5	1590	97.1
Selling	1638	60	3.7	1636	99.9	13	0.8	1634	99.8
Herding	1638	1096	66.9	1630	99.5	529	32.3	1628	99.4
Breeding	1638	435	26.6	1631	99.6	200	12.2	1629	99.5
Caring for sick goats	1638	694	42.4	1633	99.7	376	23.0	1628	99.4
Feeding	1637	245	15.0	1636	99.9	139	8.5	1630	99.6
Milking	1638	36	2.2	1627	99.3	92	5.6	1637	99.9
Making dairy products	1638	6	0.4	1637	99.9	31	1.9	1633	99.7
Selling dairy products	1638	5	0.3	1638	100.0	29	1.8	1636	99.9
Agro-pastoral system									
Purchasing	148	1	0.7	148	100.0	1	0.7	141	95.3
Selling	148	1	0.7	148	100.0	4	2.7	148	100.0
Herding	148	105	70.9	148	100.0	86	58.1	146	98.6
Breeding	148	45	30.4	148	100.0	34	23.0	147	99.3
Caring for sick goats	148	62	41.9	148	100.0	53	35.8	147	99.3
Feeding	148	25	16.9	148	100.0	20	13.5	147	99.3
Milking	148	10	6.8	147	99.3	41	27.7	148	100.0
Making dairy products	148	1	0.7	148	100.0	13	8.8	147	99.3
Selling dairy products	148	2	1.4	148	100.0	14	9.5	148	100.0
Pastoral systems									
Purchasing	66	1	1.5	66	100.0	0	0.0	66	100.0
Selling	66	0	0	66	100.0	0	0.0	66	100.0
Herding	66	60	90.9	66	100.0	50	75.8	65	98.5
Breeding	66	27	40.9	66	100.0	25	37.9	66	100.0
Caring for sick goats	66	24	36.4	66	100.0	26	39.4	66	100.0
Feeding	66	22	33.3	66	100.0	22	33.3	65	98.5
Milking	66	32	48.5	65	98.5	36	54.5	66	100.0
Making dairy products	66	6	9.1	65	8.5	23	34.8	66	100.0
Selling dairy products	66	7	10.6	66	100.0	13	19.7	66	100.0

12.4 Feeding and supplementation

Herded grazing was a common feeding practice followed by non-herded and tethered feeding of goats (Tables 12.4.1, 12.4.2 and 12.4.3). Feeding in stalls or yards and paddock grazing were rare practices. Herded grazing during both wet and dry seasons is much more common in pastoral than in other production systems. Tethered, stall/yard and paddock feeding are not practised in pastoral system.

Table 12.3.1. *Type of goat housing by agro-ecological zones, production systems and livestock densities.*

Categories	No. of households	In family house		Separate house		Veranda		Kraal		Yard		No enclosure		Other	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Agro-ecological zones															
Dega	389	217	55.8	150	38.6	14	3.6	13	3.3	12	3.1	0	0.0	0	0.0
Weinadega	906	553	61.0	304	33.6	30	3.3	32	3.5	26	2.9	0	0.0	0	0.0
Kolla	569	256	45.0	230	40.4	16	2.8	134	23.6	5	0.9	0	0.0	2	0.4
Sub-total	1864	1026	55.0	684	36.7	60	3.2	179	9.6	43	2.3	0	0.0	3	0.2
Production systems															
Crop–livestock	1637	947	57.8	610	37.3	60	3.7	71	4.3	39	2.4	1	0.1	3	0.2
Agro-pastoral	148	71	48.0	41	27.7	0	0.0	49	33.1	4	2.7	0	0.0	0	0.0
Pastoral	66	2	3.0	25	37.9	0	0.0	58	87.9	0	0.0	0	0.0	0	0.0
Sub-total	1851	1020	55.1	676	36.5	60	3.2	178	9.6	43	2.3	1	0.1	3	0.2
Livestock densities															
Low	243	83	34.2	137	56.4	3	1.2	53	21.8	6	2.5	0	0.0	0	0.0
Medium	548	313	57.1	193	35.2	20	3.6	40	7.3	3	0.5	0	0.0	0	0.0
High	648	376	58.0	227	35.0	32	4.9	44	6.8	34	5.2	0	0.0	2	0.3
Very high	425	254	59.8	127	29.9	5	1.2	42	9.9	0	0.0	0	0.0	1	0.2
Sub-total	1864	1026	55.0	684	36.7	60	3.2	179	9.6	0	0.0	0	0.0	3	0.2
Overall housing	1864	1026	55.0	684	36.7	60	3.2	179	9.6	43	2.3	1	0.1	3	0.2

Table 12.3.2. *Types of material used for housing of goat by agro-ecological zones.*

	Agro-ecological zones						Overall	
	Dega		*Weinadega*		*Kolla*			
Housing material	No.	%	No.	%	No.	%	No.	%
Roof								
Iron sheet	42	11.1	180	20.3	77	13.8	299	16.4
Thatch grass/bushes	322	85.0	676	76.4	346	62.2	1344	73.8
Wood	37	9.8	116	13.1	101	18.2	254	14.0
Stone/brick	1	0.3	4	0.5	6	1.1	11	0.6
Earth	336	88.7	821	92.8	514	92.4	1671	91.8
Sub-total	379		885		556		1820	
Wall								
Iron sheet	3	0.8	2	0.2	0	0.0	5	0.3
Grass/bushes	12	3.2	10	1.1	4	0.7	26	1.4
Wood	359	94.7	863	96.7	535	96.4	1757	96.2
Stone/brick	28	7.4	22	2.5	13	2.3	63	3.5
Earth	76	20.1	139	15.6	100	18.0	315	17.3
Sub-total	379		892		555		1826	
Floor								
Iron sheet	3	5.1	0	0.0	0	0.0	3	1.6
Grass/bushes	0	0.0	1	1.4	1	1.9	2	1.1
Wood	3	5.1	29	41.4	35	64.8	67	36.6
Stone/brick	49	83.1	32	45.7	9	16.7	90	49.2
Earth	5	8.5	2	2.9	9	16.7	16	8.7
Concrete	2	3.4	7	10.0	0	0.0	9	4.9
Sub-total	59		70		54		183	

Table 12.3.3. *Types of material used for housing of goat by livestock densities.*

	Livestock densities								Overall	
	Low		Medium		High		Very high			
Type of material	No.	%	No.	%	No.	%	No.	%	No.	%
Roof										
Iron sheet	33	13.9	96	17.5	112	17.9	58	14.2	299	16.4
Grass/bushes	158	66.7	410	74.8	476	76.0	300	73.3	1344	73.8
Wood	27	11.4	88	16.1	51	8.1	88	21.5	254	14.0
Stone/brick	5	2.1	3	0.5	2	0.3	1	0.2	11	0.6
Earth	219	92.4	481	87.8	605	96.6	366	89.5	1671	91.8
Sub-total	237		548		626		409		1820	
Wall										
Iron sheet	0	0.0	2	0.4	0	0.0	3	0.7	5	0.3
Grass/bushes	2	0.8	4	0.7	8	1.3	12	2.9	26	1.4
Wood	236	97.5	532	97.4	597	95.4	392	95.1	1757	96.2
Stone/brick	5	2.1	7	1.3	34	5.4	17	4.1	63	3.5

cont'd...

Table 12.3.3. cont'd.

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Type of material	No.	%	No.	%	No.	%	No.	%	No.	%
Earth	5	2.1	64	11.7	135	21.6	111	26.9	315	17.3
Sub-total	242		546		626		412		1826	
Floor										
Iron sheet	0	0.0	0	0.0	0	0.0	3	5.7	3	1.6
Grass/bushes	1	5.0	0	0.0	1	2.5	0	0.0	2	1.1
Wood	17	85.0	48	68.6	2	5.0	0	0.0	67	36.6
Stone/brick	2	10.0	14	20.0	32	80.0	42	79.2	90	49.2
Earth	1	5.0	0	0.0	7	17.5	8	15.1	16	8.7
Concrete	0	0.0	8	11.4	1	2.5	0	0.0	9	4.9
Sub-total	20		70		40		53		183	

Table 12.3.4. *Types of material used for housing of goat by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Type of material	No.	%	No.	%	No.	%	No.	%
Roof								
Iron sheet	284	17.7	8	5.8	0	0.0	292	16.2
Grass/bushes	1235	77.0	95	68.3	9	13.8	1339	74.1
Wood	223	13.9	11	7.9	14	21.5	248	13.7
Stone/brick	10	0.6	1	0.7	0	0.0	11	0.6
Earth	1456	90.8	139	100.0	65	100.0	1660	91.9
Sub-total	1603		139		65		1807	
Wall								
Iron sheet	5	0.3	0	0.0	0	0.0	5	0.3
Grass/bushes	24	1.5	1	0.7	1	1.6	26	1.4
Wood	1545	96.0	137	98.6	62	96.9	1744	96.2
Stone/brick	61	3.8	1	0.7	1	1.6	63	3.5
Earth	307	19.1	2	1.4	0	0.0	309	17.0
Sub-total	1610		139		64		1813	
Floor								
Iron sheet	3	0.2	0	0.0	0	0.0	3	0.2
Grass/bushes	2	0.1	0	0.0	0	0.0	2	0.1
Wood	65	4.0	2	1.4	0	0.0	67	3.7
Stone/brick	88	5.5	0	0.0	0	0.0	88	4.9
Earth	16	1.0	0	0.0	0	0.0	16	0.9
Concrete	9	0.6	0	0.0	0	0.0	9	0.5
Sub-total	179		2		0		181	

Table 12.4.1 *Grazing and feeding practices by season, grazing/feeding type and agro-ecological zones.*

Grazing season and grazing type	Agro-ecological zones						Overall	
	Dega		*Weinadega*		*Kolla*			
	No.	%	No.	%	No.	%	No.	%
Dry								
Unherded	112	28.8	344	38.0	144	25.3	600	32.2
Herded	290	74.6	550	60.8	426	74.7	1266	67.9
Paddock	6	1.5	3	0.3	12	2.1	21	1.1
Tethered	13	3.3	63	7.0	10	1.8	86	4.6
Stall/yard	6	1.5	4	0.4	11	1.9	21	1.1
No. of households	389		905		570		1864	
Wet								
Unherded	23	5.9	60	6.7	66	11.6	149	8.0
Herded	348	89.7	763	84.6	493	86.8	1604	86.3
Paddock	15	3.9	20	2.2	10	1.8	45	2.4
Tethered	36	9.3	201	22.3	24	4.2	261	14.0
Stall/yard	6	1.5	7	0.8	12	2.1	25	1.3
No. of households	388		902		568		1858	

Table 12.4.2. *Grazing and feeding practices by season, grazing/feeding type and livestock densities.*

Grazing season and grazing type	Livestock densities								Overall	
	Low		Medium		High		Very high			
	No.	%	No.	%	No.	%	No.	%	No.	%
Dry										
Unherded	64	26.2	212	38.7	190	29.3	134	31.6	600	32.2
Herded	182	74.6	334	60.9	463	71.5	287	67.7	1266	67.9
Paddock	9	3.7	4	0.7	6	0.9	2	0.5	21	1.1
Tethered	4	1.6	20	3.6	35	5.4	27	6.4	86	4.6
Stall/yard	5	2.0	0	0.0	6	0.9	10	2.4	21	1.1
Sub-total	244		548		648		424		1864	
Wet										
Unherded	25	10.3	73	13.4	42	6.5	9	2.1	149	8.0
Herded	218	89.7	427	78.2	561	87.1	398	93.6	1604	86.3
Paddock	7	2.9	4	0.7	28	4.3	6	1.4	45	2.4
Tethered	15	6.2	86	15.8	87	13.5	73	17.2	261	14.0
Stall/yard	3	1.2	2	0.4	3	0.5	17	4.0	25	1.3
Sub-total	243		546		644		425		1858	

Table 12.4.3. *Grazing and feeding practices by season, grazing/feeding type and production systems.*

Grazing season and grazing type	Production systems						Overall	
	Crop–livestock		Agro-pastoral		Pastoral			
	No.	%	No.	%	No.	%	No.	%
Dry								
Unherded	546	33.4	50	33.8	1	1.5	597	32.3
Herded	1089	66.5	102	68.9	65	98.5	1256	67.9
Paddock	16	1.0	4	2.7	0	0.0	20	1.1
Tethered	82	5.0	1	0.7	1	1.5	84	4.5
Stall/yard	21	1.3	0	0.0	0	0.0	21	1.1
Sub-total	1637		148		66		1851	
Wet								
Unherded	112	6.9	33	22.3	2	3.1	147	8.0
Herded	1417	86.8	114	77.0	63	96.9	1594	86.4
Paddock	41	2.5	3	2.0	0	0.0	44	2.4
Tethered	251	15.4	6	4.1	1	1.5	258	14.0
Stall/yard	24	1.5	1	0.7	0	0	25	1.4
Sub-total	1632		148		65		1845	

Tables 12.4.4, 12.4.5 and 12.4.6 show supplementation given to goats by season. Goats are supplemented with minerals and vitamins, roughage/crop residues and concentrates in that order. In general, roughage/crop residue supplementation is higher during the dry than during the wet season. In contrast, mineral/vitamins supplementation is more frequent during the wet than during the dry season. Higher proportions of the households in low and medium livestock densities have supplemented minerals/vitamins during wet seasons than households in high and very high livestock densities. Concentrate supplementation of goats is not practised in the pastoral production system; instead they supplement them with minerals and crop residues.

Adult female goats are reportedly better supplemented than adult males or young goats across AEZs, livestock densities or production systems (Tables 12.4.7, 12.4.8 and 12.4.9). Except in the pastoral production system, where more adult male goats are ranked first to receive feed supplements, adult female goats generally receive priority for feed supplementation (Tables 12.4.10, 12.4.11 and 12.4.12).

Table 12.4.4. *Households supplementing goats with different feeds by season and agro-ecological zones.*

	Agro-ecological zones					
	Dega		*Weinadega*		*Kolla*	
Season and type of supplements	No.	%	No.	%	No.	%
Dry						
Roughage/residue	118	36.4	368	48.9	208	47.7
Minerals/vitamins	288	88.9	626	83.2	322	73.9
Concentrates	25	7.7	47	6.3	18	4.1
No. of households	324		752		436	
Wet						
Roughage/residue	102	32.4	314	41.5	117	24.7
Minerals/vitamins	289	91.7	720	95.2	449	94.7
Concentrates	18	5.7	36	4.8	7	1.5
No. of households	315		756		474	

Table 12.4.5. *Households supplementing goats with different feeds by season and livestock densities.*

	Livestock densities							
	Low		Medium		High		Very high	
Season and type of supplements	No.	%	No.	%	No.	%	No.	%
Dry								
Roughage/residues	85	42.3	196	41.1	248	43.7	165	62.0
Minerals/vitamins	172	85.6	426	89.3	467	82.2	171	64.3
Concentrates	4	2.0	33	6.9	36	6.3	17	6.4
No. of households	201		477		568		266	
Wet								
Roughage/residue	47	21.2	169	34.9	200	34.8	117	44.3
Minerals/vitamins	217	97.7	467	96.5	539	93.7	235	89.0
Concentrates	4	1.8	27	5.6	21	3.7	9	3.4
No. of households	222		484		575		264	

Table 12.4.6. *Households supplementing goats with different feeds by season and production systems.*

	Production systems					
	Crop–livestock		Agro-pastoral		Pastoral	
Season and type of supplements	No.	%	No.	%	No.	%
Dry						
Roughage/residue	649	48.2	36	35.3	2	3.8
Minerals/vitamins	1095	81.3	81	79.4	51	98.1
Concentrates	82	6.1	3	2.9	0	0.0
No. of households	1347		102		52	
Wet						
Roughage/residue	484	36.1	43	33.3	1	1.6
Minerals/vitamins	1264	94.2	121	93.8	61	98.4
Concentrates	54	4.0	2	1.6	0	0.0
No. of households	1342		129		62	

Table 12.4.7. *Supplementation by type of animal and agro-ecological zones.*

Supplemented goat type	Agro-ecological zones						Overall	
	Dega		*Weinadega*		*Kolla*			
	No.	%	No.	%	No.	%	No.	%
Adult male	284	93.1	671	96.0	429	96.4	1384	95.5
Adult female	286	93.8	691	98.9	437	98.2	1414	97.6
Young animals	265	86.9	611	87.4	379	85.2	1255	86.6
No. of households	305		699		445		1449	

Table 12.4.8. *Supplementation by type of animal and livestock densities.*

Supplemented goat type	Livestock densities								Overall	
	Low		Medium		High		Very high			
	No.	%	No.	%	No.	%	No.	%	No.	%
Adult male	186	95.4	426	95.7	514	95.0	258	96.3	1384	95.5
Adult female	189	96.9	441	99.1	523	96.7	261	97.4	1414	97.6
Young animals	179	91.8	395	88.8	451	83.4	230	85.8	1255	86.6
No. of households	195		445		541		268		1449	

Table 12.4.9. *Supplementation by type of animal and production systems.*

Supplemented goat type	Production systems						Overall	
	Crop–livestock		Agro-pastoral		Pastoral			
	No.	%	No.	%	No.	%	No.	%
Adult male	1188	95.3	127	96.9	59	96.7	1374	95.5
Adult female	1214	97.4	131	100.0	59	96.7	1404	97.6
Young animals	1083	86.8	113	86.3	52	85.2	1248	86.7
No. of households	1247		131		61		1439	

Table 12.4.10. *Type of goat ranked as no. 1 for supplementation by agro-ecological zones.*

Supplemented goat type	Agro-ecological zones						Overall	
	Dega		*Weinadega*		*Kolla*			
	No.	%	No.	%	No.	%	No.	%
Adult male	124	40.7	239	34.2	174	39.1	537	37.1
Adult female	153	50.2	433	61.9	245	55.1	831	57.3
Young animals	38	12.5	74	10.6	52	11.7	164	11.3
No. of households	305		699		445		1449	

Table 12.4.11. *Type of goat ranked as no. 1 for supplementation by livestock densities.*

Supplemented goat type	Livestock densities								Overall	
	Low		Medium		High		Very high			
	No.	%	No.	%	No.	%	No.	%	No.	%
Adult male	78	40.0	131	29.4	218	40.3	110	41.0	537	37.1
Adult female	100	51.3	306	68.8	275	50.8	150	56.0	831	57.3
Young animals	22	11.3	58	13.0	52	9.6	32	11.9	164	11.3
No. of households	195		445		541		268		1449	

Table 12.4.12. *Type of goat ranked as no. 1 for supplementation by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Supplemented goat type	No.	%	No.	%	No.	%	No.	%
Adult male	432	34.6	63	48.1	39	63.9	534	37.1
Adult female	720	57.7	78	59.5	26	42.6	824	57.3
Young animals	116	9.3	37	28.2	11	18.0	164	11.4
No. of households	1247		131		61		1439	

12.5 Watering

In general terms, during both wet and dry seasons rivers are the most important sources of water followed by spring, rain and dam, except for pastoral and agro-pastoral production systems during the wet season when dams and rains are more important sources of water for goats (Tables 12.5.1, 12.5.2 and 12.5.3). By AEZs, river is more important in *dega* than in *kolla* whereas dam is more important water source in *kolla* than in *weinadega* and *dega* AEZs. Likewise, bore wells are important sources of water in low livestock density and pastoral areas, especially during the dry season.

The reported average distance to the nearest watering point (Tables 12.5.4, 12.5.5 and 12.5.6) was less than a kilometre for two-thirds of the households during wet season but this falls to about one-third in the *kolla* AEZ, or even to only 8% in pastoral system during the dry season. Irrespective of the season, greater proportion of households in areas of low livestock density travel longer distances than households in areas with medium to very high livestock densities, indicating that water availability may be one factor determining livestock density. During dry season, about 43% of the households in pastoral areas have to travel to more than 10 km and another 28% to 6–10 km to reach to the nearest watering point.

The reported quality of water used for goats by season, AEZs and livestock densities is summarised in Tables 12.5.7, 12.5.8 and 12.5.9. In general, during the rainy season, most of the households fetch muddy water and only about 47% have access to good quality water. During the dry season, 85% of the households have access to good quality water. During the rainy season, 59% of the households in *dega* AEZ have more access to good quality water than households in *weinadega* (45%) and *kolla* (41%) AEZs. Smelly water was more frequently reported in the *kolla* AEZ where livestock use common watering points.

