

Support for Effective Cooperation and Coordination of Cross-border Initiatives (SECCCI) Project in the Cross-borders of Ethiopia, Kenya and Somalia



IGAD Training Manual for Animal Production, Transboundary Animal Diseases (TADS) Control and Commodity Value Chain in the SECCCI Project Clusters

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Declaimer:

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This training manual was undertaken as part of an on-going SECCCI project implementation plan. With objectives to develop a training manual on animal production, TADs control and commodity value chains in the cross-border areas of Ethiopia, Kenya and Somalia.

The manual was prepared by a team of ICPALD, under Dr. Agol Kwai, IGAD Cluster I Coordinator, Dr. Wamalwa Kinyanjui, IGAD Animal Health Expert and Dr. Jiddah Choke, IGAD Cluster II Coordinator. The overall guidance was provided by Dr. Solomon Munyua, Director of ICPALD and Dr. Gezahegn Aboset, the IGAD Regional SECCCI Project Coordinator.

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Forward

While this training manual is localized, designed to address training capacity needs of the crossborder areas of the SECCCI project in Ethiopia, Kenya and Somalia; it largely depended on the Regional Training of Trainers Manual: Strengthening Value Chain of ASALS Livestock and Livestock Products in the IGAD Region (2018); designed to address training needs of the IGAD region related to regional trade between IGAD MS and MENA countries. The IGAD training manual for animal production, TADs control and community value chain is primarily a training for the trainees with focus on cross-border livestock production, TADs control and value chain commodity and trade without much to do with broader regional trade and associated challenges. It has six (6) different modules on which courses will be offered for a period and degree to be determined by the national authorities, in charge of offering those outlined courses and practicals in recognized technical colleges or institutes. It was noted that the value added from the sited regional training manual would be the highlighted importance of livestock identification and traceability (LITS), animal welfare and SPS and animal feeding and nutrition to good husbandry as key requirements always attached to livestock regional trade by the importing countries; and that these issues could now be introduced by the cross-border training manual inform both the farmers and traders in order to benefit from livestock production.

The IGAD Centre for Pastoral Areas and Livestock Development (ICPALD), one of the specialized centres in IGAD, in pursuit of its mandate, undertook development of the training manual for animal production, transboundary animal diseases (TADs) control and commodity value chain in the SECCCI project areas in Ethiopia, Kenya and Somalia from a period between February to May 2020.

The training manual's emphasis has been put on animal production, TADs control and commodity value chains to address huge challenges currently facing animal production, animal diseases and supply chain for live animals and their products to enhance livelihoods and strengthen capacities to cope with day-to-day challenges affecting livelihoods, food and nutrition security, peace building and natural resources sharing and accessibility.

The war on cross-border development, livelihood resilience and security can only be won if we are able to support the vulnerable poor pastoral and agro-pastoral communities living along the cross-borders of Ethiopia, Kenya and Somalia. This can be achieved by building institutions to undertake effective cooperation and coordination within communities, build their capacities; and to raise awareness on the importance of equitable sharing of natural resources and living in peace and harmony that will subsequently attract investment and services delivery to the areas already marginalized economically and politically.

This training manual was undertaken with these considerations in mind and is expected to serve as a basic tool to train middle technical cadres in animal production, TADs control and commodity value chain in those areas.

Dr. Solomon J.M. Munyua

Director, ICPALD

Executive summary

The major economic driver of the IGAD Member States is agriculture, with livestock contributing an estimated 57% of the regional Agricultural Gross Domestic Product (AGDP). The contribution of livestock to the economy varies with country. The highest contribution is in Somalia with 70% AGDP and 40 % GDP (table 5).

South Omo and Borana Zones of Ethiopia and Marsabit, Mandera and Turkana Counties of Kenya are largely inhabited by pastoralists in the border areas of Southwest Ethiopia, Northwest Kenya, to Marsabit-Moyale and Mandera-Gedo corridors between Ethiopia, Kenya and Somalia.

These communities have long relied on the management of natural resources to maximize land use and sustain livestock productivity. Managing herd movements plays a key role in rangeland management, with some areas suitable for use during the dry season and some during the wet season.

Herders and their livestock continue to move across the international border, maintaining and restoring collaboration among clans and ethnic groups and provides a framework for managing disputes and conflicts that are recurrent and happen unpredicted due to their nature of resourcebased. For decades, the viability of livelihood systems in the region has been weakened for a number of reasons, including the erosion of pastoralist institutional arrangements around natural resources management. This is in part due to state policies and actions that have not recognized the right of the pastoralists to own or manage their rangelands, and have therefore ignored their institutional system.

Pastoralism remains the most resilient and economic activity but for it to remain a viable livelihood option, and one which continues to contribute millions of dollars to exports and to national economies, institutional arrangements around natural resources and land management need to be better supported, including institutions for cross-border mobility.

Numerous existing bilateral memoranda of understanding (MOU) or agreements between Ethiopia and Kenya, there are sufficient and specific sections that mention issues related to the cross-border sharing of natural resources and livestock mobility. Ongoing sharing arrangements around natural resources have been currently included in the draft IGAD Transhumance Protocol and other related MOUs. This, of course, did lessen rivalry and conflicts over the scarce national resources or disputes over other competing local political and economic interests.

In arid and semi-arid lands (ASALS), communities primarily engage in pastoralism where droughts are a common occurrence. Evidence indicates that pastoral destitution is principally driven by feed and water scarcity, a consequence of ever-shrinking natural resource base.

Feed security, therefore, needs to be considered in broader perspective and not only during emergencies such as during drought spells. It requires serious attention from the top of policy makers and institutionalization of it all.

Governments need to put in place the right trade and investment policies as well as enabling environments to deepen and diversify the sources of economic growth and thereby stimulate job creation.

SECCCI project forms a part of the EU programme "collaboration in cross-border areas of the Horn of Africa Region" – phase 1, whose action is consistent with the objectives of IDDRSI in its aim to enhance the resilience of vulnerable communities of the IGAD region; and that contributes to EU trust Fund objectives (1) creating greater economic and employment opportunities , (2) strengthening resilience of communities, and in particular the most vulnerable; and (3) improving governance and conflict prevention, and (4) reducing forced displacement and irregular migration.

The overall goal of the new programme is to prevent and mitigate the impact of local conflict in borderland areas, and to promote economic development and greater resilience, including investments in conflict management and resolution capacities; enhancing and diversifying livelihoods, including livestock, agriculture and fisheries, basic services delivery, natural resources management, and promoting cross-border trade and private sector development.

The manual comprises of modules covering livestock production and animal health and transboundary animal disease (TADs) and control, commodity value chains in modules 3, 4 and 5 while the module 6 covers veterinary services and epidemio-surveillance system.

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Acronyms

AGDP	Agricultural Gross Domestic Product		
AU-IBAR	African Union Inter-African Bureau for Animal Resources		
CBPP	Contagious Bovine Pleuropneumonia		
CCPP	Contagious Caprine Pleuropneumonia		
EU	European Union		
EU SHARE	European Union Supporting Horn of Africa Resilience		
FAO	Food and Agriculture Organization of the United Nations		
FMD	Foot and Mouth Disease		
FMDV	Foot and Mouth Disease Virus		
GDP	Gross Domestic Product		
GF-TADS	Global Framework for the Control of Trans-boundary Animal Diseases		
HoA	Horn of Africa		
HS	Hemorrhagic Septicemia		
ICPALD	IGAD Center for Pastoral Areas and Livestock Development		
IGAD	Inter-Governmental Authority on Development		
LPI	Livestock Policy Initiative		
LSD	Lumpy Skin Disease		
MENA	Middle East and North Africa		
MoA	Ministry of Agriculture		
MS	Member States		
NGO	Non-Governmental Organization		
PPP	Public Private Partnership		
PPR	Peste des Petits Ruminants		
PVS	Performance of Veterinary Services		
RVF	Rift Valley Fever		
SAOS	Saudi Arabia Standard Organization		
SGP	Sheep and Goat Pox		
SPS	Sanitary and Phytosanitary		
TADs	Trans-boundary Animal Diseases		
ТВ	Tuberculosis		
USD	United States Dollar		

1. Introduction

Pastoralism, considered both an economic and social system, is highly dependent on raising and herding of livestock, which are core to pastoral livelihoods. Livestock production is essential for diversified income sources and maintenance of soil fertility, in addition to the contribution that animal-sourced foods provide, not just to children's growth and health, but also to their cognitive development. The livestock production system in the region is predominantly extensive and in the arid and semi-arid lands that have long characterized the borderlands of Ethiopia, Kenya and Somalia.