Table 12.5.1. *Source of water for goat by season and agro-ecological zones.*

	Agro-ecological zones						Overall	
	Dega		*Weinadega*		*Kolla*			
Season and source of water	No.	%	No.	%	No.	%	No.	%
Dry								
Borehole/well	11	2.8	81	9.4	138	24.6	230	12.7
Dam/pond	22	5.7	22	2.5	77	13.7	121	6.7
River	317	81.9	585	67.6	266	47.3	1168	64.4
Spring	69	17.8	182	21.0	112	19.9	363	20.0
Piped	7	1.8	46	5.3	45	8.0	98	5.4
Rain	4	1.0	6	0.7	1	0.2	11	0.6
No. of households	387		866		562		1815	
Wet								
Borehole/well	13	3.5	27	3.2	58	10.9	98	5.6
Dam/pond	12	3.2	66	7.8	189	35.6	267	15.3
River	238	64.3	502	59.6	177	33.3	917	52.6
Spring	59	15.9	153	18.2	85	16.0	297	17.0
Piped	7	1.9	14	1.7	23	4.3	44	2.5
Rain	123	33.2	218	25.9	211	39.7	552	31.7
No. of households	370		842		531		1743	

Table 12.5.2. *Source of water for goat by season and livestock densities.*

	Livestock densities								Overall	
	Low		Medium		High		Very high			
Season and source of water	No.	%	No.	%	No.	%	No.	%	No.	%
Dry										
Borehole/well	78	33.3	85	15.6	44	6.8	23	5.9	230	12.7
Dam/pond	12	5.1	29	5.3	63	9.8	17	4.3	121	6.7
River	109	46.6	370	67.8	438	68.0	251	64.2	1168	64.4
Spring	54	23.1	74	13.6	149	23.1	86	22.0	363	20.0
Piped	16	6.8	15	2.7	26	4.0	41	10.5	98	5.4
Rain	1	0.4	2	0.4	3	0.5	5	1.3	11	0.6
No. of households	234		546		644		391		1815	
Wet										
Borehole/well	33	15.1	25	5.0	25	4.0	15	3.7	98	5.6
Dam/pond	66	30.3	50	9.9	81	13.1	70	17.4	267	15.3
River	91	41.7	327	65.0	377	60.8	122	30.3	917	52.6
Spring	45	20.6	64	12.7	122	19.7	66	16.4	297	17.0
Piped	11	5.0	5	1.0	9	1.5	19	4.7	44	2.5
Rain	68	31.2	106	21.1	192	31.0	186	46.3	552	31.7
No. of households	218		503		620		402		1743	

Table 12.5.3. *Source of water for goats by season and production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Season and source of water	No.	%	No.	%	No.	%	No.	%
Dry								
Borehole/well	129	8.0	43	33.3	57	87.7	229	12.7
Dam/pond	70	4.4	34	26.4	15	23.1	119	6.6
River	1106	68.8	43	33.3	15	23.1	1164	64.6
Spring	347	21.6	13	10.1	0	0.0	360	20.0
Piped	66	4.1	16	12.4	11	16.9	93	5.2
Rain	9	0.6	2	1.6	0	0.0	11	0.6
No. of households	1608		129		65		1802	
Wet								
Borehole/well	76	4.9	7	6.1	14	25.5	97	5.6
Dam/pond	148	9.5	64	55.7	53	96.4	265	15.3
River	884	56.7	21	18.3	8	14.5	913	52.8
Spring	287	18.4	7	6.1	0	0.0	294	17.0
Piped	37	2.4	4	3.5	0	0.0	41	2.4
Rain	463	29.7	53	46.1	32	58.2	548	31.7
No. of households	1560		115		55		1730	

Table 12.5.4. *Distance to the nearest watering point for goats by season and agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Season and distance of water	No.	%	No.	%	No.	%	No.	%
Dry								
At home	18	4.7	76	8.6	62	10.9	156	8.5
<1 km	235	60.7	531	60.3	195	34.4	961	52.4
1–5 km	129	33.3	258	29.3	188	33.2	575	31.3
6–10 km	14	3.6	36	4.1	59	10.4	109	5.9
>10 km	1	0.3	10	1.1	97	17.1	108	5.9
No. of households	387		881		567		1835	
Wet								
At home	32	9.3	92	10.9	55	10.3	179	10.4
<1 km	240	70.0	567	67.3	324	60.8	1131	65.8
1–5 km	75	21.9	190	22.6	150	28.1	415	24.2
6–10 km	6	1.7	18	2.1	17	3.2	41	2.4
>10 km	1	0.3	3	0.4	12	2.3	16	0.9
No. of households	343		842		533		1718	

Table 12.5.5. *Distance to the nearest watering point for goats by season and livestock densities.*

Season and distance of water	Livestock densities								Overall	
	Low		Medium		High		Very high			
	No.	%	No.	%	No.	%	No.	%	No.	%
Dry										
At home	32	13.3	45	8.2	53	8.2	26	6.5	156	8.5
<1 km	98	40.8	340	62.2	346	53.6	177	44.0	961	52.4
1–5 km	72	30.0	149	27.2	212	32.8	142	35.3	575	31.3
6–10 km	26	10.8	17	3.1	36	5.6	30	7.5	109	5.9
>10 km	30	12.5	22	4.0	26	4.0	30	7.5	108	5.9
No. of households	240		547		646		402		1835	
Wet										
At home	18	8.2	56	11.0	49	8.1	56	14.5	179	10.4
<1 km	122	55.7	360	70.9	391	64.6	258	66.8	1131	65.8
1–5 km	73	33.3	97	19.1	167	27.6	78	20.2	415	24.2
6–10 km	5	2.3	12	2.4	11	1.8	13	3.4	41	2.4
>10 km	5	2.3	3	0.6	3	0.5	5	1.3	16	0.9
No. of households	219		508		605		386		1718	

Table 12.5.6. *Distance to the nearest watering point for goats by season and production systems.*

Season and distance of water	Production systems						Overall	
	Crop–livestock		Agro-pastoralist		Pastoralist			
	No.	%	No.	%	No.	%	No.	%
Dry								
At home	119	7.3	20	15.6	13	20.0	152	8.3
<1 km	917	56.3	32	25.0	5	7.7	954	52.4
1–5 km	520	31.9	39	30.5	14	21.5	573	31.4
6–10 km	77	4.7	14	10.9	18	27.7	109	6.0
>10 km	43	2.6	36	28.1	28	43.1	107	5.9
No. of households	1629		128		65		1822	
Wet								
At home	167	10.9	4	3.4	2	3.7	173	10.1
<1 km	1019	66.5	69	58.5	36	66.7	1124	65.9
1–5 km	367	23.9	32	27.1	15	27.8	414	24.3
6–10 km	28	1.8	12	10.2	1	1.9	41	2.4
>10 km	8	0.5	5	4.2	2	3.7	15	0.9
No. of households	1533		118		54		1705	

Table 12.5.7. *Quality of water offered to goats by season and agro-ecological zones.*

Season and quality of water	Agro-ecological zones						Overall	
	Dega		*Weinadega*		*Kolla*			
	No.	%	No.	%	No.	%	No.	%
Dry								
Good/clear	327	84.7	778	87.8	453	80.0	1558	84.8
Muddy	59	15.3	113	12.8	92	16.3	264	14.4
Salty	0	0.0	3	0.3	23	4.1	26	1.4
Smelly	22	5.7	33	3.7	48	8.5	103	5.6
No. of households	386		886		566		1838	
Wet								
Good/clear	213	59.3	392	45.1	225	41.3	830	46.8
Muddy	170	47.4	504	57.9	341	62.6	1015	57.2
Salty	0	0.0	5	0.6	6	1.1	11	0.6
Smelly	12	3.3	26	3.0	40	7.3	78	4.4
No. of households	359		870		545		1774	

Table 12.5.8. *Quality of water offered to goats by season and livestock densities.*

Season and quality of water	Livestock densities								Overall	
	Low		Medium		High		Very high			
	No.	%	No.	%	No.	%	No.	%	No.	%
Dry										
Good/clear	227	94.6	437	79.9	534	82.4	360	89.3	1558	84.8
Muddy	13	5.4	99	18.1	119	18.4	33	8.2	264	14.4
Salty	6	2.5	3	0.5	14	2.2	3	0.7	26	1.4
Smelly	6	2.5	30	5.5	34	5.2	33	8.2	103	5.6
No. of households	240		547		648		403		1838	
Wet										
Good/clear	112	48.5	245	47.8	302	47.8	171	43.0	830	46.8
Muddy	136	58.9	283	55.2	366	57.9	230	57.8	1015	57.2
Salty	5	2.2	2	0.4	1	0.2	3	0.8	11	0.6
Smelly	40	17.3	12	2.3	13	2.1	13	3.3	78	4.4
No. of households	231		513		632		398		1774	

Table 12.5.9. *Quality of water offered to goats by season and production systems.*

Season and quality of water	Production systems						Overall	
	Crop–livestock		Agro-pastoral		Pastoral			
	No.	%	No.	%	No.	%	No.	%
Dry								
Good/clear	1392	85.3	103	79.8	53	81.5	1548	84.8
Muddy	236	14.5	13	10.1	12	18.5	261	14.3
Salty	3	0.2	8	6.2	15	23.1	26	1.4
Smelly	74	4.5	17	13.2	12	18.5	103	5.6
No. of households	1631		129		65		1825	
Wet								
Good/clear	791	49.7	24	20.9	8	15.1	823	46.7
Muddy	869	54.6	95	82.6	45	84.9	1009	57.3
Salty	7	0.4	2	1.7	2	3.8	11	0.6
Smelly	36	2.3	28	24.3	14	26.4	78	4.4
No. of households	1593		115		53		1761	

12.6 Reproduction

Tables 12.6.1, 12.6.2 and 12.6.3 summarise the reported levels of controlled mating in sample goat flocks. In general, a larger proportion of the communities do not determine matings, and use available breeding bucks for mating their does. A larger proportion of the households do not control mating of their goats, particularly in the *dega* AEZ, in areas where the livestock density is very high and in crop–livestock as well as in agro-pastoral production systems. In pastoral areas and where the livestock density is low, but where flock sizes are much higher, more households use selected breeding bucks in their flocks.

Across AEZs, production systems and livestock density categories, about three-quarters of the sample households had used their own homebred bucks for breeding within the previous 12 months. The next important sources of bucks were flocks of their neighbours and local markets as farmers decide to use purchased bucks (Tables 12.6.4, 12.6.5 and 12.6.6). Particularly in pastoral areas, up to 89% of households used their own bucks for breeding. But these figures do not relate to whether breeding bucks used for mating were actively selected in the communities.

Kids were born in every month of the year across AEZs, production systems and livestock density categories, but more frequent kiddings were reported for the months of August through November, which are the months following the main rains in most of the Oromiya Regional State. For pastoral areas, the months of February through April see a slightly more frequent kiddings (Tables 12.6.7, 12.6.8 and 12.6.9).

Goats are habitually castrated throughout the region, but the practice appears to be even more frequent in pastoral areas than in crop–livestock systems (Table 12.6.10). Castration is mostly practised after six months of age consistently across the agro-ecological zones, livestock densities and production systems (Table 12.6.11). The

reported reasons for castrating goats are primarily to increase meat quality and to earn better prices on sale. Castration as a measure of control over matings was rated as less important. The other notable reason for castration of goats was improved temperament of the buck (Tables 12.6.12, 12.6.13 and 12.6.14).

Male and female kids were reported to reach sexual maturity on average by about eight months of age. In pastoral areas, however, this was reported to average about 14 months. The ranges of values reported were very wide (Table 12.6.15). The reported age at first parturition (Table 12.6.16) was about 14 months. In pastoral areas, however, this was reported to average about 20 months. The ranges of values reported were very wide. Kidding interval was reported to be about nine months (Table 12.6.17). This was shorter in goats of pastoral system than in agro-pastoral and crop–livestock systems.

Fertility rates calculated from the reported number of lambs born over the last 12 months are summarised in Table 12.6.18. It appears that goats are reportedly more fertile in the *dega* than in the *weinadega* or *kolla* AEZs. Similarly, higher average fertility was calculated for the crop–livestock production system compared to those of the agro-pastoral and pastoral systems. However, the reported kiddings may be influenced by the time of data collection, as farmers are more likely to recall births in more recent months than those that happened in distant past months. The overall fertility rate was close to 64%.

Table 12.6.1. *Reported level of control over mating goats by agro-ecological zones.*

	Agro-ecological zones					
	Dega		*Weinadega*		*Kolla*	
Control mating?	No.	%	No.	%	No.	%
Yes	9	8.4	76	38.4	77	43.8
No	98	91.6	122	61.6	99	56.3
No. of households	107		198		176	

Table 12.6.2. *Reported level of control over mating goats by livestock densities.*

	Livestock densities							
	Low		Medium		High		Very high	
Control mating?	No.	%	No.	%	No.	%	No.	%
Yes	25	80.6	29	40.8	74	35.1	34	20.2
No	6	19.4	42	59.2	137	64.9	134	79.8
No. of households	31		71		211		168	

Table 12.6.3. *Reported level of control over mating goats by production systems.*

	Production systems					
	Crop–livestock		Agro-pastoral		Pastoral	
Control mating?	No.	%	No.	%	No.	%
Yes	140	34.0	15	26.3	6	85.7
No	272	66.0	42	73.7	1	14.3
No. of households	412		57		7	

Table 12.6.4. *Reported source of breeding buck used during the last 12 months by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Source of buck	No.	%	No.	%	No.	%	No.	%
Home-bred	286	77.1	651	74.7	387	71.9	1324	74.3
Bought	54	14.6	132	15.1	92	17.1	278	15.6
Donated	3	0.8	4	0.5	4	0.7	11	0.6
Borrowed	9	2.4	21	2.4	8	1.5	38	2.1
Neighbour	135	36.4	278	31.9	97	18.0	510	28.6
Communal	115	4.0	45	5.2	18	3.3	178	4.4
Unknown	35	9.4	59	6.8	22	4.1	116	6.5
No. of households	371		872		538		1781	

Table 12.6.5 *Reported source of breeding buck used during the last 12 months by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Source of buck	No.	%	No.	%	No.	%	No.	%	No.	%
Home-bred	183	77.2	378	71.1	469	74.6	294	76.8	1324	74.3
Bought	32	13.5	79	14.8	115	18.3	52	13.6	278	15.6
Donated	1	0.4	4	0.8	3	0.5	3	0.8	11	0.6
Borrowed	3	1.3	16	3.0	3	0.5	16	4.2	38	2.1
Neighbour	38	16.0	136	25.6	178	28.3	158	41.3	510	28.6
Communal	15	6.3	26	4.9	13	2.1	24	6.3	78	4.4
Unknown			16	3.0	54	8.6	46	12.0	116	6.5
No. of households	237		532		629		383		1781	

Table 12.6.6. *Reported source of breeding buck used during the last 12 months by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Source of buck	No.	%	No.	%	No.	%	No.	%
Home-bred	1132	72.6	126	87.5	55	88.7	1313	74.4
Bought	259	16.6	15	10.4	3	4.8	277	15.7
Donated	8	0.5	1	0.7	2	3.2	11	0.6
Borrowed	32	2.1	3	2.1	2	3.2	37	2.1
Neighbour	477	30.6	22	15.3	4	6.5	503	28.5
Communal	68	4.4	3	2.1	7	11.3	78	4.4
Unknown	114	7.3	2	1.4	0	0.0	116	6.6
No. of households	1559		144		62		1765	

Table 12.6.7. *Distribution of reported kiddings by month and agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Kidding month	No.	%	No.	%	No.	%	No.	%
January	54	15.7	154	19.5	97	19.1	305	18.6
February	49	14.2	151	19.2	89	17.6	289	17.6
March	82	23.8	162	20.6	142	28.0	386	23.5
April	84	24.3	163	20.7	150	29.6	397	24.2
May	70	20.3	115	14.6	102	20.1	287	17.5
June	94	27.2	236	29.9	118	23.3	448	27.3
July	50	14.5	208	26.4	135	26.6	393	24.0
August	74	21.4	233	29.6	166	32.7	473	28.8
September	128	37.1	310	39.3	197	38.9	635	38.7
October	115	33.3	258	32.7	168	33.1	541	33.0
November	119	34.5	208	26.4	135	26.6	462	28.2
December	101	29.3	143	18.1	74	14.6	318	19.4
No. of households	345		788		507		1640	

Table 12.6.8. *Distribution of reported kiddings by month and livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Kidding month	No.	%	No.	%	No.	%	No.	%	No.	%
January	47	21.8	100	20.8	106	18.7	52	13.8	305	18.6
February	47	21.8	90	18.8	92	16.2	60	15.9	289	17.6
March	74	34.3	95	19.8	138	24.3	79	21.0	386	23.5
April	72	33.3	121	25.2	129	22.8	75	19.9	397	24.2
May	39	18.1	69	14.4	121	21.3	58	15.4	287	17.5
June	48	22.2	104	21.7	168	29.6	128	34.0	448	27.3
July	45	20.8	101	21.0	117	20.6	130	34.5	393	24.0
August	55	25.5	113	23.5	146	25.7	159	42.2	473	28.8
September	78	36.1	226	47.1	195	34.4	136	36.1	635	38.7
October	52	24.1	187	39.0	193	34.0	109	28.9	541	33.0
November	58	26.9	158	32.9	150	26.5	96	25.5	462	28.2
December	24	11.1	90	18.8	137	24.2	67	17.8	318	19.4
No. of households	216		480		567		377		1640	

Table 12.6.9. *Distribution of reported kiddings by month and production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Kidding month	No.	%	No.	%	No.	%	No.	%
January	258	18.2	27	19.1	15	23.1	300	18.5
February	228	16.1	34	24.1	22	33.8	284	17.5
March	313	22.0	45	31.9	24	36.9	382	23.5
April	329	23.2	44	31.2	21	32.3	394	24.2
May	245	17.3	23	16.3	17	26.2	285	17.5
June	400	28.2	27	19.1	18	27.7	445	27.4
July	337	23.7	31	22.0	21	32.3	389	23.9
August	396	27.9	52	36.9	21	32.3	469	28.8
September	551	38.8	55	39.0	23	35.4	629	38.7
October	489	34.4	31	22.0	20	30.8	540	33.2
November	424	29.9	26	18.4	11	16.9	461	28.4
December	291	20.5	20	14.2	4	6.2	315	19.4
No. of households	1420		141		65		1626	

Table 12.6.10. *Frequency of households practising goat castration by agro-ecological zones, livestock densities and production systems.*

	Castration	
Categories	No.	%
Agro-ecological zones		
Dega	305	81.3
Weinadega	638	75.2
Kolla	406	74.4
Sub-total	1349	76.3
Livestock densities		
Low	147	62.3
Medium	421	80.5
High	476	76.7
Very high	305	78.4
Sub-total	1349	76.3
Production systems		
Crop–livestock	1167	75.0
Agro-pastoral	114	82.6
Pastoralist	54	90.0
Sub-total	1335	76.2

Table 12.6.11. *Reported age for goat castration by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	<3 months		3–6 months		>6 months	
		No.	%	No.	%	No.	%
Agro-ecological zones							
Dega	304	1	0.3	8	2.6	295	97.0
Weinadega	639	2	0.3	10	1.6	627	98.1
Kolla	405	7	1.7	22	5.4	382	94.3
Overall	1348	10	0.7	40	3.0	1304	96.7
Livestock densities							
Low	145	2	1.4	3	2.1	141	97.2
Medium	414	2	0.5	6	1.4	406	98.1
High	477	2	0.4	10	2.1	465	97.5
Very high	312	4	1.3	21	6.7	292	93.6
Overall	1348	10	0.7	40	3.0	1304	96.7
Production systems							
Crop–livestock	1169	8	0.7	37	3.2	1130	96.7
Agro-pastoral	112	1	0.9	3	2.7	108	96.4
Pastoral	52	1	1.9			51	98.1
Overall	1333	10	0.8	40	3.0	1289	96.7

Table 12.6.12. *Reported reasons for goat castration by agro-ecological zones.*

Reason for castration	Agro-ecological zones					
	Dega		*Weinadega*		*Kolla*	
	No.	%	No.	%	No.	%
Control breeding	115	37.3	242	37.5	191	46.7
Improve meat quality	284	92.2	627	97.1	374	91.4
Better temperament	214	69.5	365	56.5	201	49.1
Better price	296	96.1	612	94.7	367	89.7
Others	3	1.0	1	0.2	2	0.5
No. of households	308		646		409	

Table 12.6.13. *Reported reasons for goat castration by livestock densities.*

Reason for castration	Livestock densities							
	Low		Medium		High		Very high	
	No.	%	No.	%	No.	%	No.	%
Control breeding	82	55.8	150	35.6	224	46.4	92	29.5
Improve meat quality	144	98.0	396	94.1	458	94.8	287	92.0
Better temperament	82	55.8	241	57.2	289	59.8	168	53.8
Better price	125	85.0	396	94.1	448	92.8	306	98.1
Others	2	1.4	1	0.2	2	0.4	1	0.3
No. of households	147		421		483		312	

Table 12.6.14. *Reported reasons for goat castration by production systems.*

	Production systems					
	Crop–livestock		Agro-pastoral		Pastoral	
Reason for castration	No.	%	No.	%	No.	%
Control breeding	440	37.3	62	53.9	37	68.5
Improve meat quality	1104	93.6	113	98.3	54	100.0
Better temperament	701	59.5	52	45.2	15	27.8
Better price	1100	93.3	110	95.7	50	92.6
Others	6	0.5	0	0.0	0	0.0
No. of households	1179		115		54	

Table 12.6.15. *Average age at sexual maturity (in months) of goat across different categories.*

			Age of sexual maturity				
Categories	Sex	No. of households	Mean	Std	Min	Max	Range
Agro-ecological zones							
Dega	Male	389	7.8	3.6	3	24	21
	Female	392	7.6	3.6	3	26	23
Weinadega	Male	896	7.5	3.1	3	36	33
	Female	919	7.5	3.3	3	36	33
Kolla	Male	582	9.8	5.9	3	36	33
	Female	589	9.7	5.6	3	36	33
Overall	Male	1867	8.3	4.4	3	36	33
	Female	1900	8.2	4.3	3	36	33
Livestock densities							
Low	Male	246	10.5	6.9	4	36	32
	Female	249	10.0	6.7	3	36	33
Medium	Male	550	8.0	3.8	3	36	33
	Female	554	7.9	3.9	3	36	33
High	Male	647	8.4	4.4	3	36	33
	Female	655	8.3	4.3	3	36	33
Very high	Male	424	7.2	2.2	3	18	15
	Female	442	7.4	2.6	3	18	15
Overall	Male	1867	8.3	4.4	3	36	33
	Female	1900	8.2	4.3	3	36	33
Production systems							
Crop–livestock	Male	1644	7.8	3.8	3	36	33
	Female	1677	7.8	3.8	3	36	33
Agro-pastoral	Male	156	11.3	6.6	3	36	33
	Female	156	10.8	6.2	3	36	33
Pastoral	Male	67	14.0	4.9	6	24	18
	Female	67	13.7	4.8	4	24	20
Overall	Male	1867	8.3	4.4	3	36	33
	Female	1900	8.2	4.3	3	36	33