Pastoralism is an important livelihood in the region that must be resilient and sustainable; and resilience is the capability of a social-ecological system to continue after and to reorganize while sustaining a fundamentally similar function such as pastoralism and with alternative systems that are accessible to a household in order to make a living and determine the household's resilience at a given point in time. Change in climate and climate extremes are acknowledged as a vital challenge to pastoral production systems.

In the cross-border areas, 85% of livestock are on frequent move in search of pasture and water as low availability of animal feeds and water often results in massive livestock deaths, rendering household critically vulnerable. Despite their relative huge livestock population, this region is yet to realize its economic potential to contribute to food and nutrition security, income generation and socio-economic development. Due to inter-related challenges that include escalating impact of climate change, exacerbated feed situation (seasonal scarcity of pasture), water and rapidly changing land use with poorly managed rangelands, strategies to promote investments will provide alternative livelihoods, reduce poverty levels and prevent conflicts; enhance livelihoods, community resilience, create wealth and employment opportunities.

Priority livestock diseases are transboundary and zoonotic animal diseases that are endemic and prevalent in all the cross-border areas of Ethiopia and Kenya. Transboundary animal diseases (TADs) form main risk factors in IGAD member states where pastoral communities, that live and frequently migrate within the cross-border areas, share natural resources and marketing of livestock and livestock products. Pastoralists' adaptive capability, to resist or recover from climate-related shocks, is seen to have been progressively undermined. A meshed of factors; among them the effects of recurrent conflicts and famines, chronic underdevelopment and lack of access to basic services, high population growth and environmental degradation as well as political marginalization of pastoralist areas, have weakened pastoralist resilience and undermined livelihood systems, leading to an increased number of pastoralists migrating to peri-urban areas in the hope of securing alternative livelihood opportunities.

Local cross-border communities are dependent upon subsistence agriculture, livestock production, fishing and food gathering, all of which are threatened by environmental degradation. Development of key training courses on animal production and animal diseases control will greatly help enhanced traditional practice and introduction of suitable technologies will have potential to enhance pastoral livelihoods, livestock production and TADs control in the cluster.

The Intergovernmental Authority on Development (IGAD) member countries (Djibouti, Ethiopia, Kenya, Somalia, South Sudan, the Sudan and Uganda) are home to over 532 million heads of

livestock of which about 360 million are ruminants (cattle, sheep, goats and camels). Livelihoods and income of the pastoral and agro-pastoral communities in arid and semi-arid lands (ASALs), that account for about 60-70% of the IGAD landmass, largely depend on livestock. Livestock production and productivity in ASALS are affected by multiple factors such as trans-boundary animal diseases (TADs), drought-induced animal feeds/fodder and water shortage, poor infrastructure for market, information flow, among others, along the livestock value chain.

Moreover, there are challenges in meeting market requirements including health and product quality certification and weak businesses linkages along the livestock value chain. Global meat demand and prices are currently at unprecedented high levels. Buoyed by high GDP growth, globalization, higher incomes, and increased urbanization, diets are rapidly diversifying away from traditional staple commodities and towards high-value products including meat. With this increased demand for meat arises new opportunities for IGAD member states. However, available data indicates that exports of livestock and livestock products from the region are minimal, compared with the potential demand. Despite the substantial demand for meat and live animals from potential importing countries, exports to those markets often face impediments because of stringent SPS requirements and poor quality of products.

Existing market opportunities can only be seized if IGAD MS address quality and sanitary and nonsanitary constraints hampering export trade in livestock and meat. To enhance trade in live animals and meat from the region, livestock value chain actors, service providers and governments in the region will need to invest heavily to ensure quality of livestock products destined for export and comply with SPS requirements of importing countries and international standards. A value chain is a linked groups of people and processes by which a specific commodity such as livestock and its products are supplied to the final consumer.

The chains have inputs that are used to produce and transport a commodity towards a consumer, generally referred to as the supply chain. It encompasses production process, flow of information and incentives between the people involved from farm to fork. Money is sent from the consumer to the different people in the chains to complete the value chain. Understanding the flow of materials among stakeholders is key to understanding how to manage identified risks along the value chain. It is important to note that the chain may involve several products, including waste and by-products.

In general, the livestock value chain involves improving 1) livestock husbandry practices for producers; 2) livestock practices for traders, brokers, transporters and exporters; 3) practices for meat processors and exporters and 4) practices for service providers. Through the lead of FAO, the IGAD region, by the joint efforts of IGAD member countries, has already developed four training kits for livestock value chain actors and service providers. The four training kits target four different actors/service providers: i) producers, ii) traders, iii) processors and iv) service providers.

In an effort to move this initiative forward, the support for effective cooperation and coordination for cross-borders initiative (SECCCI) project in Ethiopia, Kenya and Somalia, under its outputs 'enhancing capacities of relevant actors to engage in cross-border cooperation, at local level and develop processes to ensure interventions are attuned to the local contexts and benefit community support and ownership', has planned to develop a training manual with specific training modules, whose contents will regularly be updated to provide an up-to-date training of trainees (TOT) courses

to the government technical staff who will be drawn from the cross-border pastoral and agro-pastoral communities in the three SECCCI project clusters in Kenya, Ethiopia and Somalia.

The training will adopt the following modules for training:

- **Module 1: Livestock production**, with an introduction to livestock production systems in the cross-border pastoral and agro-pastoral areas of Ethiopia, Kenya and Somalia.
- **Module 2: Animal health and TADs control,** with an introduction to animal health and diseases, their control that includes prevention (vaccination) and diseases control (treatment) measures;
- Module 3: Commodity value chain, in relation to producers or farmers,
 - a. Husbandry practices;
 - b. Interventions required to improve feeds/feeding in the cross-border pastoral and agropastoral areas.
- Module 4: Commodity value chain, in relation to livestock marketing, traders and transporters;
 - a. Local livestock markets and traders
 - b. Local abattoirs and slaughter slabs
- **Module 5: Commodity value chain,** with an introduction to concepts of value-addition and processors and traders.
- Module 6: Veterinary Services and epidemio-surveillance system, ensuring both active and passive disease surveillance that operates to timely inform national veterinary authorities with recommended responses.

2. Purpose and objectives of the training manual

The overall objective of this training manual is to develop a training manual on animal production, transboundary animal diseases (TADS) control and commodity value chain in 3 clusters of South Omo-Turkana, Moyale-Marsabit and Mandera, in close collaboration with IGAD specialized centres so that it can properly build capacities of relevant actors to engage in cross-border cooperation to strengthen resilience of communities and create greater economic and employment opportunities through enhancing plans and processes related to the animal production, TADS control and commodity value chain in the 3 neighbouring countries of the IGAD region, which will ultimately help to improve commercialize livestock and boost trade of live animals and products from the region. Broadly, the manual is expected to achieve the following specific objectives:

- i. To review, tailor make and compile existing IGAD training manuals on animal production and TADs control in the cluster;
- ii. To include relevant modules in this training manual.

The training will blend farmer field school (FFS) training with that of the community-based animal health workers (CBAHWs). Where the first recruits secondary school leavers while the later recruits young males and females who may not read and write, from their local communities, with characteristics of selection of trainees being restricted to respective beneficiary communities.

3. General approach

This training manual addresses training challenges facing the marginalized and neglected crossborder pastoral and agro-pastoral communities in Ethiopia, Kenya and Somalia. The training manual blends together the livestock farmer field schools (FFSs) and community-based animal health workers (CBAHWs) training approaches to provide and build capacities on enhancing livelihood resilience and improve basic animal production and healthcare services at community levels. While CBAHWs are selected from and by the communities, trained and deployed to work within them, livestock FFSs training looks more broader but also tailored to the local context and reflects the gaps and priorities of the relevant livelihood activities.

This training manual will use non-formal adult education approach and will focus on topics such as animal production and health, TADs control, commodity value chain, livestock marketing, animal welfare, rangeland and pastures, water management, livelihood diversification and human nutrition and health. These topics may be broadened or modified during the course of training evaluation.

FFSs approach selects candidates who write and read for a relatively longer class courses and practical trainings while community-based animal health workers normally come from within communities that are asked to nominate trainees who may not necessarily be literate. All the trainees, under this training manual, will all be literate, secondary school leavers but will all be selected from and by their communities. The trainees, after graduation, will be linked to a sustainable and affordable services supply system as well as a referral system with veterinary professional; and county and zonal veterinary offices. The manual also highlights the importance of gender mainstreaming into the training plan.

The training will be first piloted to start with short pilot training courses in Turkana University College and Jinka University of Technology for a period of 4 months with practical training for 3 weeks in between and then followed with refresher courses for another 4 months after which the trainees qualify for certificate decrees. Candidates for the training will be assessed in attendance of community elders/leaders and selected based on self-esteem, resourcefulness, responsibility and associative strengths within their communities.

Training will focus on animal production, animal health, transboundary animal diseases (TADs) control and commodity value chains in the SECCCI project cross-border pastoral and agro-pastoral areas in Ethiopia, Kenya and Somalia. It is an attempt to marry pastoral practices with advanced livestock production, disease control and to introduce value chain concepts to these target communities.

The trainees will be a mix of community-based animal health workers (Ethiopia) or County disease reporters (Kenya) with the farmer field school training principle; and the training will offer certificates after completion of courses. The training looks at livestock production systems, animal health and diseases control, veterinary services and whether value addition exists within the targeted pastoral cross-border communities in the study clusters. Most livestock producers in these drought-prone clusters have long continued to lose livestock due to lack of reliable water, endemic diseases and inadequate pastures.

4. Livestock production in the cross-border areas

4.1 Cattle production practices

Zebu breeds (Bos indicus or Bos indicus crossbred) that are tolerant to heat, humidity and many vector-borne diseases (ticks-borne and tryps) with characteristics of well sweating and more suited to the tropics and subtropics are the breeds kept by pastoral and agro-pastoral communities in the cross-border areas between Ethiopia-Kenya-Somalia. As logic rules, cattle farmers need animals that will survive, thrive and reproduce in their environment and for which there is a local and profitable market. For high production and productivity, pure European or British breeds are currently being introduced but are vulnerable to endemic diseases and take a form of being only pilot projects.

4.2 Common cattle breeds in the Cross-border areas

a. East African Zebu, with variable body colour, is the breed with a prominent hump, low milk production, a very hardy animal and late maturing. East African Zebu are, somehow, disease tolerant and has average live weight of 350kg. This breed is important for both dairy and beef (Dual purpose) in arid and semi-arid areas.

b. Boran, with brown or light grey body colour, the breed has a prominent hump, good beef production. They are tolerant to harsh conditions with the average live weight of 500kg and their importance for beef production.

c. Husbandry procedures

Dehorning Horns should be removed to prevent injury to other cattle and to handlers. It is best done when the calf is under three months old as this will cause no setback. Dehorning an older animal when the horn is attached to the skull is a major and painful operation. Calves can normally be dehorned when two to three weeks old. Older calves (up to two to three months) need irons sized according to the size of the emerging horn.

As part of husbandry, animals are also branded, castrated and with records of performance and treatment kept all the times by the farmers and producers.

4.3 Sheep and goat production

The sheep and goat industry contribute about 30% of the total red meat consumed in the country. On average, the production of meat from sheep and goats is about 70,000 metric tones per annum. Sheep and goats produce other products including wool, skins and milk. The bulk of sheep and goats are reared under nomadic pastoralism while to a limited extent under ranching systems.

The population of sheep and goats is estimated at about 7.3 million hair sheep, 850,000 wool sheep, 11.08 million meat goats and some 80,000 dairy goats. Given the high nutritional value of dairy goat milk, the production efficiency and land space utilisation, there is high potential for development of the dairy goats enterprise. The potential for wool production to make yarn for the local textile industry and for export, is not fully exploited in eastern Africa.

Sheep farming is among the traditional business and occupations of various people of countries around the world. Sheep have been reared as a domestic animal from the ancient time. Usually sheep farming means 'rearing sheep commercially for the purpose of meat, milk and wool production'.

Although sheep farming for commercial milk production is not a good decision. Sheep are suitable for meat and wool production. If you have proper facilities, then you can raise sheep in both small and large scale. Commercial sheep farming business is very profitable and you will get your investment back within a very short period.

Sheep are raised mainly for their wool, milk, skins and manure production. Sheep meat is very tasty, nutritious and popular to all types of people throughout the world.

The increasing human population is leading to increased land pressure. Consequently, the smaller land sizes cannot support dairy cattle, making the dairy goat a better option. As a nation by promoting dairy goat's production we will be addressing the millennium development goals of Alleviating extreme poverty and hunger. Goats are a good pathway out of poverty for smallholders. The high quality of goat's milk addresses malnutrition at the household level.

4.4 Sheep and goat production under pastoral production system

Pastoralists keep large flocks of sheep for subsistence, income, breeding, restoring wealth and social prestige. At a subsistence level, sheep are kept for occasional slaughter for meat. Sheep are rarely milked. Sheep are sold regularly in exchange for small commodities and food items. Off-take is mainly males while the females are reserved for breeding. The nomadic pastoralists' sheep are to a high degree drought resistant and well adapted to arid range with bush vegetation. Milk is very important for the nourishment of children. Skins are used for storing butter, for churning milk, as water buckets, for storage of cereals and for sale.

The age of first kidding is 8 to 12 months; kidding interval is six months. Four to five days old male sheep (kids) are often given to guests as a gift. Some newborn male sheep are slaughtered after a few days, to increase the amount of milk for the family use. In the dry season all, the new kids are slaughtered, because of fodder scarcity and female sheep would be unable to survive with suckling kids. Some male sheep are kept for reproduction and meat. At the age of four-five years, male sheep are castrated for fattening, and called 'sanga'. They grow fast and provide good meat; sangas command a high price in local and export markets and are preferred for ritual occasions: holydays, when a woman has given birth and during circumcision ceremonies

4.4.1 Common sheep breeds in the cross-border areas

a. Hair and meat sheep breeds, are the major hair sheep breeds include Dorper; Nyanza Fat-tail; Persian Black Head; Red Masai and crosses of these four with local stock. The hair sheep are mainly reared in the arid and semi-arid areas. The origin of the Dorper breed, which is a composite breed of South Africa developed at The name 'Dorper' is a coupling of the first syllables of the parent breeds Dorset and Persian Grootfontein in 1940-50 by the Department of Agriculture and some farmers to produce maximum number of lambs with good mutton qualities, which could be marketed off arid and extensive grazing conditions. The Dorper sheep thrive in arid to semi-tropical climate and are suitable for areas with rainfall of only 100 to 760 mm. Although this breed was developed originally for the more arid areas, today they are widely spread throughout the continent.

b. Wool and Dual-purpose breeds, are the major wool and dual purpose sheep breeds include: Merino; Corriedale; Hampshire Down; Romney Marsh and crosses of these breeds with local stock. The wool sheep are reared mainly in the cool high rainfall areas.

Physical characteristics of Dorper breeds: The typical breed standard involves a short loose light covering of hair and wool (wool predominating on the forequarter) with a natural clean kemp underline. The breed is barrel-shaped, hornless (polled) with short, dull black or white hair on the head, often with black feet; they have short hair and coarse wool; the black headed ones are called "Dorper" and the white headed ones "White Dorper".

The peculiar features for the Dorper is that they were developed for arid to semi-arid environments, but are well adapted to, and perform favorably under a variety of climatic and grazing conditions, including intensive feeding systems. They are non-selective grazers and fit well in cool climates where they can be used to convert feed resources, which are not utilized or underutilized by other livestock. They have a high lambing percentage reaching up to 180% and can produce 2.25 lambs on an annual basis. Rams reach sexual maturity at an early age, rams have been observed to start working by five months. Their inherent growth potential is such that they can attain live weight of 36 kg at 3-4 months of age. They have also a very even temperament.

The breed is not only ideally suited to the purpose for which it was bred, but is adaptable to a variety of conditions throughout the world and makes a huge contribution to mutton production worldwide. It has a long breeding season which is not seasonally limited so that lambs can be dropped at any time of the year. Lambing intervals is about eight months, so under good conditions they can drop lambs three times in two years. The average litter size is 1.19 to 1.5. A lambing percentage of 150% can be reached under good conditions while, in exceptional cases, 180% can be attained. Thus on average a Doper ewe can produce 2.25 lambs on an annual basis.

Dorper ewes produce a large quantity of milk, are instinctively fond of their lambs and therefore care for, and rear, their offspring well. The Dorper ewe will nourish her lambs under difficult conditions. When the ewes are left alone they will lamb easily, and will retain and look after their lambs. A well-grown Dorper lamb has carcass qualities with respect to conformation and fat distribution, which generally qualifies for a super grading. Dressing percentages can reach 54%. In South Africa, Dorper hides are sold as top quality leather under the name "Cape glovers" and represents 20% of the total carcass value.

The Dorper are not susceptible to fly strike and fleece rot. They have a high degree of disease resistance.

c. Red Maasai, origin and distribution: The Red Maasai sheep are also called Tanganyika sheep and are sheep of the semi-arid regions of Kenya and Tanzania. Currently they are mostly found in the semi-arid regions of southern Kenyan and northern Tanzanian rangelands, especially in Kajiado District of Kenya and the neighboring districts. The red Maasai sheep are tolerant and/or resistant to the notorious *Haemonchus contortus* parasite. They are predominantly kept by the Maasai pastoralists as well as by the neighboring tribes.