Table 12.6.16. *Average age at first parturition (in months) of goat by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Age at 1st parturition				
		Mean	Std	Min	Max	Range
Agro-ecological zones						
Dega	368	12.8	3.7	8	30	22
Weinadega	822	13.1	3.2	8	30	22
Kolla	521	14.8	4.6	8	30	22
Overall	1711	13.6	3.9	8	30	22
Livestock densities						
Low	230	15.1	5.3	8	30	22
Medium	498	13.3	3.7	8	30	22
High	599	13.5	3.8	8	30	22
Very high	384	13.0	2.9	8	26	18
Overall	1711	13.6	3.9	8	30	22
Production systems						
Crop–livestock	1503	13.1	3.5	8	30	22
Agro-pastoral	142	15.3	4.5	10	30	20
Pastoral	66	19.6	5	12	30	18
Overall	1711	13.6	3.9	8	30	22

Table 12.6.17. *Average kidding interval (in months) of goat by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Average kidding interval				
		Mean	Std	Min	Max	Range
Agro-ecological zones						
Dega	337	8.9	2.8	6	24	18
Weinadega	808	8.9	2.8	6	24	18
Kolla	504	9.3	3.2	6	24	18
Overall	1649	9.0	2.9	6	24	18
Livestock densities						
Low	223	9.0	3.2	6	24	18
Medium	465	9.7	3.4	6	24	18
High	577	8.6	2.5	6	24	18
Very high	384	8.8	2.6	6	24	18
Overall	1649	9.0	2.9	6	24	18
Production systems						
Crop–livestock	1466	9.1	3.0	6	24	18
Agro-pastoral	130	8.9	2.4	6	24	18
Pastoral	53	8.4	1.8	6	12	6
Overall	1649	9.0	2.9	6	24	18

Table 12.6.18. *Goat fertility rates by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households*	Total birth of goats	No. of adult female goats	Fertility (%)**
Agro-ecological zones				
Dega	341	1522	1846	82.4
Weinadega	780	3030	4253	71.2
Kolla	515	3027	5779	52.4
Sub-total	1636	7579	11,878	63.8
Livestock densities				
Low	215	1245	2047	60.8
Medium	482	2481	3796	65.4
High	550	2251	3197	70.4
Very high	389	1602	2838	56.4
Sub-total	1636	7579	11,878	63.8
Production systems				
Crop–livestock	1426	5895	8449	69.8
Agro-pastoral	144	896	1831	48.9
Pastoral	66	788	1598	49.3
Sub-total	1636	7579	11,878	63.8

* No. of households represents the number of households that reported goat birth during the one year prior to the survey.
** Fertility = Total goat births/Total adult female goats*100%.

12.7 Goat health

Three sources of veterinary services were identified for goats: government veterinary services, private drug stores and private veterinary services, in their order of importance. Overall, government services were cited in 85% of the households, compared to 26% for private drug shops and 12% for private clinics. By administrative zones, exceptions to this generalisation are North Shewa, Illubabor and Borana where private services were cited by far more frequently (Table 12.7.1). Similar patterns emerged when these responses were categorised by agro-ecological zones, production systems or livestock densities (Tables 12.7.1 and 12.7.2). Drug stores were cited more frequently in the *dega* than in other AEZs. Fewer private veterinarians serve the low livestock density and pastoral areas compared with higher livestock density areas and other production systems.

In terms of distance travelled to the nearest veterinary service, Arsi, Borana, Jimma and East Hararge administrative zones reported distances of over 10 km more frequently. Overall, more than half of the households trek their goat for over 10 km to take them to the nearest veterinary service (Table 12.7.3). Ninety-five percent of the households in pastoral areas had to travel over 10 km to reach to the nearest veterinary service (Table 12.7.4).

Table 12.7.1. *Use of available veterinary services for goat by administrative zones.*

Administrative zones	No. of households	Government services		Private services		Drug stores (private)	
		No.	%	No.	%	No.	%
Arsi	131	112	85.5	39	29.8	52	39.7
Bale	141	129	91.5	4	2.8	29	20.6
Borana	183	139	76.0	47	25.7	38	20.8
East Hararge	134	115	85.8	0	0.0	35	26.1
East Shewa	154	138	89.6	14	9.1	30	19.5
East Wellega	127	123	96.9	55	43.3	40	31.5
Illubabor	123	87	70.7	17	13.8	38	30.9
Jimma	112	107	95.5	0	0.0	8	7.1
North Shewa	98	53	54.1	5	5.1	76	77.6
West Hararge	139	138	99.3	1	0.7	5	3.6
West Shewa	171	146	85.4	7	4.1	60	35.1
West Wellega	184	150	81.5	16	8.7	28	15.2
Overall	1697	1437	84.6	205	12.1	439	25.9

Table 12.7.2. *Use of available veterinary services for goat by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Government services		Private services		Drug stores (private)	
		No.	%	No.	%	No.	%
Agro-ecological zones							
Dega	349	283	81.1	58	16.6	161	46.1
Weinadega	850	715	84.1	133	15.6	179	21.1
Kolla	507	446	88.0	16	3.2	103	20.3
Overall	1706	1444	84.6	207	12.1	443	26.0
Livestock densities							
Low	227	180	79.3	12	5.3	80	35.2
Medium	522	422	80.8	107	20.5	93	17.8
High	564	520	92.2	48	8.5	146	25.9
Very high	393	322	81.9	40	10.2	124	31.6
Overall	1706	1444	84.6	207	12.1	443	26.0
Production systems							
Crop–livestock	1496	1263	84.4	171	11.4	390	26.1
Agro-pastoral	135	114	84.4	29	21.5	43	31.9
Pastoral	59	52	88.1	3	5.1	8	13.6
Overall	1690	1429	84.6	203	12.1	441	26.1

Table 12.7.3. *Distance to the nearest veterinary service for goat by administrative zones.*

Administrative zones	No. of households	<1 km		1–5 km		6–10 km		>10 km	
		No.	%	No.	%	No.	%	No.	%
Arsi	131	3	2.3	41	31.3	56	42.7	103	78.6
Bale	141	17	12.1	35	24.8	30	21.3	80	56.7
Borana	183	7	3.8	53	29.0	38	20.8	126	68.9
East Hararge	134	25	18.7	28	20.9	11	8.2	86	64.2
East Shewa	154	7	4.5	34	22.1	51	33.1	89	57.8
East Wellega	127	45	35.4	80	63.0	47	37.0	46	36.2
Ilubabor	123	9	7.3	26	21.1	38	30.9	68	55.3
Jimma	112	0	0.0	27	24.1	15	13.4	73	65.2
North Shewa	98	8	8.2	29	29.6	44	44.9	53	54.1
West Hararge	139	7	5.0	52	37.4	25	18.0	60	43.2
West Shewa	171	9	5.3	95	55.6	27	15.8	82	48.0
West Wellega	184	18	9.8	38	20.7	46	25.0	92	50.0
Overall	1697	155	9.1	538	31.7	428	25.2	958	56.5

Table 12.7.4. *Distance to nearest veterinary service by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	<1 km		1–5 km		6–10 km		>10 km	
		No.	%	No.	%	No.	%	No.	%
Agro-ecological zones									
Dega	347	29	8.4	108	31.1	79	22.8	131	37.8
Weinadega	846	53	6.3	219	25.9	219	25.9	355	42.0
Kolla	524	44	8.4	112	21.4	72	13.7	296	56.5
Overall	1717	126	7.3	439	25.6	370	21.5	782	45.5
Livestock densities									
Low	232	33	14.2	45	19.4	21	9.1	133	57.3
Medium	532	41	7.7	143	26.9	146	27.4	202	38.0
High	563	25	4.4	168	29.8	96	17.1	274	48.7
Very high	390	27	6.9	83	21.3	107	27.4	173	44.4
Overall	1717	126	7.3	439	25.6	370	21.5	782	45.5
Production systems									
Crop–livestock	1504	108	7.2	419	27.9	338	22.5	639	42.5
Agro-pastoral	138	10	7.2	15	10.9	31	22.5	82	59.4
Pastoral	60	1	1.7	2	3.3	0	0.0	57	95.0
Overall	1702	119	7.0	436	25.6	369	21.7	778	45.7

The reported prevalence of goat diseases and disease conditions in the region are summarised in Tables 12.7.5, 12.7.6, 12.7.7 and 12.7.8. Judged by their frequency of occurrence, liver fluke and/or haemonchosis, enteritis, respiratory diseases, black leg, pasteurellosis and orf were reported as the major goat diseases in the region. These were followed by emaciation, anthrax, foot-and-mouth disease (FMD), contagious caprine pleuro-pneumonia (CCPP) and skin diseases. Disease occurrence varied by AEZs. For

example, liver fluke and/or haemonchosis were more prevalent in *dega* than in other AEZs. CCPP and skin diseases were commonly reported from pastoral areas. Only households in the *kolla* and *weinadega* AEZs reported trypanosomosis where mixed crop–livestock production is practised.

Table 12.7.5. *Reported prevalence of goat diseases by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Diseases	No.	%	No.	%	No.	%	No.	%
No. of households	286		740		509		1535	
Fasciolosis/haemonchosis	71	24.8	94	12.7	52	10.2	217	14.1
Enteritis	37	12.9	91	12.3	60	11.8	188	12.2
Respiratory diseases	49	17.1	78	10.5	40	7.9	167	10.9
Black leg	35	12.2	117	15.8	8	1.6	160	10.4
Pasteurellosis	17	5.9	77	10.4	48	9.4	142	9.3
Orf	5	1.7	77	10.4	54	10.6	136	8.9
Emaciation	22	7.7	53	7.2	58	11.4	133	8.7
Anthrax	3	1.0	54	7.3	56	11.0	113	7.4
Foot-and-mouth disease	12	4.2	45	6.1	48	9.4	105	6.8
Contagious caprine pleuro-pneumonia	0	0.0	27	3.6	73	14.3	100	6.5
Skin diseases	13	4.5	18	2.4	67	13.2	98	6.4
Bloat	0	0.0	31	4.2	27	5.3	58	3.8
Goat and sheep pox	2	0.7	34	4.6	18	3.5	54	3.5
Internal parasites	11	3.8	27	3.6	5	1.0	43	2.8
Rabies	25	8.7	10	1.4	0	0.0	35	2.3
Trypanosomosis	14	4.9	4	0.5	7	1.4	25	1.6
Eye disease	3	1.0	10	1.4	8	1.6	21	1.4
Foot rot	4	1.4	9	1.2	6	1.2	19	1.2
Gid/coenurosis	6	2.1	10	1.4	3	0.6	19	1.2
Oestrosis/nasal bot	2	0.7	3	0.4	12	2.4	17	1.1
Abscess	0	0.0	10	1.4	4	0.8	14	0.9
Colic	1	0.3	2	0.3	11	2.2	14	0.9
Lameness	0	0.0	3	0.4	10	2.0	13	0.8
Sudden death	2	0.7	5	0.7	6	1.2	13	0.8
External parasites	1	0.3	0	0.0	7	1.4	8	0.5
Blue tongue	0	0.0	5	0.7	2	0.4	7	0.5
Haematuria	0	0.0	3	0.4	0	0.0	3	0.2
Abortion	0	0.0	2	0.3	0	0.0	2	0.1
Cowdriosis	0	0.0	2	0.3	0	0.0	2	0.1
Anaplasmosis	0	0.0	0	0.0	1	0.2	1	0.1
Unidentified	190	66.4	584	78.9	483	94.9	1257	81.9

Table 12.7.6. *Reported prevalence of goat diseases by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Diseases	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	211		479		489		356		1535	
Fasciolosis/haemonchosis	37	17.5	39	8.1	80	16.4	61	17.1	217	14.1
Enteritis	18	8.5	94	19.6	49	10.0	27	7.6	188	12.2
Respiratory diseases	6	2.8	57	11.9	56	11.5	48	13.5	167	10.9
Black leg	28	13.3	57	11.9	47	9.6	28	7.9	160	10.4
Pasteurellosis	17	8.1	56	11.7	45	9.2	24	6.7	142	9.3
Orf	17	8.1	55	11.5	21	4.3	43	12.1	136	8.9
Emaciation	32	15.2	43	9.0	32	6.5	26	7.3	133	8.7
Anthrax	8	3.8	44	9.2	40	8.2	21	5.9	113	7.4
Foot-and-mouth disease	8	3.8	16	3.3	22	4.5	59	16.6	105	6.8
Contagious caprine pleuro-pneumonia	24	11.4	39	8.1	37	7.6	0	0.0	100	6.5
Skin diseases	31	14.7	14	2.9	44	9.0	9	2.5	98	6.4
Bloat	9	4.3	33	6.9	8	1.6	8	2.2	58	3.8
Goat and sheep pox	15	7.1	28	5.8	3	0.6	8	2.2	54	3.5
Internal parasites	2	0.9	20	4.2	9	1.8	12	3.4	43	2.8
Rabies	0	0.0	17	3.5	9	1.8	9	2.5	35	2.3
Trypanosomosis	9	4.3	2	0.4	13	2.7	1	0.3	25	1.6
Eye disease	0	0.0	4	0.8	4	0.8	13	3.7	21	1.4
Foot rot	5	2.4	2	0.4	7	1.4	5	1.4	19	1.2
Gid/coenurosis	0	0.0	7	1.5	10	2.0	2	0.6	19	1.2
Oestrosis/nasal bot	2	0.9	12	2.5	2	0.4	1	0.3	17	1.1
Abscess	1	0.5	6	1.3	0	0.0	7	2.0	14	0.9
Colic	3	1.4	9	1.9	1	0.2	1	0.3	14	0.9
Lameness	0	0.0	2	0.4	1	0.2	10	2.8	13	0.8
Sudden death	2	0.9	3	0.6	7	1.4	1	0.3	13	0.8
External parasites	3	1.4	2	0.4	3	0.6	0	0.0	8	0.5
Blue tongue	0	0.0	6	1.3	1	0.2	0	0.0	7	0.5
Haematuria	0	0.0	0	0.0	0	0.0	3	0.8	3	0.2
Abortion	0	0.0	1	0.2	1	0.2	0	0.0	2	0.1
Cowdriosis	1	0.5	1	0.2	0	0.0	0	0.0	2	0.1
Anaplasmosis	1	0.5	0	0.0	0	0.0	0	0.0	1	0.1
Unidentified	194	91.9	350	73.1	385	78.7	328	92.1	1257	81.9

Table 12.7.7. *Reported prevalence of goat diseases by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Diseases	No.	%	No.	%	No.	%	No.	%
No. of households	1322		143		61		1526	
Fasciolosis/haemonchosis	186	14.1	24	16.8	6	9.8	216	14.2
Enteritis	180	13.6	7	4.9	1	1.6	188	12.3
Respiratory diseases	151	11.4	15	10.5	1	1.6	167	10.9
Black leg	158	12.0	1	0.7	0	0.0	159	10.4
Pasteurellosis	136	10.3	5	3.5	0	0.0	141	9.2
Orf	98	7.4	38	26.6	0	0.0	136	8.9
Emaciation	96	7.3	11	7.7	26	42.6	133	8.7
Anthrax	88	6.7	24	16.8	0	0.0	112	7.3
Foot-and-mouth disease	92	7.0	10	7.0	3	4.9	105	6.9
Contagious caprine pleuro-pneumonia	20	1.5	37	25.9	43	70.5	100	6.6
Skin diseases	47	3.6	30	21.0	21	34.4	98	6.4
Bloat	55	4.2	1	0.7	1	1.6	57	3.7
Goat and sheep pox	28	2.1	18	12.6	8	13.1	54	3.5
Internal parasites	39	3.0	2	1.4	1	1.6	42	2.8
Rabies	34	2.6	1	0.7	0	0.0	35	2.3
Trypanosomosis	24	1.8	0	0.0	0	0.0	24	1.6
Eye disease	21	1.6	0	0.0	0	0.0	21	1.4
Foot rot	13	1.0	5	3.5	1	1.6	19	1.2
Gid/coenurosis	19	1.4	0	0.0	0	0.0	19	1.2
Oestrosis/nasal bot	16	1.2	1	0.7	0	0.0	17	1.1
Abscess	13	1.0	1	0.7	0	0.0	14	0.9
Colic	12	0.9	2	1.4	0	0.0	14	0.9
Lameness	13	1.0	0	0.0	0	0.0	13	0.9
Sudden death	10	0.8	2	1.4	0	0.0	12	0.8
External parasites	8	0.6	0	0.0	0	0.0	8	0.5
Blue tongue	7	0.5	0	0.0	0	0.0	7	0.5
Haematuria	3	0.2	0	0.0	0	0.0	3	0.2
Abortion	2	0.2	0	0.0	0	0.0	2	0.1
Cowdriosis	2	0.2	0	0.0	0	0.0	2	0.1
Anaplasmosis	1	0.1	0	0.0	0	0.0	1	0.1
Unidentified	1072	81.1	126	88.1	51	83.6	1249	81.8

Table 12.7.8. *Reported prevalence of goat diseases by administrative zones (%).*

Administrative zones	Arsi	Bale	Borana	East Hararge	East Shewa	East Wellega	Illubabor	Jimma	North Shewa	West Hararge	West Shewa	West Wellega	Overall
Diseases	%	%	%	%	%	%	%	%	%	%	%	%	%
No. of cases	219	206	456	288	344	253	117	174	178	292	279	378	3184
No. of households	114	116	174	134	152	120	77	96	98	125	154	175	1535
Fasciolosis/haemonchosis	46.5	1.7	0.6	24.6	13.2	16.7	1.3	28.1	14.3	4.0	12.3	12.6	14.1
Enteritis	21.9	0.9	12.1	6.7	2.0	9.2	0.0	0.0	4.1	11.2	3.2	54.3	12.2
Respiratory diseases	36.8	1.7	18.4	3.7	9.2	2.5	1.3	10.4	21.4	20.8	7.1	0.0	10.9
Black leg	0.0	0.0	0.0	0.0	0.0	54.2	5.2	0.0	12.2	0.0	51.3	0.0	10.4
Pasteurellosis	0.0	0.0	2.3	5.2	3.3	11.7	13.0	25.0	13.3	4.8	17.5	18.3	9.3
Orf	0.0	0.0	0.0	9.0	17.8	13.3	3.9	4.2	0.0	40.0	4.5	9.7	8.9
Emaciation	0.0	0.0	19.5	0.7	1.3	16.7	13.0	0.0	35.7	0.8	0.0	17.1	8.7
Anthrax	7.0	0.0	0.0	6.0	4.6	0.8	0.0	0.0	0.0	64.8	0.0	4.6	7.4
Foot-and-mouth disease	0.0	0.0	2.9	11.2	32.2	1.7	2.6	3.1	2.0	0.0	5.2	10.9	6.8
Contagious caprine pleuro-pneumonia	0.0	0.0	52.3	0.0	0.0	0.0	0.0	9.4	0.0	0.0	0.0	0.0	6.5
Skin diseases	0.9	2.6	32.2	8.2	9.2	0.8	7.8	0.0	0.0	0.8	3.2	0.0	6.4
Bloat	0.0	0.0	0.6	0.0	0.7	0.0	0.0	8.3	0.0	5.6	0.0	23.4	3.8
Goat and sheep pox	0.0	0.0	16.1	0.0	6.6	12.5	0.0	0.0	1.0	0.0	0.0	0.0	3.5
Internal parasites	0.9	0.0	2.3	4.5	2.0	8.3	2.6	0.0	2.0	1.6	3.9	4.0	2.8
Rabies	30.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
Eye disease	0.0	0.0	0.0	3.7	7.9	0.0	0.0	0.0	0.0	0.0	0.0	2.3	1.4
Foot rot	0.0	0.0	0.0	3.7	0.7	0.8	0.0	0.0	5.1	0.0	2.6	1.7	1.2
Gid/coenurosis	0.9	0.0	0.0	0.7	2.0	1.7	11.7	0.0	1.0	1.6	0.0	0.0	1.2
Oestrosis/nasal blot	0.0	0.0	5.2	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	4.0	1.1
Abscess	0.0	0.0	0.0	6.0	0.0	1.7	3.9	0.0	0.0	0.0	0.0	0.6	0.9
Colic	0.0	0.0	0.0	3.0	0.0	0.0	1.3	8.3	0.0	0.0	0.6	0.0	0.9

cont'd...

Table 12.7.8. cont'd.