The Red Maasai sheep is identified by its relatively large body size and thick red hair. However, when all of the strains are considered, the sheep are multicolored, the most preferred color by the Maasai

and therefore the commonest being red, brown and occasionally pied. Average height at withers is 73 (range = 72-75) cm for males and 62 (range = 58-66) cm for females. Average heart girth and body length for females are 75.1 cm and 63.3 cm, respectively. They are short, fat-tailed and slightly fatrumped. In populations where a fat rump is a predominant feature indicate that they may in times past have crossed with either Dorper or Black Head Somali/Persia sheep.

d. It resists worms and other diseases. On two indicators that together provide a reasonably reliable picture of resistance - faecal egg count and packed cell volume - Red Maasai ewes and lambs performed significantly better than Dorper sheep. The associated lowered mortality rates led to much faster flock growth and productivity. The breed has also been shown to resist bluetongue virus infection and a more suited breed to survive under high trypanosome challenge.

The Red Maasai are used for their mutton and lard. Their reproductive performance in terms of lambing rate, is reported to be 80-84%, which is comparable to the Dorper sheep breed under medium rainfall zones in Kenya; the lambing interval is about 340 days, which is long compared to other East African sheep breeds, but can be improved to 246 days when crossed with the Dorper; the average litter size is about 1.13-1.21, which is lower than the Dorper and their crosses.

The scope for control of helminthosis using treatments among the resource poor farmers is limited. That is why the Red Maasai sheep are recommended to pastoralist and smallholder farmers whose flocks experience a problem of severe haemonchosis.

e. Persian Blackhead, the Blackhead Persian is a fat-tailed breed of domestic sheep, originally from Somali land. The breed is also a type of hair sheep, meaning they do not grow wool and tolerate heat better than wooled breeds and are raised primarily for mutton. The Blackhead Persian has a white body and, as their name would suggest, an entirely black head.

On average at maturity, rams weigh 68 kg and ewes 52 kg. Average birth weight is 2.6 kg. Ewes lactate for approximately 84 days; produce 50 kg of milk with 5.9% fat.



Figure 1: Red Maasai sheep and Dorper sheep



Figure 2: Blackhead Persian Sheep in arid area, Isiolo, (c) Monique Hunziker, Biovision



Figure 3: Corriedale sheep, Merino sheep and Romney marsh sheep (Source: Wikipedia.org) f. Wool sheep

Merino sheep, origin and distribution: Merino sheep were introduced into Africa in 1789 with imports of Spanish Merinos. By the mid-1800s the breed was spread over many parts of Africa. From 1891 onwards, American Vermont type Merinos were introduced. The African Merino is a composite of Spanish, Saxony, Rambouillet, American and Australian Merinos. These sheep are found mainly in semi-arid to sub-humid climates in Kenya and at medium to high altitudes under ranching and agropastoral management systems.

They are uni-coloured with white coat and fine-wool. They are heavy animals: males have 100 kg mature weight and females 60 kg. The average weights at birth, weaning and 18 months in female animals are 3.58 kg (range = 2.5-4.5 kg), 15.53 kg (range = 10.7-24.2 kg), and 56.2 kg (32.0-65.3 kg) respectively.

The breed is adapted to high rainfall grassland regions. Animals of this breed are reported to be less susceptible to fly strike because of their smooth body in comparison to sheep with skin folds.

The Merino is mainly used for its wool; the fleece weight per year is 5.5 kg. Ewes produce an average of 7.15 kg wool ranging from 2.6-9.7 kg. The wool is medium to strong white, which is over-crimped

in comparison to the Merino wool of the same strength. The wool on average measures 22-23 microns without any kemp fibres. Average staple length is 7.1 cm and ranges from 5.97-8.29 cm.

Corriedale, Corriedale is a dual-purpose breed, meaning they are used both in the production of wool and mutton. Corriedale have a long life span, and are hardy and evenly balanced all over the body. Corriedales are docile, easy care mothers, with high fertility. They adapt well to a wide range of climate conditions. They are large framed and plain bodied, polled and have a broad body. Corriedales produce a thick stapled, bulky fleece, which is popular with spinners and can be used for a range of handspun garments. Their dense fleece is medium-fine and high yielding, with good length and softness, somewhat between medium wool and long wool. Corriedale lambs produce good quality carcasses and have a high pelt value.

The Corriedale produces bulky, high-yielding wool ranging from 31.5 to 24.5 microns diameter. Fleece from a mature ewe will weigh 4.5 to 7.7 kg with a staple length of 8.9 to 15 cm. After cleaning, a yield of 50 to 60% of the raw fleece weight is common. Mature rams will weigh 79 to 125 kg, ewes can weigh from 59 to 82 kg.

Romney Marsh sheep, the Romney is, in general, an open-faced breed with long wool that grows over the legs in full. Head wide, level between ears, with no horns or dark hair on the poll. Eyes are large, bright and prominent and the mouth sound. Face in ewes full, and in rams broad and masculine in appearance. Nose and hooves are black. Neck well set in at the shoulders, strong and not too long. Shoulders well put in and level with the back. Chest is wide and deep; back straight and long, with a wide and deep loin; Rump wide, long and well-turned. Tail set almost even with the chine. Thighs well let down and developed. The face is white, and the skin is of pink pigmentation. Ribs are well sprung; legs well set, with good bone and sound feet. Sheep stand well on their pasterns. The fleece is of white colour, even texture and a good decided staple from top of head to end of tail and free from kemp.

Romneys produce a heavy fleece. A healthy mature ram can yield at shearing upwards of 10 kg per year, while flock averages for breeding ewes are typically above 5 kg. The increased fleece weight of a long-wooled sheep comes from the longer fiber length produced. The "clean yield" (net weight after thorough washing) is typically high for Romneys, 75-80%; this is a higher yield than is got for most fine-wooled sheep.

Ewes usually give birth to 1 to 3 lambs at each birthing event. Birthing is called lambing. The technical term for all species is parturition. Twin births is most common in well-managed flocks and with many breeds of sheep. First-time moms, especially yearlings, are more likely to have single births, though twins are not uncommon in some breeds. Ewes produce their largest litters of lambs when they are between the ages of 3 and 6.

The more lambs an ewe has the more feed she needs to produce milk for them. Oftentimes, extra lambs need to be cross-fostered onto other ewes or artificially reared. Prolific breeds are not recommended for novice shepherds or in situations where nutrition and management are limiting factors.

Because some sheep are raised in more difficult environments, sometimes it's more desirable for an ewe to have just one lamb. This is because there may not be enough food for the ewe to have

enough milk for the growth of two lambs. If the flock has to travel far for food and water, it's usually better to have one strong lamb than two or three smaller lambs that may struggle to keep up. Smaller, weaker lambs that lag behind the flock are more likely to be killed by predators.

g. Housing

For commercial production, you have to make a separate and suitable house for them. Their house must have to be suitable enough to keep them safe from adverse weather and harmful predators. Usually an adult sheep requires about 20 squire feet floor space.

h. Feeding

Traditional sheep husbandry systems are ecologically well-balanced, but often the food available to sheep is fibrous and deficient in energy and protein and minerals are in short supply. Nutrition plays a major role in the overall productivity, health, and well-being of the sheep flock. Because feed costs account for approximately two-thirds of the total cost of production, it is important that producers consider nutrition management a top priority. The sheep owner should try to balance the demands of the sheep breed and the quality (and quantity) of the feed. It makes no sense to breed a very energy rich ration demanding sheep breed when it is impossible to meet that in the management. Nutrient requirements of sheep vary with differences in age, body weight, and stage of production.

The five major categories of nutrients required by sheep are:

- Water;
- Energy;
- Protein;
- Vitamins; and
- Minerals.

During the grazing season, sheep are able to meet their nutrient requirements from pasture and a salt and mineral supplement. Pastures of mixed grass and clover, alfalfa and small grain serve as excellent sources of nutrition for growing lambs. A source of clean, fresh water should be provided to sheep at all times.