Administrative zones	Arsi	Bale	Borana	East Hararge	East Shewa	East Wellega	Illubabor	Jimma	North Shewa	West Hararge	West Shewa	West Wellega	Overall
Lameness	0.0	0.0	0.0	0.0	6.6	1.7	0.0	1.0	0.0	0.0	0.0	0.0	0.8
Sudden death	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	4.1	3.2	1.3	0.0	0.8
External parasites	0.0	0.0	0.0	0.0	0.0	0.0	2.6	3.1	0.0	0.8	0.0	1.1	0.5
Blue tongue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	3.4	0.5
Haematuria	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Abortion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.1
Cowdriosis	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Anaplasmosis	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Unidentified	46.5	160.3	97.7	112.7	106.6	44.2	81.8	80.2	65.3	73.6	67.5	46.9	81.9

12.8 Age and sex structure

The age and sex structure of sample goat flocks is similar across AEZs, livestock densities and production systems, except that there appear to be slightly higher proportion of adult females in the *kolla* AEZ and pastoral areas. Overall, adult females constituted about 43% of the current stock with adult males representing only 17%. The rest is shared between young females and males, with the former being slightly less as they are sold more frequently starting from young age (Table 12.8).

Table 12.8. *Age and sex structure of sample goat flocks by agro-ecological zones, livestock densities and production systems.*

		Type of goat								
		Young male		Young female		Adult male		Adult female		
Categories	No. of households	No.	%	No.	%	No.	%	No.	%	Overall
Agro-ecological zones										
Dega	564	895	19.8	1000	22.1	768	17.0	1852	41.0	4515
Weinadega	1383	2068	20.0	2255	21.8	1731	16.7	4293	41.5	10,347
Kolla	1158	2598	19.7	2539	19.2	2259	17.1	5813	44.0	13,209
Total goat	3105	5561	19.8	5794	20.6	4758	16.9	11,958	42.6	28,071
Livestock densities										
Low	430	937	19.8	1024	21.7	711	15.1	2051	43.4	4723
Medium	907	1715	19.9	1841	21.3	1256	14.6	3814	44.2	8626
High	1038	1545	20.0	1659	21.5	1263	16.4	3244	42.1	7711
Very high	730	1364	19.5	1270	18.1	1528	21.8	2849	40.6	7011
Total goat	3105	5561	19.8	5794	20.6	4758	16.9	11,958	42.6	28,071
Production systems										
Crop–livestock	2562	3893	19.6	4167	21.0	3370	17.0	8449	42.5	19,879
Agro-pastoral	341	904	20.5	846	19.2	833	18.9	1831	41.5	4414
Pastoral	185	721	20.3	718	20.3	508	14.3	1598	45.1	3545
Total goat	3088	5518	19.8	5731	20.6	4711	16.9	11,878	42.7	27,838

12.9 Mortality

Based on the reported current stock of goats and numbers of deaths reported over the 12 months period prior to the survey, the overall mortality rate for the whole sample flock was 17%, and these rates for the different categories ranged from 7% for adult female in the *dega* AEZ to 35% for adult males in the pastoral production systems. The mortality of young and adult males was markedly high in the pastoral system than in any other production systems. It was also high for the same categories of goats in low, medium and high livestock densities compared to that of very high livestock densities. In

general, there is considerable variation in these rates for the different categories of goats (Table 12.9.1).

Table 12.9.1. *Calculated mortality rates (%*) of goats by age and sex groups and agro-ecological zones, livestock densities and production systems.*

		Goat type dead									
		Young male		Young female		Adult male		Adult female		Overall	
Categories	No. of households	No.	%	No.	%	No.	%	No.	%	No.	%
Agro-ecological zones											
Dega	201	222	19.9	175	14.9	155	16.8	151	7.5	703	13.5
Weinadega	554	625	23.2	516	18.6	329	16.0	616	12.5	2086	16.8
Kolla	369	696	21.1	534	17.4	657	22.5	929	13.8	2816	17.6
Overall	1124	1543	21.7	1225	17.5	1141	19.3	1696	12.4	5605	16.6
Livestock densities											
Low	194	291	23.7	215	17.4	245	25.6	344	14.4	1095	18.8
Medium	324	547	24.2	449	19.6	468	27.1	718	15.8	2182	20.2
High	388	482	23.8	361	17.9	282	18.3	378	10.4	1503	16.3
Very high	218	223	14.1	200	13.6	146	8.7	256	8.2	825	10.5
Overall	1124	1543	21.7	1225	17.5	1141	19.3	1696	12.4	5605	16.6
Production systems											
Crop–livestock	948	1074	21.6	933	18.3	662	16.4	963	10.2	3632	15.4
Agro-pastoral	105	199	18.0	144	14.5	195	19.0	301	14.1	839	16.0
Pastoral	62	259	26.4	138	16.1	273	35.0	414	20.6	1084	23.4
Overall	1115	1532	21.7	1215	17.5	1130	19.3	1678	12.4	5555	16.6

* Percent mortality = Animals dead/Current average stock + Animals dead*100%.

The reported causes of mortalities were diseases (53%), predators (25%), accidents (7%) and drought (3%) (Table 12.9.2). About 11% of the deaths were of unknown causes. There was little variation on the causes of death by AEZs, livestock densities and production systems. However, death from drought was highest in pastoral than in other production systems. Death from predators is more common in agro-pastoral and pastoral areas.

Table 12.9.2. *Proportional distribution of reported causes of goat death by agro-ecological zones, livestock densities and production systems.*

Categories	No. of HHs	Predators		Diseases		Accident		Poisons		Drought		Unknown		Total death
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Agro-ecological zones														
Dega	202	63	22.7	155	5.1	25	9.0	1	0.4	1	0.4	32	11.6	277
Weinadega	557	181	22.7	431	4.1	70	8.8	7	0.9	5	0.6	103	12.9	797
Kolla	371	172	28.2	306	50.2	31	5.1	7	1.1	42	6.9	52	8.5	610
Overall	1130	416	24.7	892	53.0	126	7.5	15	0.9	48	2.9	187	11.1	1684
Livestock densities														
Low	195	96	30.1	167	52.4	16	5.0	1	0.3	20	6.3	19	6.0	319
Medium	326	146	28.5	272	53.1	32	6.3	4	0.8	19	3.7	39	7.6	512
High	393	106	19.1	282	50.8	51	9.2	8	1.4	6	1.1	102	18.4	555
Very high	216	68	22.8	171	57.4	27	9.1	2	0.7	3	1.0	27	9.1	298
Overall	1130	416	24.7	892	53.0	126	7.5	15	0.9	48	2.9	187	11.1	1684
Production systems														
Crop–livestock	956	317	22.9	740	53.5	113	8.2	11	0.8	25	1.8	176	12.7	1382
Agro-pastoral	103	54	31.8	88	51.8	8	4.7	4	2.4	10	5.9	6	3.5	170
Pastoral	61	42	35.3	60	50.4	2	1.7	0	0.0	13	10.9	2	1.7	119
Overall	1120	413	24.7	888	53.1	123	7.4	15	0.9	48	2.9	184	11.0	1671

12.10 Acquisition and disposal of goat

About 28% of the goats in sample flocks were acquired during the 12 months prior to the survey, and 95% of these were in the form of newly born kids. Other reported means of entry into flocks were purchase, donation and exchange, in that order (Tables 12.10.1, 12.10.2 and 12.10.3). These patterns are generally similar across sex groups, AEZs and livestock density categories, except that there were slightly more contributions from birth in the *dega* than in other AEZs and where the livestock density is from medium to high. Likewise, contributions from birth were highest in pastoral compared to other production systems.

The total size of goat disposals during the 12 months prior to the survey was about 24% of the total stock (i.e. size of the current (average) flock plus those disposed). The data comes from 1448 households, which reported at least one case of goat disposal. Overall, slightly more total males than females were disposed. Goats were disposed in the form of death, sale, slaughter, donation, loss and exchange. More males than females were sold or slaughtered in all AEZs, livestock density categories and production systems (Tables 12.10.4, 12.10.5 and 12.10.6). On average, 13% of male and 11% of female goats in total stocks were disposed, of which respectively 48 and 66% were due to death.

Disposal due to slaughter is more common in pastoral than in agro-pastoral and crop livestock systems.

Table 12.10.1. *Goat acquisition patterns during the previous 12 months by type of entry, sex and agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Total acquired	
Type of entry	No.	%*	No.	%	No.	%	No.	%
Male goat								
Born	780	17.3	1479	14.3	1481	11.2	3740	13.3
Bought	19	0.4	61	0.6	46	0.3	126	0.4
Donated	7	0.2	7	0.1	11	0.1	25	0.1
Exchanged	0	0.0	0	0.0	1	<0.1	1	<0.1
Sub-total	806	17.9	1547	15.0	1539	11.7	3892	13.9
Female goat								
Born	727	16.1	1541	14.9	1433	10.8	3701	13.2
Bought	31	0.7	87	0.8	73	0.6	191	0.7
Donated	15	0.3	8	0.1	26	0.2	49	0.2
Exchanged	4	0.1	2	<0.1	4	<0.1	10	<0.1
Sub-total	777	17.2	1638	15.8	1536	11.6	3951	14.1
Overall								
Born	1507	33.4	3020	29.2	2914	22.1	7441	26.5
Bought	50	1.1	148	1.4	119	0.9	317	1.1
Donated	22	0.5	15	0.1	37	0.3	74	0.3
Exchanged	4	0.1	2	<0.1	5	<0.1	11	<0.1
Sub-total	1583	35.1	3185	30.8	3075	23.3	7843	27.9
Total goats	4515		10,347		13,209		28,071	
No. of households	346		786		507		1639	

* Percent acquired = Size of acquisition/Total number of goats in current flocks*100%.

Table 12.10.2. *Goat acquisition patterns during the previous 12 months by type of entry, sex and livestock densities.*

	Livestock densities								Total acquired	
	Low		Medium		High		Very high			
Type of entry	No.	%*	No.	%	No.	%	No.	%	No.	%
Male goat										
Born	573	12.1	1272	14.7	1117	14.5	778	11.1	3740	13.3
Bought	19	0.4	29	0.3	42	0.5	36	0.5	126	0.4
Donated	2	<0.1	5	0.1	10	0.1	8	0.1	25	0.1
Exchanged	0	0.0	0	0.0	1	0.0	0	0.0	1	<0.1
Sub-total	594	12.6	1306	15.1	1170	15.2	822	11.7	3892	13.9
Female goat										
Born	634	13.4	1172	13.6	1106	14.3	789	11.3	3701	13.2
Bought	21	0.4	69	0.8	60	0.8	41	0.6	191	0.7
Donated	9	0.2	9	0.1	22	0.3	9	0.1	49	0.2

cont'd...

Table 12.10.2. cont'd.

	Livestock densities								Total acquired	
	Low		Medium		High		Very high			
Type of entry	No.	%*	No.	%	No.	%	No.	%	No.	%
Exchanged	1	<0.1	2	<0.1	6	0.1	1	<0.1	10	<0.1
Sub-total	665	14.1	1252	14.5	1194	15.5	840	12.0	3951	14.1
Overall										
Born	1207	25.6	2444	28.3	2223	28.8	1567	22.4	7441	26.5
Bought	40	0.8	98	1.1	102	1.3	77	1.1	317	1.1
Donated	11	0.2	14	0.2	32	0.4	17	0.2	74	0.3
Exchanged	1	<0.1	2	<0.1	7	0.1	1	<0.1	11	<0.1
Sub-total	1259	26.7	2558	29.7	2364	30.7	1662	23.7	7843	27.9
Total goats	4723		8626		7711		7011		28,071	
No. of households	212		482		557		388		1639	

* Percent acquired = Size of acquisition/Total number of goats in current flocks*100%.

Table 12.10.3. *Goat acquisition patterns during the previous 12 months patterns by type of entry, sex and production systems.*

	Total	Production systems (%*)			
Type of entry	entered	Crop–livestock	Agro-pastoral	Pastoral	Overall
Male goat					
Born	3708	20.0	16.9	23.1	19.9
Bought	121	0.7	0.7	0.5	0.6
Donated	25	0.1	0.0	0.3	0.1
Exchanged	1	0.0	0.0	0.0	0.0
Sub-total	3855	20.8	17.6	23.9	20.7
Female goat					
Born	3632	19.5	19.1	20.1	19.5
Bought	185	0.9	2.4	0.3	1.0
Donated	49	0.2	0.1	0.7	0.3
Exchanged	10	0.1	0.0	0	0.1
Sub-total	3876	20.6	21.6	21.2	20.8
Overall					
Born	7340	39.5	36.1	43.2	39.4
Bought	306	1.5	3.1	0.8	1.6
Donated	74	0.4	0.1	1.1	0.4
Exchanged	11	0.1	0.0	0.0	0.1
Sub-total	7731	41.5	39.2	45.0	41.5
No. of households	1042	900	91	51	1042
Total goats	18,617	14,548	2293	1776	0

* Percent acquired = Size of acquisition/Total number of goats in current flocks*100%.

Table 12.10.4. *Goat disposal patterns during the previous 12 months by type of disposal, sex and agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Total disposal	
Type of disposal	No.	%*	No.	%	No.	%	No.	%
Male goat								
Sold	420	7.1	806	5.8	571	3.3	1797	4.9
Slaughtered	90	1.5	193	1.4	251	1.5	534	1.4
Exchanged	3	0.1	5	0.0	2	0.0	10	0.0
Died	285	4.8	838	6.1	1186	6.9	2309	6.2
Stolen	9	0.2	21	0.2	23	0.1	53	0.1
Donated	6	0.1	21	0.2	52	0.3	79	0.2
Sub-total	813	13.7	1884	13.6	2085	12.1	4782	12.9
Female goat								
Sold	228	3.8	471	3.4	352	2.0	1051	2.8
Slaughtered	42	0.7	65	0.5	87	0.5	194	0.5
Exchanged	4	0.1	9	0.1	3	0.0	16	0.0
Died	301	5.1	994	7.2	1494	8.6	2789	7.5
Stolen	8	0.1	22	0.2	14	0.1	44	0.1
Donated	13	0.2	17	0.1	55	0.3	85	0.2
Sub-total	596	10.1	1578	11.4	2005	11.6	4179	11.3
Overall								
Sold	648	10.9	1277	9.2	923	5.3	2848	7.7
Slaughtered	132	2.2	258	1.9	338	2.0	728	2.0
Exchanged	7	0.1	14	0.1	5	0.0	26	0.1
Died	586	9.9	1832	13.3	2680	15.5	5098	13.8
Stolen	17	0.3	43	0.3	37	0.2	97	0.3
Donated	19	0.3	38	0.3	107	0.6	164	0.4
Sub-total	1409	23.8	3462	25.1	4090	23.6	8961	24.2
Total goat during the year	5924		13,809		17,299		37,032	
Current total goat	4515		10,347		13,209		28,071	
Total disposed goat	1409		3462		4090		8961	
No. of households	303		721		424		1448	

* Percent disposal = Size of disposal/Total number of goats in total flock (including disposal)*100%.

Table 12.10.5. *Goat disposal patterns during the previous 12 months by type of disposal, sex and livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Total disposal	
Type of disposal	No.	%*	No.	%	No.	%	No.	%	No.	%
Male goat										
Sold	283	4.4	568	4.8	531	5.2	415	4.9	1797	4.9
Slaughtered	94	1.5	136	1.1	211	2.1	93	1.1	534	1.4
Exchanged	3	0.0	2	0.0	4	0.0	1	0.0	10	0.0
Died	448	7.0	912	7.7	606	5.9	343	4.0	2309	6.2
Stolen	15	0.2	11	0.1	15	0.1	12	0.1	53	0.1
Donated	16	0.3	32	0.3	22	0.2	9	0.1	79	0.2
Sub-total	859	13.4	1661	14.0	1389	13.6	873	10.3	4782	12.9
Female goat										
Sold	161	2.5	322	2.7	345	3.4	223	2.6	1051	2.8
Slaughtered	32	0.5	73	0.6	55	0.5	34	0.4	194	0.5
Exchanged	2	0.0	3	0.0	10	0.1	1	0.0	16	0.0
Died	601	9.4	1176	9.9	656	6.4	356	4.2	2789	7.5
Stolen	4	0.1	19	0.2	13	0.1	8	0.1	44	0.1
Donated	15	0.2	26	0.2	37	0.4	7	0.1	85	0.2
Sub-total	815	12.7	1619	13.6	1116	10.9	629	7.4	4179	11.3
Overall										
Sold	444	6.9	890	7.5	876	8.6	638	7.5	2848	7.7
Slaughtered	126	2.0	209	1.8	266	2.6	127	1.5	728	2.0
Exchanged	5	0.1	5	0.0	14	0.1	2	0.0	26	0.1
Died	1049	16.4	2088	17.5	1262	12.4	699	8.2	5098	13.8
Stolen	19	0.3	30	0.3	28	0.3	20	0.2	97	0.3
Donated	31	0.5	58	0.5	59	0.6	16	0.2	164	0.4
Sub-total	1674	26.2	3280	27.5	2505	24.5	1502	17.6	8961	24.2
Total goat during the year	6397		11,906		10,216		8513		37,032	
Current total goat	4723		8626		7711		7011		28,071	
Total disposed goat	1674		3280		2505		1502		8961	
No. of households who disposed	208		420		507		313		1448	

* Percent disposal = Size of disposal/Total number of goats in total flock (including disposal)*100%.

Table 12.10.6. *Goat disposal patterns during the previous 12 months by type of disposal, sex and production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Total disposal	
Type of disposal	No.	%	No.	%	No.	%	No.	%
Male goat								
Sold	1338	5.2	262	4.5	176	3.4	1776	4.8
Slaughtered	319	1.2	88	1.5	113	2.2	520	1.4
Exchanged	9	0.0	1	0.0		0.0	10	0.0
Died	1527	5.9	345	6.0	426	8.3	2298	6.3
Stolen	38	0.1	12	0.2	3	0.1	53	0.1
Donated	33	0.1	20	0.3	26	0.5	79	0.2
Sub-total	3264	12.6	728	12.6	744	14.5	4736	12.9
Female goat								
Sold	791	3.1	149	2.6	96	1.9	1036	2.8
Slaughtered	114	0.4	25	0.4	52	1.0	191	0.5
Exchanged	13	0.1	1	0.0	1	0.0	15	0.0
Died	1669	6.5	445	7.7	655	12.8	2769	7.5
Stolen	43	0.2	1	0.0			44	0.1
Donated	38	0.1	17	0.3	30	0.6	85	0.2
Sub-total	2668	10.3	638	11.0	834	16.3	4140	11.3
Overall								
Sold	2129	8.2	411	7.1	272	5.3	2812	7.7
Slaughtered	433	1.7	113	2.0	165	3.2	711	1.9
Exchanged	22	0.1	2	0.0	1	0.0	25	0.1
Died	3196	12.4	790	13.7	1081	21.1	5067	13.8
Stolen	81	0.3	13	0.2	3	0.1	97	0.3
Donated	71	0.3	37	0.6	56	1.1	164	0.4
Sub total	5932	23.0	1366	23.6	1578	30.8	8876	24.2
Total goat during the year	25,811		5780		5123		36,714	
Current total goat	19,879		4414		3545		27,838	
Total disposed goat	5932		1366		1578		8876	
No. of households	1247		122		65		1434	

* Percent disposal = Size of disposal/Total number of goats in total flock (including disposal)*100%.

12.11 Milk production and kid rearing practices

About 41% of the goat-owning households in the Oromiya Regional State across all AEZs, livestock density categories and production systems use their goats for milk production. Goats are reportedly milked from one to four times a day, with an overall average of 1.5 times. Goats are more frequently milked in the *kolla* AEZ, low livestock density areas and in the pastoral production systems (Table 12.11.1). The reported average daily milk off-take is 0.5 litre per doe for an average lactation length of about 3.4 months (Tables 12.11.2 and 12.11.3). Average milk off-takes and lactation lengths varied by AEZs, livestock densities and production systems.

Table 12.11.1. *Frequency of milking goats by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Milking frequency				
		Mean	sd	Min	Max	Range
Agro-ecological zones						
Dega	99	1.3	0.5	1	4	3
Weinadega	203	1.4	0.6	1	4	3
Kolla	345	1.7	0.5	1	3	2
Overall	647	1.5	0.5	1	4	3
Livestock densities						
Low	134	1.8	0.4	1	3	2
Medium	150	1.6	0.5	1	4	3
High	185	1.5	0.6	1	4	3
Very High	178	1.3	0.5	1	4	3
Overall	647	1.5	0.5	1	4	3
Production systems						
Crop–livestock	457	1.5	0.5	1	4	3
Agro-pastoral	130	1.6	0.5	1	4	3
Pastoral	60	1.9	0.3	1	2	1
Overall	647	1.5	0.5	1	4	3

Table 12.11.2. *Average milk off-take (litres per day) of goat by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Average milk yield (litres)				
		Mean	sd	Min	Max	Range
Agro-ecological zones						
Dega	103	0.6	0.4	0.2	2.0	1.8
Weinadega	211	0.5	0.3	0.13	2.0	1.88
Kolla	351	0.5	0.3	0.1	1.5	1.4
Overall	665	0.5	0.3	0.1	2.0	1.9
Livestock densities						
Low	139	0.6	0.3	0.2	1.5	1.3
Medium	152	0.5	0.3	0.1	2.0	1.9
High	190	0.5	0.3	0.12	2.0	1.88
Very High	184	0.5	0.3	0.2	2.0	1.8
Overall	665	0.5	0.3	0.1	2.0	1.9
Production systems						
Crop–livestock	470	0.5	0.3	0.1	2.0	1.9
Agro-pastoral	135	0.5	0.3	0.13	1.5	1.38
Pastoral	60	0.5	0.3	0.25	1.0	0.75
Overall	665	0.5	0.3	0.1	2.0	1.9

Table 12.11.3. *Average goat lactation length by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Average lactation length (months)				
		Mean	sd	Min	Max	Range
Agro-ecological zones						
Dega	106	3.7	1.1	1	7	6
Weinadega	207	3.5	1.3	1	7	6
Kolla	357	3.3	1.2	1	7	6
Overall	670	3.4	1.2	1	7	6
Livestock densities						
Low	142	3.5	1.1	1	6	5
Medium	151	3.5	1.1	1	6	5
High	192	3.2	1.4	1	7	6
Very high	185	3.4	1.2	1	7	6
Overall	670	3.4	1.2	1	7	6
Production systems						
Crop livestock	471	3.6	1.2	1	7	6
Agro-pastoral	135	3.0	1.0	1	6	5
Pastoral	64	3.1	1.2	1	6	5
Overall	670	3.4	1.2	1	7	6

The reported average weaning age of goats falls between 3 and 4 months in about 50% of the cases, between 5 and 6 months in 25% of the cases and over 6 months of age in 15% of the cases (Table 12.11.4). Pastoral and agro-pastoral households tend to wean kids earlier than crop–livestock farmers.

Kid rearing practice varied between AEZs and production systems (Table 12.11.5). Unrestricted suckling is practised more frequently in the *dega* and *weinadega* AEZs and in crop–livestock systems. In contrast, pastoral and agro-pastoral communities practice restricted suckling of the kids before weaning.

Table 12.11.4. *Average weaning age of goat by agro-ecological zones, livestock densities and production systems.*

	Average weaning age							
	<3 months		3–4 months		5–6 months		>6 months	
Categories	No.	%	No.	%	No.	%	No.	%
Agro-ecological zones								
Dega	11	3.1	189	53.7	97	27.6	55	15.6
Weinadega	58	6.8	415	48.8	229	26.9	148	17.4
Kolla	54	9.3	322	55.6	134	23.1	69	11.9
Total	123	6.9	926	52.0	460	25.8	272	15.3
Livestock densities								
Low	27	11.0	139	56.5	52	21.1	28	11.4
Medium	28	5.5	258	50.9	144	28.4	77	15.2
High	30	4.9	292	47.7	169	27.6	121	19.8
Very high	38	9.1	237	57.0	95	22.8	46	11.1
Total	123	6.9	926	52.0	460	25.8	272	15.3
Production systems								
Crop–livestock	98	6.3	793	50.8	419	26.9	250	16.0
Agro-pastoral	25	16.1	88	56.8	28	18.1	14	9.0
Pastoral	0	0.0	45	68.2	13	19.7	8	12.1
Total	123	6.9	926	52.0	460	25.8	272	15.3

Table 12.11.5. *Average kid rearing up to weaning by agro-ecological zones, livestock densities and production systems.*

	Kid rearing up to weaning			
	Unrestricted suckling		Restricted suckling	
Categories	No.	%	No.	%
Agro-ecological zones				
Dega	262	76.2	82	23.8
Weinadega	675	77.5	196	22.5
Kolla	195	34.6	369	65.4
Overall	1132	63.6	647	36.4
Livestock densities				
Low	97	40.2	144	59.8
Medium	384	72.9	143	27.1
High	437	72.0	170	28.0
Very high	214	53.0	190	47.0
Overall	1132	63.6	647	36.4
Production systems				
Crop–livestock	1105	70.6	460	29.4
Agro-pastoral	26	17.4	123	82.6
Pastoral	1	1.5	64	98.5
Overall	1132	63.6	647	36.4

12.12 Goat trait preferences

Tables 12.12.1, 12.12.2 and 12.12.3 summarise farmers' preferences for goat traits as assessed based on their evaluation of certain goat traits as 'not important', 'poor', 'average' and 'good'. Across the region, meat production capacity, body size, coat colour, growth rate, fertility, and tolerance to heat and drought were the most preferred traits whereas disease tolerance, milk yield, horns and cold tolerance were the least preferred. However, the latter traits were better rated in the *kolla* AEZ as well as pastoral areas than in the overall average. Particularly, milk yield was rated very high in pastoral and low livestock density areas.

The criteria used for choosing breeding bucks were body size, coat colour, overall performance and temperament, in that order, with little variation between the AEZs, production systems and livestock density categories (Tables 12.12.4, 12.12.5 and 12.12.6). When the households were asked to identify the most important criteria they use in choosing their breeding buck, this order changes. The overall frequencies show that primary criteria used are body size, overall performance, and availability of the buck (Tables 12.12.7, 12.12.8 and 12.12.9), whereas temperament, coat colour and horns were rated less frequently. There are slight variations on primary criteria used for the choice of breeding buck between AEZs, livestock density categories and production systems.

The reported criteria used for disposing of goats are summarised in Tables 12.12.10, 12.12.11 and 12.12.12. In general, old age, low fertility, body size, poor health and poor performance were the most important reasons for disposing goats. The reported primary criteria used for the disposal of goat are also summarised in Tables 12.12.13, 12.12.14 and 12.12.15. Again, poor performance, old age, poor health, low fertility and body size were more frequently identified as primary criteria for goat disposal, compared to character, colour and body condition. There were some variations in the primary criteria used for disposing of goat between AEZs, livestock densities and production systems.

Table 12.12.1. *Preferred goat traits by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%
No. of households	546		1342		1112		3000	
Meat	405	74.2	919	68.5	844	75.9	2168	72.3
Size	362	66.3	800	59.6	812	73.0	1974	65.8
Coat colour	333	61.0	834	62.1	767	69.0	1934	64.5
Growth rate	332	60.8	710	52.9	740	66.5	1782	59.4
Fertility	308	56.4	716	53.4	737	66.3	1761	58.7
Heat tolerance	262	48.0	665	49.6	687	61.8	1614	53.8
Drought	261	47.8	629	46.9	701	63.0	1591	53.0
Temperament	205	37.5	640	47.7	657	59.1	1502	50.1
Distance	215	39.4	503	37.5	703	63.2	1421	47.4
Longevity	263	48.2	551	41.1	578	52.0	1392	46.4
Cold tolerance	194	35.5	315	23.5	346	31.1	855	28.5
Horns	121	22.2	290	21.6	371	33.4	782	26.1
Milk yield	102	18.7	216	16.1	442	39.7	760	25.3
Disease tolerance	127	23.3	281	20.9	341	30.7	749	25.0
Others			2	0.1	10	0.9	12	0.4

* Percent = No. of households rating a given trait as good/Total no. of households who rated traits as good*100%.

Table 12.12.2. *Preferred goat traits by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%*	No.	%	No.	%	No.	%	No.	%
No. of households	408		879		997		716		3000	
Meat	342	83.8	662	75.3	705	70.7	459	64.1	2168	72.3
Size	293	71.8	548	62.3	623	62.5	510	71.2	1974	65.8
Coat colour	276	67.6	522	59.4	658	66.0	478	66.8	1934	64.5
Growth rate	292	71.6	459	52.2	548	55.0	483	67.5	1782	59.4
Fertility	275	67.4	435	49.5	549	55.1	502	70.1	1761	58.7
Heat tolerance	266	65.2	446	50.7	504	50.6	398	55.6	1614	53.8
Drought	226	55.4	489	55.6	467	46.8	409	57.1	1591	53.0
Temperament	285	69.9	368	41.9	527	52.9	322	45.0	1502	50.1
Distance	256	62.7	388	44.1	431	43.2	346	48.3	1421	47.4
Longevity	226	55.4	386	43.9	433	43.4	347	48.5	1392	46.4
Cold tolerance	142	34.8	212	24.1	308	30.9	193	27.0	8552	28.5
Horns	155	38.0	183	20.8	236	23.7	208	29.1	7822	26.1
Milk yield	183	44.9	200	22.8	214	21.5	163	22.8	7602	25.3
Disease tolerance	92	22.5	218	24.8	260	26.1	179	25.0	7492	25.0
Others	4	0.9	5	0.5	2	0.2	1	0.1	12	0.4

* Percent = No. of households rating a given trait as good/Total no. of households who rated traits as good*100%.

Table 12.12.3. *Preferred goat traits by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	2477		339		184		3000	
Meat	1705	68.8	286	84.4	177	96.2	2168	72.3
Size	1558	62.9	247	72.9	169	91.8	1974	65.8
Coat colour	1582	63.9	222	65.5	130	70.7	1934	64.5
Growth rate	1411	57.0	233	68.7	138	75.0	1782	59.4
Fertility	1379	55.7	243	71.7	139	75.5	1761	58.7
Heat tolerance	1300	52.5	227	67.0	87	47.3	1614	53.8
Drought	1174	47.4	287	84.7	130	70.7	1591	53.0
Temperament	1191	48.1	198	58.4	113	61.4	1502	50.1
Distance	1060	42.8	246	72.6	115	62.5	1421	47.4
Longevity	1128	45.5	177	52.2	87	47.3	1392	46.4
Cold tolerance	665	26.8	123	36.3	67	36.4	855	28.5
Horns	576	23.3	141	41.6	65	35.3	782	26.1
Milk yield	437	17.6	194	57.2	129	70.1	760	25.3
Disease tolerance	591	23.9	124	36.6	34	18.5	749	25.0
Others	4	0.2	4	1.2	4	2.2	12	0.4

* Percent = No. of HHs rating a given trait as 'good'/Total no. of HHs who rated traits as good*100%.

Table 12.12.4. *Criteria used to choose breeding buck by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	321		783		513		1617	
Body size	314	97.8	733	93.6	466	90.8	1513	93.6
Colour	258	80.4	627	80.1	368	71.7	1253	77.5
Horns	38	11.8	81	10.3	72	14.0	191	11.8
Temperament	133	41.4	425	54.3	263	51.3	821	50.8
Availability	6	1.9	24	3.1	37	7.2	67	4.1
Performance	181	56.4	389	49.7	280	54.6	850	52.6

Table 12.12.5. *Criteria used to choose breeding buck by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	212		491		563		351		1617	
Body size	195	92.0	453	92.3	528	93.8	337	96.0	1513	93.6
Colour	143	67.5	360	73.3	449	79.8	301	85.8	1253	77.5
Horns	20	9.4	48	9.8	78	13.9	45	12.8	191	11.8
Temperament	122	57.5	267	54.4	301	53.5	131	37.3	821	50.8
Availability	9	4.2	28	5.7	17	3.0	13	3.7	67	4.1
Performance	132	62.3	266	54.2	275	48.8	177	50.4	850	52.6

Table 12.12.6. *Criteria used to choose breeding buck by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	1422		124		56		1602	
Body size	1337	94.0	108	87.1	53	94.6	1498	93.5
Colour	1123	79.0	79	63.7	39	69.6	1241	77.5
Horns	178	12.5	9	7.3	2	3.6	189	11.8
Temperament	748	52.6	43	34.7	24	42.9	815	50.9
Availability	44	3.1	18	14.5	5	8.9	67	4.2
Performance	709	49.9	96	77.4	38	67.9	843	52.6

Table 12.12.7. *Primary criteria used to choose breeding buck by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
Body size	314	57.0	733	53.3	466	62.9	1513	57.0
Colour	258	10.1	627	12.4	368	10.6	1253	11.4
Horns	38	7.9	81	3.7	72	8.3	191	6.3
Temperament	133	14.3	425	18.8	263	5.3	821	13.8
Availability	6	66.7	24	29.2	37	37.8	67	37.3
Performance	181	50.3	389	57.3	280	50.7	850	53.6
Overall	930	34.6	2279	34.3	1486	34.2	4695	34.3

Table 12.12.8. *Primary criteria used to choose breeding buck by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
Body size	195	50.8	453	63.4	528	56.8	337	52.5	1513	57.0
Colour	143	9.1	360	9.4	449	13.6	301	11.6	1253	11.4
Horns	20	0.0	48	8.3	78	6.4	45	6.7	191	6.3
Temperament	122	13.1	267	12.4	301	16.6	131	10.7	821	13.8
Availability	9	88.9	28	7.1	17	64.7	13	30.8	67	37.3
Performance	132	55.3	266	49.2	275	48.0	177	67.8	850	53.6
Overall	621	33.7	1422	34.5	1648	33.9	1004	35.2	4695	34.3

Table 12.12.9. *Primary criteria used to choose breeding buck by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
Body size	1337	56.9	108	44.4	53	77.4	1498	56.7
Colour	1123	12.3	79	3.8	39	2.6	1241	11.4
Horns	178	6.7	9	0.0	2	0.0	189	6.3
Temperament	748	15.1	43	0.0	24	0.0	815	13.9
Availability	44	36.4	18	50.0	5	0.0	67	37.3
Performance	709	53.2	96	66.7	38	36.8	843	54.0
Overall	4139	34.2	353	35.1	161	34.8	4653	34.3

Table 12.12.10. *Criteria used for the disposal of goats by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	121		281		163		565	
Body size	51	42.1	95	33.8	58	35.6	204	36.1
Colour	22	18.2	34	12.1	23	14.1	79	14.0
Character	37	30.6	74	26.3	58	35.6	169	29.9
Poor health	48	39.7	92	32.7	56	34.4	196	34.7
Body condition	12	9.9	51	18.1	34	20.9	97	17.2
Performance	15	12.4	103	36.7	54	33.1	172	30.4
Old age	86	71.1	165	58.7	104	63.8	355	62.8
Low fertility	64	52.9	83	29.5	58	35.6	205	36.3

Table 12.12.11. *Criteria used for the disposal of goats by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	78		183		251		53		565	
Body size	34	43.6	90	49.2	65	25.9	15	28.3	204	36.1
Colour	13	16.7	20	10.9	33	13.1	13	24.5	79	14.0
Character	42	53.8	52	28.4	71	28.3	4	7.5	169	29.9
Poor health	22	28.2	65	35.5	98	39.0	11	20.8	196	34.7
Body condition	6	7.7	44	24.0	28	11.2	19	35.8	97	17.2
Performance	10	12.8	54	29.5	88	35.1	20	37.7	172	30.4
Old age	67	85.9	108	59.0	150	59.8	30	56.6	355	62.8
Low fertility	38	48.7	55	30.1	88	35.1	24	45.3	205	36.3

Table 12.12.12. *Criteria used for the disposal of goats by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	499		14		44		557	
Body size	177	35.5	9	64.3	18	40.9	204	36.6
Colour	77	15.4	0	0.0	2	4.5	79	14.2
Character	145	29.1	3	21.4	17	38.6	165	29.6
Poor health	173	34.7	4	28.6	15	34.1	192	34.5
Body condition	86	17.2	4	28.6	7	15.9	97	17.4
Performance	161	32.3	3	21.4	4	9.1	168	30.2
Old age	307	61.5	7	50.0	36	81.8	350	62.8
Low fertility	176	35.3	3	21.4	26	59.1	205	36.8

Table 12.12.13. *Primary criteria used for the disposal of goats by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Choice traits	No.	%	No.	%	No.	%	No.	%
Body size	51	35.3	95	27.4	58	36.2	204	31.9
Colour	22	18.2	34	17.6	23	4.3	79	13.9
Character	37	8.1	74	18.9	58	17.2	169	16.0
Poor health	48	31.3	92	48.9	56	39.3	196	41.8
Body condition	12	0.0	51	7.8	34	26.5	97	13.4
Performance	15	46.7	103	55.3	54	51.9	172	53.5
Old age	86	62.8	165	44.8	104	53.8	355	51.8
Low fertility	64	29.7	83	57.8	58	27.6	205	40.5
Overall	335	35.8	697	39.3	445	36.6	1477	37.7

Table 12.12.14. *Primary criteria used for the disposal of goats by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
Body size	34	20.6	90	26.7	65	40.0	15	53.3	204	31.9
Colour	13	7.7	20	5.0	33	21.2	13	15.4	79	13.9
Character	42	21.4	52	11.5	71	15.5	4	25.0	169	16.0
Poor health	22	22.7	65	41.5	98	44.9	11	54.5	196	41.8
Body condition	6	16.7	44	15.9	28	14.3	19	5.3	97	13.4
Performance	10	60.0	54	44.4	88	62.5	20	35.0	172	53.5
Old age	67	61.2	108	54.6	50	46	30	50.0	355	51.8
Low fertility	38	18.4	55	50.9	88	39.8	24	54.2	205	40.5
Overall	232	33.2	488	36.1	621	40.4	136	39.0	1477	37.7

Table 12.12.15. *Primary criteria used for the disposal of goats by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
Body size	177	29.9	9	55.6	18	38.9	204	31.9
Colour	77	14.3	0	0.0	2	0.0	79	13.9
Character	145	17.2	3	0.0	17	5.9	165	15.8
Poor health	173	43.4	4	25.0	15	13.3	192	40.6
Body condition	86	14.0	4	0.0	7	14.3	97	13.4
Performance	161	53.4	3	66.7	4	50.0	168	53.6
Old age	307	50.5	7	57.1	36	66.7	350	52.3
Low fertility	176	42.6	3	66.7	26	23.1	205	40.5
Overall	1302	37.8	33	42.4	125	34.4	1460	37.6

12.13 Sale of goats

Across AEZs, livestock densities and production systems, goats were reportedly sold during the 12 months prior to the survey mostly directly in the local markets and only about one-fourth of the households had experienced selling goats via traders/butchers in fairly similar patterns (Table 12.13.1).

Table 12.13.1. *Market outlets for sale of goats.*

	No. of	Market		Local/traders	
Categories	households	No.	%	No.	%
Agro-ecological zones					
Dega	312	304	97.4	85	27.2
Weinadega	727	699	96.1	177	24.3
Kolla	416	392	94.2	80	19.2
Sub-total	1455	1395	95.9	342	23.5
Livestock densities					
Low	174	170	97.7	32	18.4
Medium	455	445	97.8	140	30.8
High	508	475	93.5	146	28.7
Very high	318	305	95.9	24	7.5
Sub-total	1455	1395	95.9	342	23.5
Production systems					
Crop–livestock	1261	1206	95.6	302	23.9
Agro-pastoral	122	120	98.4	19	15.6
Pastoral	61	60	98.4	19	31.1
Sub-total	1444	1386	96.0	340	23.5
Total	1455	1395	95.9	342	23.5

The reported reasons for selling goats are summarised in Table 12.13.2. Irrespective of the AEZs, livestock densities and production systems, goats are sold mostly for cash. In only 16% of the cases, goats were sold for culling and disposal reasons.

Table 12.13.2. *Reported reason for selling goats.*

Categories	No. of households	Cash		Culling/disposal		Both	
		No.	%	No.	%	No.	%
Agro-ecological zones							
Dega	320	317	99.1	56	17.5	53	16.6
Weinadega	737	728	98.8	145	19.7	136	18.5
Kolla	421	418	99.3	40	9.5	37	8.8
Sub-total	1478	1463	99.0	241	16.3	226	15.3
Livestock densities							
Low	175	175	100.0	20	11.4	20	11.4
Medium	460	458	99.6	95	20.7	93	20.2
High	514	503	97.9	106	20.6	95	18.5
Very high	329	327	99.4	20	6.1	18	5.5
Sub-total	1478	1463	99.0	241	16.3	226	15.3
Production systems							
Crop–livestock	1281	1269	99.1	223	17.4	211	16.5
Agro-pastoral	125	122	97.6	5	4.0	2	1.6
Pastoral	61	61	100.0	10	16.4	10	16.4
Sub-total	1467	1452	99.0	238	16.2	223	15.2
Overall reasons of sell	1478	1463	99.0	241	16.3	226	15.3

13 Secondary species

13.1 Chicken

A total of 3231 households, or about 59% of the total sample across Oromiya Regional State, maintain chicken for various purposes. The number of chicken in current holdings of these households was about 20 thousand birds, which gives an average holding of 6.2 chickens per household. The ownership ratio across administrative zones varies from 32% in East Hararge to 81% in West Wellega (Table 9.1.1).

13.1.1 Purposes of keeping chickens

Chickens are mainly kept for egg (females), reproduction, meat, income and savings. Egg production appears to be not a major reason for keeping male chickens. Other purposes of keeping chickens include socio-cultural role (dowry, ceremonies, wealth status), manure and feathers (Tables 13.1.1a, b and c). The relative importance of each of the purposes is generally similar across AEZs, livestock densities and production systems, except in the cases of income and meat production. The role of chicken in income generation was more emphasised in crop–livestock and agro-pastoral areas than in pastoral areas, and in medium to high livestock density areas than in low livestock density areas, where instead meat production was rated better. Similarly, pastoral areas have less frequent socio-cultural reasons for keeping chickens, as these appear to be better served by other livestock species.