Ewe body weight does not remain constant throughout the year, but changes with stage of production. Nutrient requirements are lowest for ewes during maintenance, increase gradually from early to late gestation, and are highest during lactation. Decisions affecting feeding management are improved significantly by knowing ewe body weight and condition score at three distinct stages of production:

- Three weeks before breeding;
- Mid-gestation; and
- Weaning.

i. Urea application in organic herds

Urea is not normally used in organic herds, and if used, very careful measuring needs to take place as urea used badly can kill your animals very fast. Do not try urea unless there are good facilities for weighing and mixing feeds properly. Urea is not a protein supplement, but a source of non-protein nitrogen (NPN) for protein synthesis by rumen bacteria. It should be used only in conjunction with high-energy feeds such as maize. Urea, which is 45 percent nitrogen and has a crude protein equivalent of 281 percent, should not supply over one-third of the total nitrogen in a diet. To determine the grams of nitrogen in a diet, multiply the total kilos of crude protein in the diet by 16 percent. Other general rules for the use of urea are:

Should not be more than 1 percent of the diet or 3 percent of the concentrate mix; and

Should not be more than 5 percent of a supplement to be used with low grade roughages.

j. Minerals

Salt and mineral supplementation is required on a free choice, year-round basis. Failure to supplement salt and minerals results in low fertility, weak lambs at birth, lowered milk production, impaired immunity, and numerous metabolic disorders. A variety of salt and mineral supplements specifically formulated for sheep are commercially available. These supplements range from trace mineralized salt (TMS) fortified with selenium to complete mineral mixes containing all of the macro and micro minerals required by sheep.

k. Vitamins

Pasture or high-quality hay provides the vitamins required by most categories of sheep. However, after a drought, or when low-quality hay or silage is fed, a supplement supplying vitamins A, D, and E may be needed.

I. Fencing

Make a suitable fence around the pasture, if you allow them to graze on the pasture. Keep the fence strong enough, so that they can't go out, and stay safe inside. Good fencing also helps to keep all types of predators out. You can make a wire or woven fence.

m. Marketing

In case of marketing, you can try your local livestock market. It will be better, if you determine the marketing strategies before starting this business. You can also consider international market (if you have proper facilities).

4.4.2 Common goat breeds in East Africa

The small East African, the galla and all the exotic goats and their crosses occur throughout East Africa from desert to urban and known in tribal or local names. Their colour ranges from pure white to pure black with various intermixes of roan and speckled brown. The tassels (toggles) occur in up to 30% of the population. Adult males can weigh 30- 40kg and female's 25-30kg. They grow up to a height of 64cm at the shoulders. Both sexes have horns that sweep directly backwards and are often curved upwards at the tip. The horns vary from 2.5 cm to 20cm. The ears are of medium length (approximately 12cm), are slightly pendent and rarely pricked. 40% of the males under 14 months have beards. The coat is short and fine in both males and females but has longer hair on the hindquarters. The males often have a pronounced mane running the full length of the buck. They are mainly kept for meat as their milk is rarely enough for one kid. They are a useful animal to use as a base in an upgrading programme.



Figure 4: The small East African goat (male) and the galla goat (female)

a. Galla

The galla goat is an indigenous to northern Kenya, and is also known as the Boran or Somali goat. It's the milk queen of the Kenyan arid and semi arid areas. The female is about 60cm wide at the shoulders and weighs 45-55kgs. The male weighs up to 70kgs. They are white haired with a black skin, on the nose (muzzle) feet and underneath the tail.

Another subtype exists that has colour around the neck and lower legs and black stripe down the spine. The females are long-lived and will continue to breed and rear healthy kids up to 10 years of age. They carry better milk genes and give greater opportunity for genetic selection for this trait. The back is fairly long and slightly dipped. They are docile animals easy to handle but do not like cold wet climate, thriving best in low altitude preferably in acacia bush country. They have a higher compensatory growth rate after long dry season. The Galla produces about half litre of milk per day.



Figure 5: Cross-bred goat to Saanen goat (middle) and Toggenburg goat (female)

b. Exotic Breeds

Saanen

This is the milk queen in the goat world, that originated from Switzerland. It's all white or creamy coloured with pink skin pigmentation. The face is straight, the ears are upright and alert (pricked) the hair is short and fine and the body is long. As a rule, Saanen does not carry tassels. Under good management, it produces 3-5 litres of milk per day depending on management regime. They are prolific and have high twinning rate. Sometimes the kids are born with both male and female organs (hermaphrodite). This has been observed on polled goats. Mature male weighs 70-100 kg and mature female weighs 50-70 kg. The female measures 74 -80 cm in height while the mature buck measures 81-92cm. Udders are usually shapely and well attached.

c.Toggenburg

There are two breeds of Toggenburg; one originating from Switzerland and the other one from Britain. The British breed is bigger than the Swiss breed with the female of the British type weighing up to 70kg and bucks up to 100 kg. With Swiss type, the female weights are in the range of 50kgs with bucks up to 70 kg. They are brown or greyish brown in colour with distinctive white stripes on the face and legs. They may be horned or naturally polled. Horns in male are long and curving back. They may have toggles (tassels) or not. They are very gentle and quiet in temperament. They are easily handled and can be trained. They have a long body and seem bony. They are bred for milk with average milk yield of 1-3lts per day depending on management. The breed is suited for the higher cooler regions where heat stress is not a problem and good quality fodder is freely available.

d.Alpine

The breed originated in French Alps. They are medium to large in size and are hardy and adaptable animals thriving in many climates. They have a varied coat colour with shades of grey, brown, black, red-buff and combinations. They have a pronounced mane in both male and female. They may or may not have horns. The goat is bred for milk with average milk yield ranging from 2.5-4lts subject to levels of management. The Female weighs from 50-60kgs while bucks weigh 65-80kg. The female ranges in height from 70-76.cm and the male 80-90cm when mature.

e.Crosses

There are many crosses depending on the breeds used. The exotic breeds have been crossed with the local breeds to get a better adapted and higher yielding animal than the local goats. This is the best starting point for those with the local goats wishing to keep dairy goats. The performance of the crosses has varying degree of success depending on environment and management. There are also crosses between the exotic breeds for instance Saanen and Alpine.

4.4.3 Advantages of rearing dairy goats

Many advantages that can be realized from keeping the dairy goats include:

- Have a superior production capacity than a cow. A dairy cow is bigger in size and therefore requires more feeds, water, mineral salt and labour than the dairy goat.
- Can be reared in urban and peri-urban plots. This is because the faecal consistence (pellets) is easier to handle and dispose than the bulky cow dung of the dairy cattle.
- Requires relatively smaller space than a dairy cow.
- Dairy goats are much easier to convert to money than a cow.

- Dairy goats are less vulnerable to diseases especially tick borne diseases e.g. anaplasmosis, babesiosis and are not susceptible to ECF.
- Goats are fastidious feeders as a result they are the last animals to die from drought.
- Goats consume a wide variety of grasses, weeds and small branches of bushes and trees. They also act as scavengers consuming discarded leaves, peelings and roots of vegetables, husks of corn, citrus and banana peeling and other waste plant residues that would otherwise cause pollution

4.4.4 Goat Products

Other products include. Castrates, bulls, breeding stock, and skins, in addition to the following by products:

a. By-products

Include hooves, manure, bones, horns and blood.

b.Opportunities

Availability of goat rearing space.

- High demand for goat's milk.
- Availability of goat's semen at CAIS.
- High nutritional and medicinal value of goat's milk.
- Highly trained personnel are available.
- Credit facilities available.

4.4.5 Cultural issues

Though dairy goats (e.g galla and boar goats) are currently being introduced to some ASALS communities for milk production, relative resistance to diseases and adaptability to harsh enviroments, yet in some communities, goat's milk is not acceptable. Though this is changing with time, there is need for concerted efforts from all the stakeholders to promote consumption of goat's milk.

4.4.6 Breeding of goats

a. Selection of the breeding Buck

There are several important things when selecting for breeding:

A healthy and good quality buck (he goat). The buck must be healthy, strong and should have a well-developed body frame. It must be of productive breed. It must have normal sexual organs and well developed testicles. The buck must be selected from does that produce a high volume of milk and are prolific.

Control mating i.e. Limit the number of does per male (the recommended ratio is 1 male for 35 does)

The Buck must be free of any physical defects e.g. undershot jaws, overshot jaws

It should have a strong masculine head and neck and noisy and should seek out females on heat and mate them. If it's shy and timid it should be culled.

Badly worn teeth indicate old age. Males with split, missing or worn teeth should not be selected for breeding as they are physically unable to browse or graze properly.

Legs should be checked for deformities and hooves trimmed.

b. Selecting a Replacement Buck

A healthy a well-developed male for mating should be identified by the second month of birth. It should be used for breeding when it is 11 months old. Depending on the dairy breed the buck should weigh 10-15 kg at six months and about 20-25 kg at 11-12 months of age.

At the beginning, the use of young buck should be limited to 10-15 does per male, but at the end of the second year, the number of does can be increased and maintained at 35-40 does per buck. One active buck can deal with 20-25 females per season.