Table 13.1.1a. *Purposes of keeping chickens by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	633		1725		794		3152	
Male chickens								
Reproduction	469	74.1	1400	81.2	671	84.5	2540	80.6
Meat	515	81.4	1281	74.3	562	70.8	2358	74.8
Income	391	61.8	1173	68	519	65.4	2083	66.1
Savings	135	21.3	372	21.6	195	24.6	702	22.3
Dowry	43	6.8	190	11.0	67	8.4	300	9.5
Manure	51	8.1	85	4.9	34	4.3	170	5.4
Eggs	46	7.3	49	2.8	32	4.0	127	4.0
Ceremonies	18	2.8	29	1.7	31	3.9	78	2.5
Feathers	12	1.9	18	1.0	22	2.8	52	1.6
Others	3	0.5	4	0.2	10	1.3	17	0.5
Wealth status	1	0.2	9	0.5	4	0.5	14	0.4
Female chickens								
Eggs	582	91.9	1592	92.3	738	92.9	2912	92.4
Reproduction	521	82.3	1526	88.5	666	83.9	2713	86.1
Income	341	53.9	1154	66.9	449	56.5	1944	61.7
Meat	202	31.9	474	27.5	239	30.1	915	29.0
Savings	94	14.8	225	13.0	91	11.5	410	13.0
Dowry	14	2.2	57	3.3	24	3.0	95	3.0
Manure	16	2.5	35	2.0	21	2.6	72	2.3
Feathers	7	1.1	16	0.9	15	1.9	38	1.2
Ceremonies	8	1.3	18	1.0	10	1.3	36	1.1
Others	3	0.5	4	0.2	8	1.0	15	0.5
Wealth status	0	–	3	0.2	2	0.3	5	0.2

Table 13.1.1b. *Purposes of keeping chickens by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	295		1098		1116		643		3152	
Male chickens										
Reproduction	250	84.7	949	86.4	866	77.6	475	73.9	2540	80.6
Meat	224	75.9	885	80.6	873	78.2	376	58.5	2358	74.8
Income	171	58.0	785	71.5	678	60.8	449	69.8	2083	66.1
Savings	57	19.3	251	22.9	274	24.6	120	18.7	702	22.3
Dowry	13	4.4	113	10.3	91	8.2	83	12.9	300	9.5
Manure	10	3.4	49	4.5	88	7.9	23	3.6	170	5.4
Eggs	6	2.0	5	0.5	51	4.6	65	10.1	127	4.0
Ceremonies	23	7.8	13	1.2	27	2.4	15	2.3	78	2.5
Feathers	4	1.4	11	1.0	27	2.4	10	1.6	52	1.6
Others	10	3.4	3	0.3	1	0.1	3	0.5	17	0.5
Wealth status	0	0.0	3	0.3	9	0.8	2	0.3	14	0.4
Female chickens										
Eggs	277	93.9	1004	91.4	1026	91.9	605	94.1	2912	92.4
Reproduction	251	85.1	969	88.3	943	84.5	550	85.5	2713	86.1
Income	164	55.6	736	67.0	616	55.2	428	66.6	1944	61.7
Meat	111	37.6	324	29.5	344	30.8	136	21.2	915	29.0
Savings	24	8.1	146	13.3	169	15.1	71	11.0	410	13.0
Dowry	10	3.4	32	2.9	36	3.2	17	2.6	95	3.0
Manure	9	3.1	22	2.0	33	3.0	8	1.2	72	2.3
Feathers	6	2.0	9	0.8	18	1.6	5	0.8	38	1.2
Ceremonies	7	2.4	7	0.6	13	1.2	9	1.4	36	1.1
Others	7	2.4	3	0.3	1	0.1	4	0.6	15	0.5
Wealth status	0	0.0	1	0.1	3	0.3	1	0.2	5	0.2

Table 13.1.1c. *Purposes of keeping chickens by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	2944		192		7		3143	
Male chickens								
Reproduction	2367	80.4	160	83.3	6	85.7	2533	80.6
Meat	2210	75.1	135	70.3	6	85.7	2351	74.8
Income	1970	66.9	105	54.7	2	28.6	2077	66.1
Savings	623	21.2	77	40.1	1	14.3	701	22.3
Dowry	297	10.1	2	1.0	0	0.0	299	9.5
Manure	168	5.7	1	0.5	0	0.0	169	5.4
Eggs	105	3.6	22	11.5	0	0.0	127	4.0
Ceremonies	74	2.5	4	2.1	0	0.0	78	2.5
Feathers	50	1.7	2	1.0	0	0.0	52	1.7
Others	12	0.4	4	2.1	1	14.3	17	0.5
Wealth status	10	0.3	4	2.1	0	0.0	14	0.4
Female chickens								
Eggs	2715	92.2	181	94.3	7	100.0	2903	92.4
Reproduction	2568	87.2	131	68.2	5	71.4	2704	86.0
Income	1837	62.4	99	51.6	1	14.3	1937	61.6
Meat	853	29.0	56	29.2	4	57.1	913	29.0
Savings	361	12.3	48	25.0	1	14.3	410	13.0
Dowry	93	3.2	2	1.0	0	0.0	95	3.0
Manure	71	2.4	1	0.5	0	0.0	72	2.3
Feathers	35	1.2	3	1.6	0	0.0	38	1.2
Ceremonies	32	1.1	4	2.1	0	0.0	36	1.1
Others	11	0.4	3	1.6	1	14.3	15	0.5
Wealth status	4	0.1	1	0.5	0	0.0	5	0.2

13.1.2 Number and types of chicken maintained

A total of 3231 sampled households from across the different categories of AEZs, livestock densities and production systems had a current total holding of about 20 thousand chickens with an overall average flock size per household of 6.2 chickens. Indigenous chickens constitute 95% of this population in the region while the remaining 5% are various crosses with introduced exotic chickens. It is important to note that crossbred chickens are found in all AEZs and production systems, but their proportion is nearly double in the *dega* AEZ and high livestock density areas compared to that of the *kolla* AEZ and low livestock density areas (Table 13.1.2).

Table 13.1.2. *Total current holding and breed type of chicken by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Chicken type			
		Indigenous		Cross	
		No.	%	No.	%
Agro-ecological zones					
Dega	670	4049	92.1	348	7.9
Weinadega	1754	10097	95.1	523	4.9
Kolla	807	5797	97.0	180	3.0
Total	3231	19943	95.0	1051	5.0
Livestock densities					
Low	315	1700	97.0	53	3.0
Medium	1105	7059	97.9	154	2.1
High	1159	6777	93.1	501	6.9
Very high	652	4407	92.8	343	7.2
Total	3231	19,943	95.0	1051	5.0
Production systems					
Crop–livestock	3028	18,417	95.1	951	4.9
Agro-pastoral	195	1480	94.0	95	6.0
Pastoral	8	46	90.2	5	9.8
Total	3231	19943	95.0	1051	5.0

13.1.3 Chicken trait preferences

Farmers' preferences for chicken traits were assessed based on their evaluation of certain chicken traits as 'not important', 'poor', 'average' and 'good'. The more preferred traits, that were considered good by at least 40% of the households are: meat quality, body size, scavenging ability, growth rate, broodiness, contributions to fly control, fertility, egg production and temperament. The less preferred traits were appearance of feathers, disease tolerance, appearance of the neck, longevity, heat and cold tolerances. These patterns are generally consistent across AEZs, livestock density categories and production systems (Tables 13.1.3a, b and c). Some notable exceptions are the higher than average preference for body size in pastoral and agro-pastoral areas and the low preference for meat quality in pastoral areas. The contribution of chicken in fly control received higher emphasis in low livestock density areas.

Table 13.1.3a. *Traits of chickens considered as good by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	650		1705		770		3125	
Meat quality	452	69.5	1229	72.1	588	76.4	2269	72.6
Body size	399	61.4	813	47.7	447	58.1	1659	53.1
Scavenging ability	358	55.1	826	48.4	440	57.1	1624	52.0
Growth rate	343	52.8	699	41.0	404	52.5	1446	46.3
Broodiness	294	45.2	791	46.4	360	46.8	1445	46.2
Fly control	260	40.0	770	45.2	408	53.0	1438	46.0
Fertility	309	47.5	709	41.6	400	51.9	1418	45.4
Egg production	300	46.2	749	43.9	343	44.5	1392	44.5
Character	314	48.3	673	39.5	398	51.7	1385	44.3
Heat tolerance	216	33.2	528	31.0	401	52.1	1145	36.6
Cold tolerance	253	38.9	357	20.9	261	33.9	871	27.9
Comb	202	31.1	374	21.9	173	22.5	749	24.0
Longevity	172	26.5	320	18.8	250	32.5	742	23.7
Neck appearance	146	22.5	260	15.2	145	18.8	551	17.6
Feathers/appearance	147	22.6	219	12.8	147	19.1	513	16.4
Disease tolerance	80	12.3	147	8.6	184	23.9	411	13.2
Feathers/ornaments	61	9.4	109	6.4	93	12.1	263	8.4
Others	1	<1.0	0	0.0	0	0.0	1	<1.0

Table 13.1.3b. *Traits of chickens considered as good by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	293		1079		1105		648		3125	
Meat quality	224	76.5	874	81.0	792	71.7	379	58.5	2269	72.6
Body size	156	53.2	564	52.3	613	55.5	326	50.3	1659	53.1
Scavenging ability	184	62.8	564	52.3	479	43.3	397	61.3	1624	52.0
Growth rate	132	45.1	466	43.2	529	47.9	319	49.2	1446	46.3
Broodiness	139	47.4	502	46.5	463	41.9	341	52.6	1445	46.2
Fly control	190	64.8	502	46.5	465	42.1	281	43.4	1438	46.0
Fertility	136	46.4	480	44.5	497	45.0	305	47.1	1418	45.4
Egg production	122	41.6	443	41.1	565	51.1	262	40.4	1392	44.5
Character	189	64.5	454	42.1	486	44.0	256	39.5	1385	44.3
Heat tolerance	142	48.5	372	34.5	369	33.4	262	40.4	1145	36.6
Cold tolerance	105	35.8	237	22.0	336	30.4	193	29.8	871	27.9
Comb	35	11.9	170	15.8	305	27.6	239	36.9	749	24.0
Longevity	66	22.5	247	22.9	245	22.2	184	28.4	742	23.7
Neck appearance	28	9.6	131	12.1	195	17.6	197	30.4	551	17.6

cont'd...

Table 13.1.3b. cont'd

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
Feathers/appearance	31	10.6	129	12	215	19.5	138	21.3	513	16.4
Disease tolerance	42	14.3	117	10.8	168	15.2	84	13	411	13.2
Feathers/ornaments	35	11.9	61	5.7	85	7.7	82	12.7	263	8.4
Others	1	<1.0	0	0.0	0	0.0	0	0.0	1	<1.0

Table 13.1.3c. *Traits of chickens considered as good by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	2921		196		8		3125	
Meat quality	2122	72.6	144	73.5	3	37.5	2269	72.6
Body size	1523	52.1	129	65.8	7	87.5	1659	53.1
Scavenging ability	1493	51.1	127	64.8	4	50.0	1624	52.0
Growth rate	1326	45.4	115	58.7	5	62.5	1446	46.3
Broodiness	1311	44.9	130	66.3	4	50.0	1445	46.2
Fly control	1330	45.5	106	54.1	2	25.0	1438	46.0
Fertility	1282	43.9	130	66.3	6	75.0	1418	45.4
Egg production	1265	43.3	124	63.3	3	37.5	1392	44.5
Character	1298	44.4	85	43.4	2	25.0	1385	44.3
Heat tolerance	1033	35.4	109	55.6	3	37.5	1145	36.6
Cold tolerance	795	27.2	73	37.2	3	37.5	871	27.9
Comb	700	24.0	49	25.0	0	0.0	749	24.0
Longevity	657	22.5	83	42.3	2	25.0	742	23.7
Neck appearance	498	17.0	52	26.5	1	12.5	551	17.6
Feathers/appearance	467	16.0	45	23.0	1	12.5	513	16.4
Disease tolerance	342	11.7	68	34.7	1	12.5	411	13.2
Feathers/ornaments	239	8.2	24	12.2	0	0.0	263	8.4
Others	1	<1.0	0	0.0	0	0.0	1	<1.0

13.2 Donkeys

Donkeys are maintained by an overall average of 46% of the households across zones in the Oromiya Regional State, with ownership ratios at zone level ranging from 7% in Illubabor to 86% in East Shewa (Table 9.1.1). Current total holdings of donkeys by the sampled 2477 households were 4918, which give an average holding per household of about 2 donkeys.

13.2.1 Purposes of keeping donkeys

Donkeys are kept for traction (transport, work), income, reproduction, manure, savings and socio-cultural purposes (wealth status, dowry, ceremonies), with some differences between the sexes. Female donkeys are kept mainly for reproduction, transport and income whereas male donkeys are used for transport, work and income. There was some variation in the relative importance of those purposes of keeping donkeys between AEZs and production systems, particularly for transport, work and reproduction (Tables 13.2.1a, b and c).

Table 13.2.1a. *Purposes of keeping donkeys by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	464		1114		719		2297	
Male donkeys								
Transport	212	45.7	546	49.0	473	65.8	1231	53.6
Work/draft	296	63.8	408	36.6	233	32.4	937	40.8
Income	202	43.5	433	38.9	257	35.7	892	38.8
Reproduction	196	42.2	373	33.5	270	37.6	839	36.5
Manure	59	12.7	224	20.1	96	13.4	379	16.5
Savings	34	7.3	172	15.4	107	14.9	313	13.6
Wealth status	17	3.7	60	5.4	42	5.8	119	5.2
Dowry	2	0.4	6	0.5	5	0.7	13	0.6
Ceremonies	1	0.2	3	0.3	1	0.1	5	0.2
Others	0	0.0	0	0.0	1	0.1	1	0.0
Female donkeys								
Reproduction	327	70.5	684	61.4	398	55.4	1409	61.3
Transport	184	39.7	482	43.3	371	51.6	1037	45.1
Income	172	37.1	459	41.2	210	29.2	841	36.6
Manure	40	8.6	142	12.7	58	8.1	240	10.4
Savings	23	5.0	137	12.3	58	8.1	218	9.5
Wealth status	7	1.5	48	4.3	41	5.7	96	4.2
Dowry	2	0.4	6	0.5	7	1.0	15	0.7
Ceremonies	0	0.0	1	0.1	2	0.3	3	0.1
Others	0	0.0	0	0.0	1	0.1	1	0.0

Table 13.2.1b. *Purposes of keeping donkeys by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	171		677		747		702		2297	
Male donkeys										
Transport	113	66.1	323	47.7	388	51.9	407	58.0	1231	53.6
Work/draft	53	31.0	263	38.8	356	47.7	265	37.7	937	40.8
Income	29	17.0	280	41.4	274	36.7	309	44.0	892	38.8
Reproduction	81	47.4	286	42.2	214	28.6	258	36.8	839	36.5
Manure	22	12.9	120	17.7	142	19.0	95	13.5	379	16.5
Savings	28	16.4	128	18.9	76	10.2	81	11.5	313	13.6
Wealth status	17	9.9	27	4.0	31	4.1	44	6.3	119	5.2
Dowry	0	0.0	4	0.6	1	0.1	8	1.1	13	0.6
Ceremonies	0	0.0	2	0.3	2	0.3	1	0.1	5	0.2
Others	1	0.6	0	0.0	0	0.0	0	0.0	1	0.0
Female donkeys										
Reproduction	97	56.7	440	65.0	459	61.4	413	58.8	1409	61.3
Transport	71	41.5	307	45.3	349	46.7	310	44.2	1037	45.1
Income	28	16.4	280	41.4	241	32.3	292	41.6	841	36.6
Manure	6	3.5	68	10.0	96	12.9	70	10.0	240	10.4
Savings	24	14.0	77	11.4	51	6.8	66	9.4	218	9.5
Wealth status	10	5.8	24	3.5	23	3.1	39	5.6	96	4.2
Dowry	0	0.0	5	0.7	4	0.5	6	0.9	15	0.7
Ceremonies	0	0.0	0	0.0	1	0.1	2	0.3	3	0.1
Others	1	0.6	0	0.0	0	0.0	0	0.0	1	0.0

Table 13.2.1c. *Purposes of keeping donkeys by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	1992		252		51		2295	
Male donkeys								
Transport	1031	51.8	156	61.9	42	82.4	1229	53.6
Work/draft	806	40.5	100	39.7	29	56.9	935	40.7
Income	783	39.3	103	40.9	4	7.8	890	38.8
Reproduction	687	34.5	131	52.0	21	41.2	839	36.6
Manure	377	18.9	2	0.8	0	0.0	379	16.5
Savings	249	12.5	63	25.0	1	2.0	313	13.6
Wealth status	95	4.8	9	3.6	15	29.4	119	5.2
Dowry	7	0.4	6	2.4	0	0.0	13	0.6
Ceremonies	5	0.3	0	0.0	0	0.0	5	0.2
Others	0	0.0	1	0.4	0	0.0	1	0.0

cont'd...

Table 13.2.1c. cont'd.

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
Female donkeys								
Reproduction	1217	61.1	163	64.7	28	54.9	1408	61.4
Transport	857	43.0	152	60.3	27	52.9	1036	45.1
Income	732	36.7	107	42.5	2	3.9	841	36.6
Manure	228	11.4	12	4.8	0	0.0	240	10.5
Savings	151	7.6	66	26.2	1	2.0	218	9.5
Wealth status	82	4.1	5	2.0	9	17.6	96	4.2
Dowry	8	0.4	7	2.8	0	0.0	15	0.7
Ceremonies	3	0.2	0	0.0	0	0.0	3	0.1
Others	0	0.0	1	0.4	0	0.0	1	0.0

13.2.2 Number and types of donkeys

The 2477 sample donkey-owning households had current total holding of 4918 donkeys, or an average of about 2 donkeys per household. Nearly all of these donkeys are identified as local-type donkeys, and only 0.3% are recognised as crosses between the local and other breed types (Table 13.2.2). The table shows the number and percent by type/breeds of donkeys. It can be seen from the table that almost all donkeys are indigenous to the localities.

Table 13.2.2. *Total current holdings and breed types of donkeys by agro-ecological zones, livestock densities and production systems.*

		Donkey type			
		Local		Cross	
Categories	No. of households	No.	%	No.	%
Agro-ecological zones					
Dega	508	1195	99.2	10	0.8
Weinadega	1163	2280	100.0	0	0.0
Kolla	806	1430	99.8	3	0.2
Total	2477	4904	99.7	14	0.3
Livestock densities					
Low	219	389	100.0	0	0.0
Medium	693	1289	99.8	2	0.2
High	806	1543	99.9	2	0.1
Very high	759	1683	99.4	10	0.6
Total	2477	4904	99.7	14	0.3
Production systems					
Crop–livestock	2149	4096	99.7	11	0.3
Agro-pastoral	261	673	99.7	2	0.3
Pastoral	67	135	99.3	1	0.7
Total	2477	4904	99.7	14	0.3

13.2.3 Donkey trait preferences

Farmers' preferences for donkey traits were assessed based on their evaluation of certain selected traits as 'not important', 'poor', 'average' and 'good'. Traits regarded by farmers as good by about half of the respondents are temperament, longevity, growth rate, body size, cold tolerance, drought tolerance and traction power. Traits like heat tolerance, disease tolerance, fertility, coat colour and walkability were rated as good by generally low proportion of the households. This general pattern applies across all AEZs, livestock density categories and production systems, except that some adaptability traits particularly temperament, longevity, growth rate, body size and drought tolerance were rated higher in pastoral than in crop–livestock or agro-pastoral areas (Tables 13.2.3a, b and c).

Table 13.2.3a. *Traits of donkeys considered as good by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	509		1171		810		2490	
Temperament	392	77.0	899	76.8	709	87.5	2000	80.3
Longevity	403	79.2	790	67.5	594	73.3	1787	71.8
Growth rate	353	69.4	782	66.8	540	66.7	1675	67.3
Body size	300	58.9	700	59.8	525	64.8	1525	61.2
Cold tolerance	335	65.8	629	53.7	461	56.9	1425	57.2
Drought tolerance	285	56.0	538	45.9	446	55.1	1269	51.0
Work/draft	255	50.1	513	43.8	465	57.4	1233	49.5
Walkability	276	54.2	449	38.3	339	41.9	1064	42.7
Colour	189	37.1	489	41.8	380	46.9	1058	42.5
Fertility	235	46.2	443	37.8	364	44.9	1042	41.8
Disease tolerance	196	38.5	339	28.9	256	31.6	791	31.8
Heat tolerance	176	34.6	274	23.4	284	35.1	734	29.5
Others	0	0.0	2	0.2	0	0.0	2	0.1

Table 13.2.3b. *Traits of donkeys considered as good by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	211		693		803		783		2490	
Temperament	179	84.8	569	82.1	608	75.7	644	82.2	2000	80.3
Longevity	150	71.1	525	75.8	627	78.1	485	61.9	1787	71.8
Growth rate	180	85.3	478	69.0	517	64.4	500	63.9	1675	67.3
Body size	133	63.0	468	67.5	414	51.6	510	65.1	1525	61.2
Cold tolerance	124	58.8	384	55.4	431	53.7	486	62.1	1425	57.2
Drought tolerance	116	55.0	361	52.1	383	47.7	409	52.2	1269	51.0
Work/draft	123	58.3	300	43.3	425	52.9	385	49.2	1233	49.5
Walkability	99	46.9	245	35.4	351	43.7	369	47.1	1064	42.7
Colour	84	39.8	272	39.2	294	36.6	408	52.1	1058	42.5
Fertility	99	46.9	291	42.0	288	35.9	364	46.5	1042	41.8
Disease tolerance	69	32.7	218	31.5	217	27.0	287	36.7	791	31.8
Heat tolerance	64	30.3	186	26.8	261	32.5	223	28.5	734	29.5
Others	0	0.0	0	0.0	2	0.2	0	0.0	2	0.1

Table 13.2.3c. *Traits of donkeys considered as good by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	2153		270		67		2490	
Temperament	1682	78.1	253	93.7	65	97.0	2000	80.3
Longevity	1538	71.4	188	69.6	61	91.0	1787	71.8
Growth rate	1432	66.5	192	71.1	51	76.1	1675	67.3
Body size	1282	59.5	193	71.5	50	74.6	1525	61.2
Cold tolerance	1214	56.4	179	66.3	32	47.8	1425	57.2
Drought tolerance	1054	49.0	166	61.5	49	73.1	1269	51.0
Work/draft	1051	48.8	154	57.0	28	41.8	1233	49.5
Walkability	891	41.4	147	54.4	26	38.8	1064	42.7
Colour	908	42.2	132	48.9	18	26.9	1058	42.5
Fertility	883	41.0	134	49.6	25	37.3	1042	41.8
Disease tolerance	673	31.3	101	37.4	17	25.4	791	31.8
Heat tolerance	635	29.5	84	31.1	15	22.4	734	29.5
Others	2	0.1	0	0.0	0	0.0	2	0.1

13.3 Horses

Horse ownership in the region is limited to only a quarter of the rural households, but there is a wide variation in the ownership ratio between the zones, from the very low ratios of 0.7 and 2.4% in West and East Hararge zones to high ratios of 59 and 48% in Arsi and West Shewa zones (Table 9.1.1).

13.3.1 Purposes of keeping horses

The reasons for keeping horses include, in their overall order of importance, transport, reproduction, income generation, work, manure use, savings and socio-cultural roles (wealth status, ceremonies and dowry), with a slight change in order when this is viewed separately between sexes. The relative importance of each of these purposes also varies between AEZs, livestock density categories and production systems (Tables 13.3.1a, b and c). For instance, higher proportions of the households in *dega* AEZ keep male horses for transport (89%) and females for reproduction (71%) than households in other AEZs. Similarly, male horses are rated higher for transport in the crop–livestock and agro-pastoral systems than in pastoral areas (but note that the sample size in the latter is far too small).

Table 13.3.1a. *Purpose of keeping horses by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	701		462		40		1203	
Male horses								
Transport	627	89.4	369	79.9	24	60.0	1020	84.8
Income	267	38.1	188	40.7	10	25.0	465	38.7
Work/draft	327	46.6	105	22.7	16	40.0	448	37.2
Reproduction	282	40.2	100	21.6	9	22.5	391	32.5
Manure	84	12.0	140	30.3	14	35.0	238	19.8
Savings	112	16.0	83	18.0	0	0.0	195	16.2
Wealth status	61	8.7	45	9.7	1	2.5	107	8.9
Ceremonies	21	3.0	33	7.1	0	0.0	54	4.5
Dowry	7	1.0	2	0.4	0	0.0	9	0.7
Female horses								
Reproduction	498	71.0	232	50.2	20	50.0	750	62.3
Transport	397	56.6	214	46.3	23	57.5	634	52.7
Manure	222	31.7	122	26.4	3	7.5	347	28.8
Savings	85	12.1	41	8.9	1	2.5	127	10.6
Wealth status	59	8.4	43	9.3	2	5.0	104	8.6
Dowry	37	5.3	8	1.7	2	5.0	47	3.9

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Table 13.3.1a. cont'd.

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
Ceremonies	7	1.0	1	0.2	0	0.0	8	0.7
Income	3	0.4	3	0.6	0	0.0	6	0.5
Others	0	0.0	1	0.2	0	0.0	1	0.1

Table 13.3.1b. *Purpose of keeping horses by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	76		339		491		297		1203	
Male horses										
Transport	64	84.2	269	79.4	438	89.2	249	83.8	1020	84.8
Income	14	18.4	156	46.0	191	38.9	104	35.0	465	38.7
Work/draft	22	28.9	74	21.8	236	48.1	116	39.1	448	37.2
Reproduction	34	44.7	101	29.8	155	31.6	101	34.0	391	32.5
Manure	5	6.6	79	23.3	119	24.2	35	11.8	238	19.8
Savings	25	32.9	57	16.8	75	15.3	38	12.8	195	16.2
Wealth status	19	25.0	24	7.1	21	4.3	43	14.5	107	8.9
Ceremonies	0	0.0	28	8.3	12	2.4	14	4.7	54	4.5
Dowry	1	1.3	2	0.6	0	0.0	6	2.0	9	0.7
Female horses										
Reproduction	55	72.4	209	61.7	306	62.3	180	60.6	750	62.3
Transport	53	69.7	176	51.9	219	44.6	186	62.6	634	52.7
Income	3	3.9	118	34.8	151	30.8	75	25.3	347	28.8
Savings	12	15.8	34	10.0	63	12.8	18	6.1	127	10.6
Manure	2	2.6	33	9.7	61	12.4	8	2.7	104	8.6
Wealth status	11	14.5	22	6.5	5	1.0	9	3.0	47	3.9
Ceremonies	0	0.0	0	0.0	5	1.0	3	1.0	8	0.7
Dowry	0	0.0	2	0.6	3	0.6	1	0.3	6	0.5
Others	0	0.0	1	0.3	0	0.0	0	0.0	1	0.1

Table 13.3.1c. *Purpose of keeping horses by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	1161		38		3		1202	
Male horses								
Transport	984	84.8	33	86.8	2	66.7	1019	84.8
Income	444	38.2	20	52.6	0	0.0	464	38.6
Work/draft	437	37.6	8	21.1	2	66.7	447	37.2
Reproduction	381	32.8	9	23.7	1	33.3	391	32.5
Manure	236	20.3	2	5.3	0	0.0	238	19.8

cont'd...

Table 13.3.1c. cont'd.

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
Savings	180	15.5	15	39.5	0	0.0	195	16.2
Wealth status	105	9.0	2	5.3	0	0.0	107	8.9
Ceremonies	49	4.2	5	13.2	0	0.0	54	4.5
Dowry	9	0.8	0	0.0	0	0.0	9	0.7
Female horses								
Reproduction	741	63.8	8	21.1	1	33.3	750	62.4
Transport	616	53.1	14	36.8	3	100.0	633	52.7
Income	341	29.4	5	13.2	0	0.0	346	28.8
Savings	121	10.4	6	15.8	0	0.0	127	10.6
Manure	103	8.9	1	2.6	0	0.0	104	8.7
Wealth status	45	3.9	0	0.0	2	66.7	47	3.9
Ceremonies	7	0.6	1	2.6	0	0.0	8	0.7
Dowry	6	0.5	0	0.0	0	0.0	6	0.5
Others	1	0.1	0	0.0	0	0.0	1	0.1

13.3.2 Age and sex structure of horses

A total of 1287 horse-owning households had an overall current holding of 3237 horses, i.e. an average of 2.5 horses per household. On average, three-quarters of these are adult male (40%) and adult female horses (35%). Even in the young stock, males have a slightly greater share (13.5%) than the females (11.5%) in the average stock. This general pattern also holds true when the population is viewed from the perspective of agro-ecological zones and livestock density categories (Table 13.3.2).

13.3.3 Horses trait preferences

Farmers' preferences for horse traits were assessed based on their evaluation of selected horse traits as 'not important', 'poor', 'average' and 'good'. The traits with the highest rates of preference, in their order of importance, are walkability, body size, temperament, coat colour, traction capacity, longevity and cold tolerance. In contrast, other traits like drought, disease and heat tolerances, fertility and growth rate were less preferred. There are some differences in farmers' preferences for some of the traits by AEZs, livestock densities and production systems (Tables 13.3.3a, b and c).

Table 13.3.2. *Age and sex composition of horse herds by agro-ecological zones, livestock densities and production systems.*

Categories	Number of households	Total horses	Horse types											
			Young male		Adult male		Young female		Adult female		Overall young		Overall adult	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Agro-ecological zones														
Dega	750	2249	317	14.1	840	37.3	280	12.4	812	36.1	597	26.5	1652	73.5
Weinadega	496	920	108	11.7	426	46.3	84	9.1	302	32.8	192	20.9	728	79.1
Kolla	41	68	11	16.2	24	35.3	9	13.2	24	35.3	20	29.4	48	70.6
Sub-total	1287	3237	436	13.5	1290	39.9	373	11.5	1138	35.2	809	25.0	2428	75.0
Livestock densities														
Low	88	272	37	13.6	108	39.7	42	15.4	85	31.3	79	29.0	193	71.0
Medium	350	752	108	14.4	310	41.2	75	10.0	259	34.4	183	24.3	569	75.7
High	537	1434	207	14.4	553	38.6	168	11.7	506	35.3	375	26.2	1059	73.8
Very high	312	779	84	10.8	319	40.9	88	11.3	288	37.0	172	22.1	607	77.9
Sub-total	1287	3237	436	13.5	1290	39.9	373	11.5	1138	35.2	809	25.0	2428	75.0
Production systems														
Crop–livestock	1244	3174	433	13.6	1251	39.4	369	11.6	1121	35.3	802	25.3	2372	74.7
Agro-pastoral	40	56	2	3.6	37	66.1	4	7.1	13	23.2	6	10.7	50	89.3
Pastoral	3	7	1	14.3	2	28.6	0	0.0	4	57.1	1	14.3	6	85.7
Sub-total	1287	3237	436	13.5	1290	39.9	373	11.5	1138	35.2	809	25.0	2428	75.0

Table 13.3.3a. *Traits of horses considered as good by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	737		493		46		1276	
Walkability	591	80.2	351	71.2	34	73.9	976	76.5
Body size	558	75.7	332	67.3	42	91.3	932	73.0
Temperament	515	69.9	374	75.9	36	78.3	925	72.5
Coat colour	472	64.0	343	69.6	38	82.6	853	66.8
Work/draft	482	65.4	242	49.1	30	65.2	754	59.1
Longevity	457	62.0	240	48.7	26	56.5	723	56.7
Cold tolerance	416	56.4	245	49.7	20	43.5	681	53.4
Growth rate	370	50.2	203	41.2	23	50.0	596	46.7
Fertility	273	37.0	137	27.8	30	65.2	440	34.5
Heat tolerance	279	37.9	139	28.2	17	37.0	435	34.1
Disease tolerance	169	22.9	80	16.2	22	47.8	271	21.2
Drought tolerance	119	16.1	102	20.7	15	32.6	236	18.5

Table 13.3.3b. *Traits of horses considered as good by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	91		346		519		320		1276	
Walkability	89	97.8	232	67.1	390	75.1	265	82.8	976	76.5
Body size	81	89.0	211	61.0	394	75.9	246	76.9	932	73.0
Temperament	67	73.6	236	68.2	423	81.5	199	62.2	925	72.5
Coat colour	29	31.9	211	61.0	418	80.5	195	60.9	853	66.8
Work/draft	49	53.8	180	52.0	334	64.4	191	59.7	754	59.1
Longevity	50	54.9	142	41.0	309	59.5	222	69.4	723	56.7
Cold tolerance	72	79.1	163	47.1	249	48.0	197	61.6	681	53.4
Growth rate	57	62.6	121	35.0	240	46.2	178	55.6	596	46.7
Fertility	31	34.1	95	27.5	166	32.0	148	46.3	440	34.5
Heat tolerance	72	79.1	56	16.2	130	25.0	177	55.3	435	34.1
Disease tolerance	22	24.2	37	10.7	139	26.8	73	22.8	271	21.2
Drought tolerance	26	28.6	76	22.0	77	14.8	57	17.8	236	18.5

Table 13.3.3c. *Traits of horses considered as good by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	1233		40		3		1276	
Walkability	938	76.1	35	87.5	3	100.0	976	76.5
Body size	897	72.7	33	82.5	2	66.7	932	73.0
Temperament	893	72.4	30	75.0	2	66.7	925	72.5
Coat colour	821	66.6	31	77.5	1	33.3	853	66.8
Work/draft	737	59.8	16	40.0	1	33.3	754	59.1
Longevity	699	56.7	24	60.0	0	0.0	723	56.7
Cold tolerance	658	53.4	23	57.5	0	0.0	681	53.4
Growth rate	577	46.8	19	47.5	0	0.0	596	46.7
Fertility	426	34.5	14	35.0	0	0.0	440	34.5
Heat tolerance	430	34.9	5	12.5	0	0.0	435	34.1
Disease tolerance	266	21.6	5	12.5	0	0.0	271	21.2
Drought tolerance	231	18.7	3	7.5	2	66.7	236	18.5

13.4 Mules

Only 8% of the study households in the region keep mules. West and East Hararge zones have the lowest zonal ownership ratios (0.5%), and Jimma and West Wellega have the highest ratios of 11 and 15%, respectively (Table 9.1.1). The 403 sample mule-owning households had an average of 1.2 mules, 52% of which are identified as female and the rest as male mules.

13.4.1 Purposes of keeping mules

The reasons for keeping mules include transport, income generation, traction, value savings and socio-cultural activities such as wealth status, ceremonies and dowry. There is a slight difference in the emphasis as well as order of importance of the purposes of keeping mules by sex across AEZs, livestock densities and production systems (Tables 13.4.1a, b and c).

Table 13.4.1a. *Purpose of keeping mules by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	90		212		88		390	
Male mules								
Transport	52	57.8	133	62.7	65	73.9	250	64.1
Income	32	35.6	75	35.4	32	36.4	139	35.6
Work/draft	20	22.2	33	15.6	30	34.1	83	21.3
Manure	11	12.2	43	20.3	18	20.5	72	18.5
Savings	13	14.4	35	16.5	20	22.7	68	17.4
Wealth status	9	10.0	17	8.0	12	13.6	38	9.7
Ceremonies	2	2.2	6	2.8	0	0.0	8	2.1
Dowry	0	0.0	2	0.9	1	1.1	3	0.8
Others	0	0.0	0	0.0	1	1.1	1	0.3
Female mules								
Transport	53	58.9	101	47.6	29	33.0	183	46.9
Income	25	27.8	63	29.7	13	14.8	101	25.9
Savings	22	24.4	31	14.6	11	12.5	64	16.4
Work/draft	20	22.2	27	12.7	10	11.4	57	14.6
Manure	11	12.2	38	17.9	3	3.4	52	13.3
Wealth status	18	20.0	11	5.2	7	8.0	36	9.2
Ceremonies	3	3.3	4	1.9	0	0.0	7	1.8
Dowry	0	0.0	4	1.9	1	1.1	5	1.3

Table 13.4.1b. *Purpose of keeping mules by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	40		178		95		77		390	
Male mules										
Transport	26	65.0	118	66.3	57	60.0	49	63.6	250	64.1
Income	7	17.5	63	35.4	32	33.7	37	48.1	139	35.6
Work/draft	10	25.0	43	24.2	26	27.4	4	5.2	83	21.3
Manure	2	5.0	27	15.2	19	20.0	24	31.2	72	18.5
Savings	16	40.0	30	16.9	12	12.6	10	13.0	68	17.4
Wealth status	11	27.5	19	10.7	3	3.2	5	6.5	38	9.7
Ceremonies	0	0.0	5	2.8	2	2.1	1	1.3	8	2.1
Dowry	1	2.5	2	1.1	0	0.0	0	0.0	3	0.8
Others	0	0.0	0	0.0	0	0.0	1	1.3	1	0.3
Female mules										
Transport	22	55.0	80	44.9	49	51.6	32	41.6	183	46.9
Income	6	15.0	49	27.5	27	28.4	19	24.7	101	25.9

cont'd...

Table 13.4.1b. cont'd.

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%	No.	%
Savings	19	47.5	17	9.6	16	16.8	12	15.6	64	16.4
Work/draft	2	5.0	34	19.1	20	21.1	1	1.3	57	14.6
Manure	1	2.5	23	12.9	14	14.7	14	18.2	52	13.3
Wealth status	10	25.0	14	7.9	8	8.4	4	5.2	36	9.2
Ceremonies	0	0.0	3	1.7	3	3.2	1	1.3	7	1.8
Dowry	1	2.5	3	1.7	1	1.1	0	0.0	5	1.3

Table 13.4.1c. *Purpose of keeping mules by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	360		14		16		390	
Male mules								
Transport	228	63.3	11	78.6	11	68.8	250	64.1
Income	137	38.1	2	14.3	0	0.0	139	35.6
Work/draft	75	20.8	2	14.3	6	37.5	83	21.3
Manure	72	20.0	0	0.0	0	0.0	72	18.5
Savings	63	17.5	5	35.7	0	0.0	68	17.4
Wealth status	27	7.5	4	28.6	7	43.8	38	9.7
Ceremonies	7	1.9	1	7.1	0	0.0	8	2.1
Dowry	3	0.8	0	0.0	0	0.0	3	0.8
Others	1	0.3	0	0.0	0	0.0	1	0.3
Female mules								
Transport	168	46.7	10	71.4	5	31.3	183	46.9
Income	101	28.1	0	0.0	0	0.0	101	25.9
Savings	59	16.4	5	35.7	0	0.0	64	16.4
Work/draft	55	15.3	1	7.1	1	6.3	57	14.6
Manure	52	14.4	0	0.0	0	0.0	52	13.3
Wealth status	28	7.8	4	28.6	4	25.0	36	9.2
Ceremonies	7	1.9	0	0.0	0	0.0	7	1.8
Dowry	4	1.1	1	7.1	0	0.0	5	1.3

13.4.2 Age and sex structure of mules

Table 13.4.2 shows the number and composition of mule holdings by sex and age categories. Overall, 47% of the mules are adult females and 42% are adult males. In the case of young stock, there are slightly more males than females. More farmers in the *kolla* and *weinadega* AEZs keep mules as are farmers in the crop–livestock production system than those in agro-pastoral and pastoral areas.

Table 13.4.2. *Age and sex structure of mules by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Total mules	Mule types											
			Young male		Adult male		Young female		Adult female		Overall young		Overall adult	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Agro-ecological zones														
Dega	85	110	11	10.0	31	28.2	10	9.1	58	52.7	21	19.1	89	80.9
Weinadega	226	286	13	4.5	115	40.2	13	4.5	145	50.7	26	9.1	260	90.9
Kolla	92	98	4	4.1	61	62.2	2	2.0	31	31.6	6	6.1	92	93.9
Total	403	494	28	5.7	207	41.9	25	5.1	234	47.4	53	10.7	441	89.3
Livestock densities														
Low	44	56	3	5.4	26	46.4	2	3.6	25	44.6	5	8.9	51	91.1
Medium	184	203	9	4.4	105	51.7	7	3.4	82	40.4	16	7.9	187	92.1
High	101	120	11	9.2	41	34.2	8	6.7	60	50.0	19	15.8	101	84.2
Very high	74	115	5	4.3	35	30.4	8	7.0	67	58.3	13	11.3	102	88.7
Total	403	494	28	5.7	207	41.9	25	5.1	234	47.4	53	10.7	441	89.3
Production systems														
Crop–livestock	366	456	28	6.1	181	39.7	25	5.5	222	48.7	53	11.6	403	88.4
Agro-pastoral	19	19	0	0.0	12	63.2	0	0.0	7	36.8	0	0.0	19	100.0
Pastoral	18	19	0	0.0	14	73.7	0	0.0	5	26.3	0	0.0	19	100.0
Total	403	494	28	5.7	207	41.9	25	5.1	234	47.4	53	10.7	441	89.3

13.4.3 Mules trait preferences

Farmers' preferences for mule traits were assessed based on their evaluation of certain mule traits as 'not important', 'poor', 'average' and 'good'. Farmers described temperament, body size, cold tolerance, coat colour, growth rate, longevity, drought tolerance, work/draft, walkability and disease and heat tolerances as good (preferred) traits in that order (Tables 13.4.3a, b and c). There were differences in farmers' preferences for some of the traits by AEZs, livestock densities and production systems.

Table 13.4.3a. *Traits of mules considered as good by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	92		228		94		414	
Character	77	83.7	179	78.5	87	92.6	343	82.9
Body size	60	65.2	171	75.0	73	77.7	304	73.4
Cold tolerance	64	69.6	141	61.8	60	63.8	265	64.0
Coat colour	50	54.3	144	63.2	54	57.4	248	59.9
Growth rate	45	48.9	135	59.2	60	63.8	240	58.0
Longevity	59	64.1	119	52.2	61	64.9	239	57.7
Drought tolerance	49	53.3	117	51.3	51	54.3	217	52.4
Work/draft	49	53.3	91	39.9	54	57.4	194	46.9
Walkability	49	53.3	81	35.5	50	53.2	180	43.5
Disease tolerance	37	40.2	82	36.0	28	29.8	147	35.5
Heat tolerance	45	48.9	56	24.6	37	39.4	138	33.3

Table 13.4.3b. *Traits of mules considered as good by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	41		188		104		81		414	
Character	39	95.1	160	85.1	83	79.8	61	75.3	343	82.9
Body size	34	82.9	135	71.8	64	61.5	71	87.7	304	73.4
Cold tolerance	33	80.5	124	66.0	58	55.8	50	61.7	265	64.0
Coat colour	16	39.0	103	54.8	63	60.6	66	81.5	248	59.9
Growth rate	30	73.2	104	55.3	57	54.8	49	60.5	240	58.0
Longevity	20	48.8	133	70.7	65	62.5	21	25.9	239	57.7
Drought tolerance	25	61.0	95	50.5	44	42.3	53	65.4	217	52.4
Work/draft	28	68.3	76	40.4	60	57.7	30	37.0	194	46.9
Walkability	27	65.9	77	41.0	45	43.3	31	38.3	180	43.5
Disease tolerance	15	36.6	65	34.6	26	25.0	41	50.6	147	35.5
Heat tolerance	25	61.0	51	27.1	41	39.4	21	25.9	138	33.3

Table 13.4.3c. *Traits of mules considered as good by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	376		20		18		414	
Character	308	81.9	18	90.0	17	94.4	343	82.9
Body size	277	73.7	14	70.0	13	72.2	304	73.4
Cold tolerance	247	65.7	11	55.0	7	38.9	265	64.0
Coat colour	234	62.2	13	65.0	1	5.6	248	59.9
Growth rate	221	58.8	11	55.0	8	44.4	240	58.0
Longevity	212	56.4	13	65.5	14	77.8	239	57.7
Drought tolerance	198	52.7	10	50.0	9	50.0	217	52.4
Work/draft	181	48.1	10	50.0	3	16.7	194	46.9
Walkability	165	43.9	12	60.0	3	16.7	180	43.5
Disease tolerance	137	36.4	9	45.0	1	5.6	147	35.5
Heat tolerance	127	33.8	10	50.5	1	5.6	138	33.3

13.5 Camels

At the level of the Oromiya Regional State, the ownership ratio of camels is very low (5%), and even these are limited to the Borana, East Hararge and Bale zones, with small camel populations reported in the neighbouring zones of East Shewa, Arsi and West Hararge (Table 9.1.1). The 264 sample camel-owning households had a current holding of 1754 camels, or an average herd per household of 6.6.