Bucks should be properly utilised to control their temperament. Under-utilised bucks tend to be vicious and very destructive. At least 3 services per week will keep the buck busy.

Breeding of male and female polled goats may result in hermaphrodite kid(s).

Replace bucks after 18-24 months of active service to prevent inbreeding.

Selection of the breeding doe

The productivity of a flock depends on the good quality of the mother. Select does with high milk production and high fertility rate:

The doe must be well built and healthy. A female should not be mated unless it's physically fit. Thin females will not come into heat, will be become pregnant and abort, and reabsorb the foetus at early stage. Those, which are mated and carry their kid will be unable to rear it satisfactorily.

Legs should be checked for deformities and hooves trimmed. Good strong legs are essential for breeding doe. Weak bent hind legs are highly heritable factor and females with this should not be selected for breeding.

- It should produce kids every 8-10 months.
- It should produce twins frequently.
- It should produce enough milk to rear the twins and for the household consumption.

The udder should be soft to touch with two functional teats. Any hardiness indicates the female has had a problem e.g. mastitis. Long pendulous udder is highly heritable and females with this should not be used for breeding. Big udder is liable to tearing by thorns and kids have difficult in suckling them. It also predisposes the doe to mastitis.

Badly worn teeth indicate old age. Females with split, missing or worn teeth should not be selected for breeding, as they are physically unable to browse or graze properly.

Any female with physical deformities (e.g. bad feet, hard udders, blind eyes) should not be selected for breeding.

NB. Farmers should seek breeding animals from registered breeding farms.

d. Breeding systems

There are several breeding systems that can be used in breeding of dairy goats depending on the environment and purpose.

Heritabilityfactors(Inheritabletraits)Many of the qualities in goats are highly heritable and knowledge of those which can be passedon from parents to the progeny is useful to the breeder who wishes to improve his stock.

Table 1: high and low heritability factor

Low heritability Factors
Birth weight
Litter size
Kidding interval
Milk flavour

e. Inbreeding

This is mating of closely related individuals without the introduction of new animals from outside. If the process continues animals with undesirable characteristics are likely to appear e.g. physical deformities, sterility and reduced body sizes.

f. Line breeding

This is a mild form of inbreeding designed to concentrate the genes of a specific ancestor

g. Crossbreeding

This is system where two different parent breeds are mated. The first generation crosses are intermediate to the parent breeds. The offspring are superior to the parental breed in some cases (hybrid vigour). The offspring's displays increase in size better live-weight gains fertility and viability

h. Backcrossing

This involves crossbred offspring's being bred to one of the parents.

i. Upgrading

Foundation refers to an F1 (first generation) at 50%, Intermediate (second generation) is at 75%, an appendix (third generation) is at 87.5% and pedigree (Fourth generation) is at 92.5%. The percentage represent the proportion of the exotic blood in the resultant cross (breed).

j. Signs of a doe on heat

For a doe to come on heat it should be nutritively fed under proper alongside appropriate supplementary feeding of concentrates and mineral licks. A doe on heat will show the following signs

- The vulva appears swollen and reddened
- loosing of appetite and restlessness

- Frequent urination
- Bleating and nervousness
- Wagging of the tail
- Slight mucus discharge from the vulva.

The presence of a buck has been shown to induce heat in a doe that could have been problematic in detection of heat. Heat can also be induced by rubbing a piece of cloth around the base of the bucks horn and then taking the clothe to the doe.

I. Mating

For successful fertilisation to occur the doe has to feed well and kept in good shed. She must be in good health. To become pregnant the doe and the buck must mate. A doe noticed to be on heat should be brought to the buck and remain with it for a period of not less than 36 hrs for effective mating to take place. If mating is successful, heat signs will not appear and pregnancy will be assumed to have occurred. The gestation period lasts for 5 months. If mating has not been successful heat signs will occur and a second mating service will be necessary. Repeated signs of heat even when the doe has been mated could be due to a problem with either the buck or the doe and therefore the doe and the buck should be examined by a vet.

m. A.I. Services

Artificial Insemination services for Dairy Goats are available at the Central Artificial Insemination Station (Kabete). The semen available is for German Alpine sold at kshs 500 per straw.

n. Feeding

Goats require five major classes of feeds,

- Energy
- Protein
- Vitamins
- Water
- Mineral salts

Goats consume a wide variety of grasses, weeds and small branches of bushes and trees. They can consume leaves, peelings and roots of vegetables, husks of corn, citrus and banana peeling and other waste plant residues. Goats are ruminant and therefore chew cud and are able to utilise roughage with high fibre content. They produce protein, vitamin B and K in the rumen. Goats are fastidious feeders as a result they are the last animals to die from drought

4.4.7 Sources of Protein

Leucaena, Calliandra, Mulberry, Grevellia, Gliricidia, Sesbania, Tithonia, Lantana camara, Siratro, Sweet potato vine, Clitoria tarnatae, Lucerne, Desmodium,

Most of these herbaceous legumes have anti-nutritional factors (eg tannins and cyanides). It's recommended that these should not exceed 25% of the total feed requirement per day. They should be wilted before feeding.

A. Agro-industrial by-products.

Groundnut cake, cotton seed cake, Sunflower cake. Maize germ, maize bran. The dairy meal fed should be divided into 2 portions daily.

B. Energy feeds

*Rhodes grass, Napier grass, Panicum spp, Cenchrus spp, Sorghum, Bana grass.*Banana stems and leaves should be fed as a last resort to feed demand.

C. Crop residues;

Maize, millet, Rice, Wheat, Barley, oats Sorghum others include bean haulms, Sugar cane tops, Sunflower heads.

D. Feeds

Goats require five major classes of feeds,

- Energy
- Protein
- Vitamins
- Water

Mineral salts

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4.4.8 Management of parasitic infestation

Most animals carry parasites burdens, but the pressure of parasites is not serious until the population rises to the extent that the host animals start showing signs e.g. weight loss, diarrhoea, unthriftness, bottle jaw, coughs, loss of hair, scratching against the wall.

The parasites are divided into ecto and endo -parasites.

a. Ecto-parasites (external)

These are mainly the ticks, biting flies, fleas and mites that can be controlled by spraying with appropriate acaricides, including a pour-on acaricide.

b. Endo-parasites (internal)

These are mainly worms e.g. round worms, tapeworms, lungworms, flukes. They are controlled or treated with regular deworming of goats and kids after every 3 months. Repeat deworming to any animal showing worm infestation.

c. Hoof trimming

This is a management practice to control abnormal growth of hooves that may lead to lameness in goats. The overgrown hooves can be trimmed using hoof knife and dipping the hooves in copper sulphate solution. The stock should have their feet regularly checked for damage due to overgrown hooves.

d. Castration

Castrates are the young goat males not intended for breeding castrated at six months of age and this done by using the rubber-ring elastrator.

e. De-budding

This is done at 3 months of age using hot bars (de-budding irons), done to both male and female kids.

f. Goat diseases and control

The table below shows some diseases and their control measures & treatment.

5. Camel production

5.1 Introduction

Camels are thought to have been introduced into East Africa by Somali speaking communities from the Arabian peninsula over 1000 years ago. These early pastoralists also had cattle, sheep and goats, but camels were better adapted to the dry climate and deteriorating rangeland of northern Kenya and other dry areas of Africa. They contribute greatly to human survival in dry areas. Historically camels arrived in the region only after deserts had been created by overgrazing and the following land degradation. Perhaps had the camels come before the desert would not have followed, as camels do not deteriorate lands at the same rates as other livestock. They have no hoofs to destroy the fragile soils and they are mainly browsers, meaning grasslands do not become depleted where camels have fed. Camels produce milk throughout the lactation period, whereas cows and small stock dry up during droughts and prolonged dry spells. The total number of camels globally is said to be 20 million, but as most camels are owned by nomads, this number can only be estimated.

5.2 Understanding camels

Camels come from the most barren and harsh places on our planet. Everything in the camel is designed to trap or save moisture; even their blood cells are different in order to deal with less water but need more salt than most animals. They are not considered 'real ruminants', but they have a 3-compartment stomach and do regurgitate and re-chew ingested forage, and they are very efficient in getting sufficient energy even from poor feed. Their body temperature can raise up to 36°C without troubling them seriously, and is often under air temperature. They can walk 3-5 days with absolutely no feed.

They have a very good sight, and their eyes are surrounded by long lashes to protect them against winds and sand. and 34 sharp teeth which allow them to chew almost anything. Despite that they come from dry areas, they are good swimmers. Naturally they will rest during the hot days and feed in the cooler evenings.