13.5.1 Purposes of keeping camels

Camels are mainly kept for transport, milk, reproduction, meat, work/draft, savings, wealth status, dowry, ceremonies and manure (Tables 13.5.1a, b and c). Data were collected for male and female camels separately by AEZs, livestock densities and production systems. There is variation in the order of the traits for purpose of keeping camels by sex.

Table 13.5.1a. *Purpose of keeping camels by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	4		19		222		245	
Male camels								
Transport	2	50.0	1	5.3	180	81.1	183	74.7
Reproduction	1	25.0	1	5.3	136	61.3	138	56.3
Meat	0	0.0	13	68.4	72	32.4	85	34.7

cont'd...

Table 13.5.1a. cont'd.

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
Work/draft	2	50.0	16	84.2	53	23.9	71	29.0
Savings	1	25.0	17	89.5	43	19.4	61	24.9
Wealth status	0	0.0	1	5.3	52	23.4	53	21.6
Dowry	0	0.0	0	0.0	14	6.3	14	5.7
Ceremonies	0	0.0	0	0.0	12	5.4	12	4.9
Manure	0	0.0	0	0.0	1	0.5	1	0.4
Female camels								
Milk	1	25.0	16	84.2	167	75.2	184	75.1
Reproduction	3	75.0	1	5.3	160	72.1	164	66.9
Wealth status	0	0.0	3	15.8	72	32.4	75	30.6
Savings	0	0.0	11	57.9	38	17.1	49	20.0
Transport	1	25.0	2	10.5	34	15.3	37	15.1
Meat	0	0.0	7	36.8	28	12.6	35	14.3
Work/draft	1	25.0	13	68.4	0	0.0	14	5.7
Manure	0	0.0	0	0.0	1	0.5	1	0.4

Table 13.5.1b. *Purpose of keeping camels by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	122		67		45		11		245	
Male camels										
Transport	113	92.6	37	55.2	26	57.8	7	63.6	183	74.7
Reproduction	86	70.5	27	40.3	18	40.0	7	63.6	138	56.3
Meat	37	30.3	24	35.8	23	51.1	1	9.1	85	34.7
Work/draft	17	13.9	41	61.2	12	26.7	1	9.1	71	29.0
Savings	24	19.7	26	38.8	11	24.4	0	0.0	61	24.9
Wealth status	26	21.3	13	19.4	9	20.0	5	45.5	53	21.6
Dowry	13	10.7	0	0.0	0	0.0	1	9.1	14	5.7
Ceremonies	11	9.0	0	0.0	1	2.2	0	0.0	12	4.9
Manure	1	0.8	0	0.0	0	0.0	0	0.0	1	0.4
Female camels										
Milk	88	72.1	53	79.1	35	77.8	8	72.7	184	75.1
Reproduction	91	74.6	42	62.7	28	62.2	3	27.3	164	66.9
Wealth status	22	18.0	33	49.3	15	33.3	5	45.5	75	30.6
Savings	25	20.5	18	26.9	4	8.9	2	18.2	49	20.0
Transport	23	18.9	8	11.9	5	11.1	1	9.1	37	15.1
Meat	19	15.6	11	16.4	5	11.1	0	0.0	35	14.3
Work/draft	0	0.0	13	19.4	1	2.2	0	0.0	14	5.7
Manure	0	0.0	0	0.0	0	0.0	1	9.1	1	0.4

Table 13.5.1c. *Purpose of keeping camels by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Purposes	No.	%	No.	%	No.	%	No.	%
No. of households	71		90		84		245	
Male camels								
Transport	59	83.1	51	56.7	73	86.9	183	74.7
Reproduction	46	64.8	46	51.1	46	54.8	138	56.3
Meat	21	29.6	36	40.0	28	33.3	85	34.7
Work/draft	16	22.5	29	32.2	26	31.0	71	29.0
Savings	18	25.4	35	38.9	8	9.5	61	24.9
Wealth status	16	22.5	10	11.1	27	32.1	53	21.6
Dowry	1	1.4	12	13.3	1	1.2	14	5.7
Ceremonies	0	0.0	12	13.3	0	0.0	12	4.9
Manure	1	1.4	0	0.0	0	0.0	1	0.4
Female camels								
Milk	42	59.2	79	87.8	63	75.0	184	75.1
Reproduction	43	60.6	53	58.9	68	81.0	164	66.9
Wealth status	13	18.3	17	18.9	45	53.6	75	30.6
Savings	15	21.1	29	32.2	5	6.0	49	20.0
Transport	7	9.9	18	20.0	12	14.3	37	15.1
Meat	13	18.3	17	18.9	5	6.0	35	14.3
Work/draft	1	1.4	13	14.4	0	0.0	14	5.7
Manure	1	1.4	0	0.0	0	0.0	1	0.4

There was considerable variations in the purposes of keeping camels by AEZs, livestock densities and production systems. For example, camels are not commonly kept in the *dega* and *weinadega* AEZs. Even a small proportion of the households who keep camels in the *weinadega* raise them only for savings, work/draft and meat. More households from both crop–livestock and pastoral systems keep male camels for transport compared to households in agro-pastoral system. Conversely, more households in agro-pastoral system keep female camels for milk compared to pastoral and crop–livestock systems.

13.5.2 Age and sex structure of camels

As stated above, only 5% of the households in the region maintain camels and these are limited mainly to Borana, East Hararge and Bale zones. More importantly, however, camels are found in all AEZs, livestock densities and production systems, although they concentrate in *kolla* AEZ and pastoral/agro-pastoral areas. The average camel herd size in these households is 6.6 heads (Table 13.5.2). In terms of composition, nearly half of them are adult females and only 19% are adult males across all the classification categories (Table 13.5.2).

Table 13.5.2. *Age and sex structure of mules by agro-ecological zones, livestock densities and production systems.*

Categories	No. of households	Total camels	Camel types											
			Young male		Adult male		Young female		Adult female		Overall young		Overall adult	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Agro-ecological zones														
Dega	2	13	3	23.1	1	7.7	1	7.7	8	61.5	4	30.8	9	69.2
Weinadega	19	71	5	7.0	8	11.3	7	9.9	51	71.8	12	16.9	59	83.1
Kolla	243	1670	272	16.3	324	19.4	293	17.5	781	46.8	565	33.8	1105	66.2
Sub-total	264	1754	280	16.0	333	19.0	301	17.2	840	47.9	581	33.1	1173	66.9
Livestock densities														
Low	132	1159	196	16.9	223	19.2	206	17.8	534	46.1	402	34.7	757	65.3
Medium	73	313	34	10.9	55	17.6	39	12.5	185	59.1	73	23.3	240	76.7
High	47	237	42	17.7	46	19.4	46	19.4	103	43.5	88	37.1	149	62.9
Very high	12	45	8	17.8	9	20.0	10	22.2	18	40.0	18	40.0	27	60.0
Sub-total	264	1754	280	16.0	333	19.0	301	17.2	840	47.9	581	33.1	1173	66.9
Production systems														
Crop–livestock	77	289	43	14.9	73	25.3	45	15.6	128	44.3	88	30.4	201	69.6
Agro-pastoral	91	701	119	17.0	114	16.3	124	17.7	344	49.1	243	34.7	458	65.3
Pastoral	96	764	118	15.4	146	19.1	132	17.3	368	48.2	250	32.7	514	67.3
Sub-total	264	1754	280	16.0	333	19.0	301	17.2	840	47.9	581	33.1	1173	66.9

13.5.3 Camel trait preferences

Farmers' preferences for camel traits were assessed based on their evaluation of certain camel traits as 'not important', 'poor', 'average' and 'good'. Unlike in the other livestock species, camel-owning households have broader trait preferences in their camels. Many of these traits are related to adaptability of these animals to the usually harsh environments they are maintained in. In general, the traits considered as good are walkability, watering frequency, drought tolerance, body size, meat, temperament, milk, heat tolerance, work/draft, coat colour, growth rate, longevity, fertility, cold and disease tolerances (Table 13.5.3a, b and c).

Table 13.5.3a. *Traits of camels considered as good by agro-ecological zones.*

	Agro-ecological zones							
	Dega		*Weinadega*		*Kolla*		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	2		19		247		268	
Walkability	2	100.0	18	94.7	230	93.1	250	93.3
Watering frequency	1	50.0	19	100.0	229	92.7	249	92.9
Drought tolerance	1	50.0	19	100.0	222	89.9	242	90.3
Body size	1	50.0	8	42.1	207	83.8	216	80.6
Meat	1	50.0	18	94.7	197	79.8	216	80.6
Temperament	2	100.0	6	31.6	204	82.6	212	79.1
Milk	1	50.0	19	100.0	165	66.8	185	69.0
Heat tolerance	1	50.0	7	36.8	169	68.4	177	66.0
Work/draft	2	100.0	16	84.2	149	60.3	167	62.3
Coat colour	1	50.0	6	31.6	159	64.4	166	61.9
Growth rate	1	50.0	2	10.5	163	66.0	166	61.9
Longevity	2	100.0	1	5.3	163	66.0	166	61.9
Fertility	0	0.0	3	15.8	125	50.6	128	47.8
Cold tolerance	1	50.0	7	36.8	71	28.7	79	29.5
Disease tolerance	0	0.0	1	5.3	52	21.1	53	19.8

Table 13.5.3b. *Traits of camels considered as good by livestock densities.*

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
No. of households	137		71		48		12		268	
Body size	126	92.0	67	94.4	45	93.8	12	100.0	250	93.3
Coat colour	124	90.5	70	98.6	43	89.6	12	100.0	249	92.9
Work/draft	129	94.2	63	88.7	44	91.7	6	50.0	242	90.3
Walkability	114	83.2	51	71.8	41	85.4	10	83.3	216	80.6
Heat tolerance	103	75.2	63	88.7	41	85.4	9	75.0	216	80.6

cont'd...

Table 13.5.3b. cont'd.

	Livestock densities									
	Low		Medium		High		Very high		Overall	
Traits	No.	%	No.	%	No.	%	No.	%	No.	%
Cold tolerance	124	90.5	40	56.3	37	77.1	11	91.7	212	79.1
Temperament	83	60.6	58	81.7	35	72.9	9	75.0	185	69.0
Growth rate	117	85.4	35	49.3	18	37.5	7	58.3	177	66.0
Fertility	61	44.5	60	84.5	36	75.0	10	83.3	167	62.3
Disease tolerance	110	80.3	23	32.4	24	50.0	9	75.0	166	61.9
Longevity	108	78.8	23	32.4	26	54.2	9	75.0	166	61.9
Drought tolerance	98	71.5	29	40.8	29	60.4	10	83.3	166	61.9
Meat	83	60.6	19	26.8	19	39.6	7	58.3	128	47.8
Milk	37	27.0	19	26.8	16	33.3	7	58.3	79	29.5
Watering frequency	30	21.9	7	9.9	14	29.2	2	16.7	53	19.8

Table 13.5.3c. *Traits of camels considered as good by production systems.*

	Production systems							
	Crop–livestock		Agro-pastoral		Pastoral		Overall	
Traits	No.	%	No.	%	No.	%	No.	%
No. of households	75		93		100		268	
Walkability	72	96.0	82	88.2	96	96	250	93.3
Watering frequency	74	98.7	83	89.2	92	92	249	92.9
Drought tolerance	68	90.7	89	95.7	85	85	242	90.3
Body size	58	77.3	71	76.3	87	87	216	80.6
Meat	61	81.3	81	87.1	74	74	216	80.6
Temperament	66	88.0	66	71.0	80	80	212	79.1
Milk	52	69.3	68	73.1	65	65	185	69.0
Heat tolerance	60	80.0	67	72.0	50	50	177	66.0
Work/draft	51	68.0	44	47.3	72	72	167	62.3
Coat colour	48	64.0	65	69.9	53	53	166	61.9
Growth rate	58	77.3	57	61.3	51	51	166	61.9
Longevity	64	85.3	45	48.4	57	57	166	61.9
Fertility	44	58.7	54	58.1	30	30	128	47.8
Cold tolerance	29	38.7	23	24.7	27	27	79	29.5
Disease tolerance	17	22.7	25	26.9	11	11	53	19.8

14 Evaluation of the survey process

14.1 Views of field supervisors

To facilitate the smooth implementation of future breed surveys, supervisors who participated in the field activities conducted a survey evaluation. The evaluation, which was in the form of a questionnaire, covered topics such as training, questionnaire design, survey length and supervision, transport and resources, accessibility and constraints. Results from this evaluation are summarised below:

a. Training: In general the training was perceived to have been well done, but the duration was too short. Use of video recording was suggested, and the sharing of experiences by those zones that already had conducted the survey. More attention should have been given to explaining the 'breed specific information', and 'phenotypic description' parts of the questionnaire, and to teaching interviewing techniques.
b. Questionnaires: The content and organisation of the questionnaires were considered to be good.
c. Survey length and supervision: In general more time was required to carry out the interviews by enumerators, and enumerators should have been visited more often by their supervisors (more than the four times allocated for the 10 days of the survey). An extra eight days on average to carry out the survey was suggested.
d. Transport and resources: Shortages of supplies such as fuel and spare parts were indicated. Public transportation and overtime allowances were also needed. Additionally, supervisors indicated a shortage of money to rent mules/horses for enumerators.
e. Accessibility of survey sites: Accessibility of survey sites was mainly unsatisfactory due to the long distances both between sampled peasant associations (PAs) and between sampled farms within PAs.
f. Constraints: A summary of the constraints faced and observed by supervisors during the survey is shown in Figure 14.1. The most frequently cited constraints were the long distance travelled to and from sample sites coupled with inconveniences in the means of transport, movements of livestock and engagement of sample households in regular activities like work in crop fields and market days. Rainfall was also a significant constraint.
g. Co-ordination: The survey, from its planning to implementation phases, to the data analysis and report writing, caused some difficulties for the co-ordinating team too. As a result of the experiences of all involved, a set of recommendations is given here to guide planning, implementation and analysis of future breed surveys.

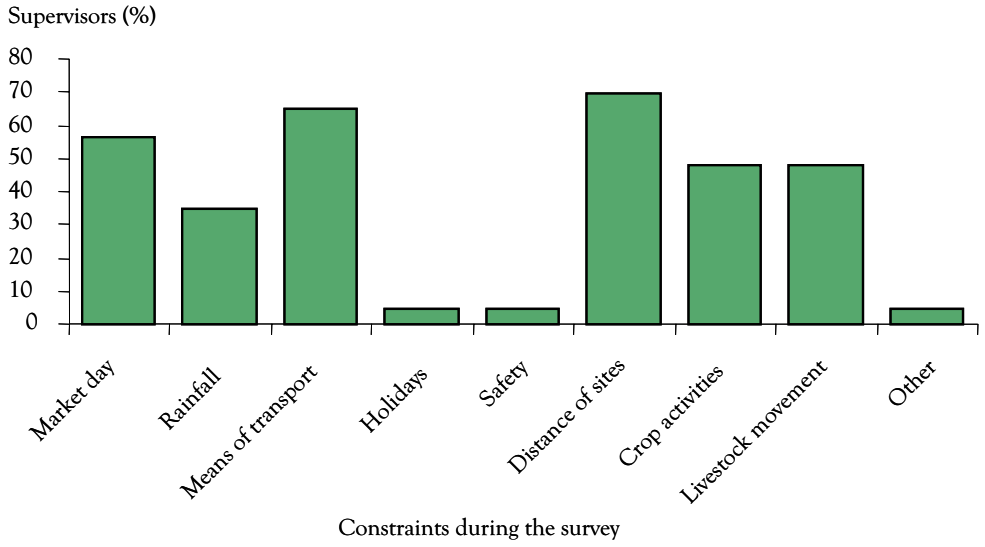

Figure 14.1. *Constraints faced in the execution of the Oromiya Regional State livestock breed survey.*

14.2 Recommendations for future breed surveys

a. The timing of the survey should be in a dry season when roads are accessible and farmers are not heavily involved with cropping activities.
b. It is recommended that each survey site be visited prior to the survey to create awareness amongst the community, and to discuss planning, logistics, transportation, budget issues, and to review the selection of the site.
c. Depending on general survey objectives production system might, though not necessarily, be considered as one criterion for sampling stratification.
d. Sufficient time should be allocated to execute the survey. Survey length depends on the numbers of selected farmers, numbers of enumerators, distances to survey sites and selected households, and availability of transportation for enumerators and supervisors.
e. Supervisors and enumerators involved in the execution of the survey should be aware of market days and holidays, so that these will not coincide with survey activities.
f. Only minimal changes should be made to the questionnaires after the commencement of the survey. Should any change be made, careful consideration must be made as to how these changes may affect the final analysis and how the results of analysis will be handled.
g. Enumerators should be thoroughly trained. The training period should preferably be five days.
h. More enumerators than those actually required for the survey should be trained in case of anyone having to drop out.
i. Enumerators should never make false promises to farmers.
j. Communication at all levels is essential.

15 Conclusion

A primary objective of the survey has been achieved in providing a wide range of baseline data on livestock production, mainly on cattle, sheep and goats (primary species) and on chickens, donkeys, horses, mules and camels (secondary species) in the Oromiya Regional State of Ethiopia. The results demonstrate the diversity in characteristics, management and use of animal genetic resources and the constraints faced in handling them across administrative zones, agro-ecological zones, livestock densities and production systems. Production system was not used as one of the stratification factors in the survey as the aim was to get an overall picture of the average features of livestock production across the region. In follow-up surveys, however, it might be useful to stratify for production system if it is considered important to quantify these differences better.

Unfortunately, the survey did not lead to a straightforward characterisation of different livestock breeds. This was primarily due to the nature of the data collected in which farmers described their livestock in different ways. The survey also revealed a long list of breed groups, which were identified by farmers as crosses between the more distinct breed types. Many of these crossbreds are deliberately produced in an effort to combine desirable attributes from the different breeds. This has also meant that the sample sizes of animals from each of the breed type from which measurements (breed descriptors) were taken were too small for extensive statistical analysis. This operational problem was not foreseen. There has also been time constraint. As described in Chapter 9.4, however, a preliminary attempt has been made to identify and test an appropriate statistical procedure for the data. The procedure, known as, multivariate cluster analysis, is successfully demonstrated on a subset of the data (cattle from Borana Zone) and the results are promising. This procedure has also shown that multivariate techniques can be used for on-farm breed characterisation work by classifying the observations on individual animals into well-defined breed types/strains. It is hoped to investigate this technique further and provide the region with general information on breed types to supplement the tables provided herein. Clustering based on phenotypic data should, however, be followed up with molecular genetic analysis of the breed types to increase the accuracy of identification as well as characterisation of the breed types. Therefore, such multivariate techniques can help formulating hypotheses, which can be tested using detailed genetic studies.

The planning of the survey relied on many decisions about many issues being made within a comparatively short period of time. These decisions on questionnaire and sampling frame design, organisation of pre-surveys and enumerator training, organisation of manpower, distribution of the budget and other logistics had to take into account the administrative infrastructure of the region, the distributions of the different agro-ecological zones, and the seasonal constraints in implementing the survey. Nevertheless, the project team remained dedicated to the task and communicated well with

supervisors in the field. This led, in general, to a good result. However, there were some inconsistencies in the way that the survey was implemented in each zone. This could have improved through better co-ordination of the survey by pre-visits to each zone and clearer realisation of how budgetary arrangements could best be handled. The implementation of the survey tended to be a little rushed and more time to cover the sample households should be allowed on another occasion. A key lesson that has been learnt through the execution of this survey, however, is that one should not underestimate the length of time needed for data entry and analysis. This was grossly underestimated in this survey.

Hopefully, the results of the survey will contribute to future planning of livestock development and conservation works in the Oromiya Regional State within the different administrative and agro-ecological zones and for different production systems, and will help to understand the constraints that need to be tackled to encourage successful livestock farming. One could now decide to target activities at the level of administrative zones, agro-ecological zones, livestock density categories or at the production systems level. Alternatively, one could decide to target activities directly at breed types. It is, therefore, up to the livestock experts or the policy makers concerned with livestock development and conservation, to decide how to use this information for planning of livestock development and conservation activities. Of course, further analyses are needed to extract additional information on the distributions, performance and perceived attributes of different breed types to help in the design of breeding strategies. As indicated at the beginning of this report, the amount of data collected from this survey is substantial and can be analysed in different ways to address different questions. It is a database, which should be maintained and updated with regular surveys. The database is to be maintained by the Oromiya Agricultural Development Bureau (OADB) as well as the Oromiya Agricultural Research Institute (OARI). Hopefully, easy access to this report will allow different users to undertake investigations of their own so that the database can be exploited to the full.