5.3 Camels in East Africa and Kenya

All camels in Kenya are dromedaries or one-humped Arabian camels. Camels are used as multifunctional animals in pastoral production systems of East Africa with the general aim of producing milk, meat, blood, hides and skins, provision of transport, barter trade (sale and exchange), and social and cultural functions. Camels have an outstanding milk production, even in harsh environments, compared with cattle and small stocks under the same harsh environmental conditions. Their lactation persists well into the dry seasons and rarely ceases even during extended dry spells. Camel's milk is preferred to milk of other livestock species because of its taste, nutritious value, medicinal and health

reasons and it is perceived that camel milk prevents thirst. Depending on the accessibility of the market, surplus camel milk is also sold for cash income by members of the communities. Meat production from camels is less important in the east African region due to low reproductive performance as compared to cattle and small stocks.

5.4 Camel milk

Camels are the main source of milk in the ASALs. Most of the milk is consumed at production points due to poor market outlets. During the rainy season significant amounts of milk go to waste despite the fact that camel milk is nutritious i.e. high in Vitamin C and Calcium. Camel milk is known to be rich in iron, unsaturated fatty acids and B vitamins, and is by some recommended to HIV/AIDS patients, and may play a role in reducing diabetes and coronary heart disease. With improved feed, water and husbandry they can yield up to 20 litres per day. It is a natural and essential food item in areas where there is a scarcity of water and forage. There may be 200 mill. potential customers in Africa and more in other parts of the globe. This calls for innovation such as processing of condensed milk that has longer shelf life and introduction of milk cooling, preservation and processing facilities in the main camel milk producing countries. Hence there is need to popularise camel milk and meat consumption in other regions outside the ASALs and foreign markets in Europe and Americas where there are large populations of immigrants from Africa's camel rearing communities.

Pastoralists emphasize that camels have a better meat quality because of the nutritive value and taste. Most camels are slaughtered at home for domestic consumption and the excess meat sold through a butcher. Camels are also regarded as a source of hides and skins, which are valuable raw materials for building huts and manufacturing utensils. Additionally, camels are a source of blood that is mixed with milk to form a diet component for the young warriors who are also herders. Camels also have social and cultural functions including social transactions like gifts, loans to relatives and friends and food supply at the occasion of ceremonies. Sale and exchange of camels only occurs during droughts or when pastoralists are in need of high amounts of cash, such as for paying hospital fees or school fees. Pastoralists also use camels for travel and/or commercial operations; domestic uses include carrying grain, commodities from market, large quantities of drinking water from wells both for people and calves in dry season; they are also used for ploughing and draught.

These unique and strategic uses of camel and related products explain the importance of the camel in the pastoral communities. Despite all the benefits associated with camel production in the pastoral areas of East Africa, camels still face challenges in their natural environment including camel diseases, drought and predation which expose the pastoralist to risks of losing their source of livelihood.

5.5 Camel breeds in Eastern Africa

The 3 main breeds of camel found in Kenya are Somali, Rendille/Gabbra and Turkana. These are kept by communities who bear the same names as those of the breed. The Somali breed in found in other countries of the Horn of Africa including Djibouti, Somalia and Ethiopia. There is a fourth breed of camel called Pakistani which was imported from Pakistan into Laikipia ranches in Kenya in the early 1990s. However, only a few pure Pakistan camels exist while crosses with Somali or Turkana breeds have since moved out of Laikipia to Samburu, East Pokot, Kajiado, Northern Tanzania, Mandera and Marsabit districts.

a. Somali breed and purpose

Good for milk production as it can give 3 to 5 liters in a day, milking the camel three times a day guarantees even more milk and lactation length is 1 to 1.5 years.

b. Body color: Cream/brown, Mature body weight: Ranges from 450 - 850 kg, first calving occurs between 4 - 5 years and average standing height is 2 meters when mature.

Feed requirements: Heavy feeders requiring 8 to 12 hours of feeding in a day depending on feed availability and are more comfortable feeding on shrubs because of their height. Advantages: More milk and matures early. Disadvantages: Cannot be reared in areas with rough terrain or rocky hillsides due to large size and suffer more when feed availability is low.

Within the Somali breed there are four sub-types namely Hoor, Siftarr, Aidimo and Gelab. These differ in physical, production and adaptability characteristics. While hoor is the highest milk producing sub-type, it is the least hardy. Gelab on the other hand is the smallest in body size, least milk producing but most hardy.

c. Rendille/Gabbra, Milk yield: 1 - 3 liters per day and lactation length of 1 to 1.5 years. Body color: Cream or brown, Mature body weight: 300 - 550 kg, first calving occurs between 5 - 6 years, average standing height is 1.8 meters and feed requirements: Less than Somali, requiring 8 - 10 hours of grazing.

Advantages: Does better under poor pasture conditions and rough terrain and tolerate drought conditions better than Somali. Disadvantage: Lower milk yield and late maturity

d. Turkana, Milk yield: Lower than Somali and Rendille/Gabbra that is, 1 to 2.5 liters/day and lactation length of about 1 year, Body color: Mainly grayish/dark. Mature body weight: 250 - 500kg. First calving: Occurs between 5 and 6 years of age, average standing height is 1.7 meters, feed requirements is less than that of Gabbra/Rendille, requiring about 7 hours of grazing. Advantages: Most hardy of all the breeds, very agile and able to climb steep lava hills because of small body size and least affected under situation of feed scarcity. Disadvantages: Least milk yield and matures late.

e. Pakistani, Purpose: Of all the breeds, this is the best for milk production and produces 4 - 7 liters of milk daily under ranch conditions. Body color: Predominantly chocolate, mature body weight: 400 - 700 kg and invariably drooping lower lip. First calving: Occurs between 4-5 years of age and averages standing height 1.9 meters. Feed requirements: It is a heavy feeder. Advantages: High milk yield. Disadvantages: Insufficiently tested on rough terrain and less hardy than all other breeds. Note: Across all the breeds, males are generally heavier than females. Breeding Practices.

5.6 Characteristics of good breeding bull and female

a. Bull

- Females of high milk production capability among daughters.
- Fast growth rate.
- Good body conformation (tall, large body frame and well built), upright in standing, high ability to chase and mount females and

• Adaptable to the environment (feed availability, terrain suitability etc)

b. Female

- History of producing high milk volume
- No history of diseases.
- Good adaptability to the environment.
- Good body conformation (slender body and large stomach).
- Well developed and pronounced milk veins.
- Large and well set udder with four teats.
- Good mothering ability and no history of stillbirths, abortions etc

c. Recommended bull: female ratio

- The camel keeper should maintain one dominant bull of between 6 to 12 years with one younger bull as his replacement. In some areas, breeding bulls are shared with the neighbors or even with the community.
- However, more than one breeding bull may be required depending on the herd size.
- A bull: female ratio of 1:50 is appropriate when sufficient forage is available

d. Sexual maturity

- Females become active at 4 to 5 years of age and give birth when about 5 to 6 years old. Although sexual maturity varies with breed, it is very much dependent on management level in terms of nutrition and health. When enough good feed is available, camels develop faster and maturity will be at an earlier age.
- Males attain sexual maturity at around 5 years but begins to serve actively at around 6 years when their canine teeth are sufficiently developed for fighting.

a. Breeding season

- Camels are seasonal breeders. The breeding season coincides with the cool rainy period of the year.
- Release of the egg (ovulation) in females is initiated (induced) by mating. This means conception only take place during the second mating which should take place after 20 25 days when the heat cycle returns after the first attempt to mate.

b. Mating

- Mating among camels is a violent affair and can lead to injury in females. Precautions should be taken, and they should be taken care of by physically strong people.
- Keep the breeding bull separate from the females especially when rutting since it can physically injure the females and the calves.
- Sometimes the female does not voluntarily sit and she is forced to do so by the male who often chases her around, biting her neck, back of the hump, and pressing her down. This may

result in severe wounds to the female. It is advisable to make the female sit before bringing the male to mate with her, the mating process takes about 15 minutes.

• It is also advisable that rutting males are herded by strong, mature people since they can easily hurt children.

c. Pregnancy diagnosis

- A traditional method of telling if a camel is pregnant, is to stand near it and raise your hand, then check for the raising of the tail and passing of some urine. If it does so, this indicates pregnancy.
- A pregnant camel will also raise her tail when a bull approaches her, the camel begins to show this sign 2 4 weeks after conception.

d. Signs of rut in male

- Loss of appetite and condition.
- Unusually aggressive and difficult to handle (Chases away all the other males and even humans).
- Frequent urination and splashing urine on the back by flicking the tail.
- Prolific secretion from the poll glands situated behind the ears and rubbing the secretion onto plants as a way of marking its territory.
- Protrusion of a soft palatal flap from the mouth (with air, in form of a pink balloon as shown in the picture below).
- Making characteristic noises and continuously grinding their teeth with saliva flowing from the mouth.
- Rutting bulls should be separated as they may fight to death.

e. Signs of heat in female camels

- She may become restless
- May show swelling of the vulva and mucous discharge
- Frequent urination.
- Making characteristic noise.
- May have reduced milk yield.
- May sniff urine from other females.
- The heat is repeated after 20 25 days for females that fail to conceive

5.7 Recommended breeding practices and their advantages

a. Avoid inbreeding by:

- Replacing the breeding bull at 12 years when its first daughters becomes sexually mature.
- Exchanging bulls with neighbours.
- Use of two or more breeding bulls.

b. Advantages

- Minimizes congenital/inherent problems e.g. deformities.
- Enhance calf growth.
- Reduce calf mortality.

c. Use bulls younger than 13 years

Advantages

- Young bulls have high ability to follow and mount females.
- Young bulls come to rut faster after the dry season and serve for a longer period in any given breeding season.
- Young and active bulls ensures higher conception rates of females.
- Retired bulls can be castrated and fattened for meat or other uses.

d. Use females of less or equal to 6 calving Advantages

- These young females normally have good body condition.
- Produce more milk for the calf and humans and their calves show higher growth rate.

e. To upgrade your camels through cross breeding, look for a bull with the traits you desire Advantage

• A bull propagates desired traits in a herd very fast as it has capacity to serve 50 dams in a breeding season. A female can only give birth to one calf at a time and it takes a long long time before you have introduced the desired traits into the herd.

5.8 Care of pregnant camels, a month before giving birth

Closely monitor the camels, as this is the most critical stage.

Graze the camels near settlement or boma as they may require some assistance in giving birth.

Avoid grazing such camels in areas with potholes, gulleys, rocky areas, slippery grounds since such camels may easily fall down and severely injure themselves.

Do not allow the camels to wallow in the soil.

Do not put such camels in sloppy bomas, as it is difficult to stand on such a ground.

a. Signs of labor

- Enlargement of the udder.
- Sagging of the ligaments at the root of the tail.
- Restlessness including lying down and standing up.
- Loss of appetite.
- Make characteristic noise.
- Isolating themselves from other camels
- b. Calving management and calf rearing

Table 2: Guidelines to follow with the pregnant camel

What the herder/helper* should do	Why

•	Separate the camel from the rest of the herd and keep it in the boma	•	You can keep a close eye on her
•	Be near the camel	•	She might need assistance
•	In case of difficult calving, pull out the calf gently	•	This is to avoid damage of the uterus or
	(after washing hands and equipment thoroughly)		injuring the calf
•	Make the mother lie down to ensure that the calf is	•	Dropping the calf while the mother is
	not dropped while the mother is standing		standing can injure the calf
•	Remove birth fluids on the calf body particularly around the nose.	•	Removing fluids from the nose and body is meant to avoid suffocation of the calf and pneumonia due to cold and possible death since camels do not lick their calves.
•	Treat the cut end of the umbilical cord with some iodine, strong salt solution or just tie it in a knot or with a string that is either boiled or disinfected with Dettol or Savlon.	•	These measures prevents entry of bacteria or foreign bodies which may cause secondary infection.
•	Put the calf in front of the mother until the mother makes some low groaning noise.	•	Groaning normally indicates her acceptance of the calf.
•	Assist the calf to suckle and if the mother refuses to suckle her calf, which is especially common with first calvers, smear the mother with some birth fluids around the nostrils. If she still proves difficult, isolate and scare her so that she only see the calf around her. This helps in forcing her to accept the calf. In case of death of the mother, cover the foster mother with hide of the dead mother to enhance acceptance.	•	Early suckling (the first 3 to 6 hours) is very important because of colostrum which gives the calf essential immunity to infections in the first few months of life
Note calf i althc man	e: If mother dies before two months post birth, the rarely survives. Must witness dropping of placenta bugh retention is very rare; can also be removed ually	Re sev	tained afterbirth in camels may lead to vere post-birth complications

a. Calf Rearing

Table 3: detailing calf feeding regime
Management	How it should be done	W/by	
practice		vvny	
Colostrum feeding	Allow unlimited access of the calf to the antibodies, vitamins, proteins rich and easily digestible colostrum within the 1st 3 to 6 hours. If the dam does not produce milk, induce the let down by palpating the udder and the abdomen. In the absence of milk from the mother, feed the calf on milk from other camels. Note: Herders sometimes deny or give very little colostrum to the calves, claiming that excess colostrum causes diarrhea, especially among the second calvers . Research has shown that irregular feeding and bacterial infection causes the diarrhea and not the colostrum. Other causes includes worms and ingestion of dirt	•	Colostrum gives the calf passive immunity and washes the stomach The quality of colostrum depreciates with time Antibodies are proteins, and can only pass through the walls of the intestines in the first 24 hours after birth
Housing	Camel calves need to be protected against cold especially at night. The pen can be made with thick and strong bushes cut from the surrounding. The pen should be swept at least once a week to avoid accumulation of ecto- parasites Ticks contribute significantly to the	•	Over-exposure to cold breeze can cause pneumonia and death, a strongly built pen protect calves from predators while regular cleaning helps in control of ticks
Tick control	high camel calf mortality. A camel keeper should thoroughly wash young calves with acaricides e.g. triatix once in two weeks or even shorter interval depending on the tick load	•	Ticks cause paralysis and eventual death of the calves if not controlled

	Method 1: Rehydration of the calf	
	using a mixture of water, table salt	
	and sugar/honey	
Diarrhea management Note: Different camel keeping communities use different traditional methods to manage diarrhea. However, these methods are largely ineffective as evidenced by high mortality rates. Effective modern and traditional methods of managing diarrhea	 Take three table spoonfuls of sugar or honey and one and half table spoonfuls of table salt and mix with three litres of clean water Give a soda bottle (300mls) full of this solution through the mouth on four hourly intervals until the diarrhea stops. Method 2: Traditionally eggs from chickens which interact with camels is used Give one egg by the mouth daily to a calf with diarrhea until it stops Method 3: Use of conventional drugs 	 Diarrhea contributes significantly to the 12-60% camel calf mortality levels reported among camel herds in Kenya When a calf has diarrhea, it looses a lot of water that leads to death if not replenished. The honey-table saltwater solution has rehydrating and treatment effects The eggs of chicken which interacts with camels and feed on ticks and other flies from camels have been observed to have both treatment and preventive effects on the diarrhea
as explained under the 'how' column exist.	 Give sulphur based drugs e.g. S- dime tablets according to manufacturer's instructions Note: The sick calf should continue suckling, be kept in a clean environment and separated from the healthy ones until it recovers 	These measures prevents spread of the diarrhea to other calves
Calf management in the first four months of growth	 Let the calf run with its mother during the day for the first three months After the third month when the calf is able to graze actively, gradually reduce the milk allowance depending on the quantity and quality of forage 	 This allows the calf adequate milk. Heavy milking for human consumption at this stage negatively affects calf growth rate hence delaying its reproductive and physical maturity Early separation contribute to calf diarrhea since such a calf stays hungry the whole day and when the

	available and its growth	mother returns home in the evening
	performance	it takes a lot of milk at one suckling
	In case of death of the mother or	The milk tends to cramp the
	calf rejection, bottle feeding is advised	undeveloped stomach leading to diarrhea.
		 Letting the calf accompany its mother during the day also triggers early rumination because of early access to forage and water
	 Gradually wean (dry) the calf 	Camel keepers wean the calves at
	from suckling	an average age of one year. Under
	 Deworm at weaning 	pastoral management, calves before
	 Vaccinate the weaners for 	weaning mostly graze around and
	trypanosomosis	are watered at home. However, after
Management of	Feed the weaners on good	weaning the calves join the main
the non-suckling	quality forage	herd that is normally subjected to
calves (weaners)	Gradually increase the watering	long distance foraging and watering.
	interval	This abrupt change in management
	 Supplement with minerals 	contributes to stress, which may be
	Wash weaners for external	disastrous to the calf. The practices
	parasites	outlined here minimize the stress.

- Additional methods of managing diarrhea in camel calves (this works in some cases with cattle calves, dose may need to be increased for camel calves).
- Drench with Kaolin (about 2 handfuls in a soda bottle mixed with a bit of cud from the mothers mouth and filled with clean (preferably boiled and cooled) water. Drench at least twice per day until symptoms disappear.
- Charcoal drench: Crush charcoal very finely. Put about 2 handfuls in a soda bottle, fill clean water and shake. Drench morning and evening.

5.9 Camel Nutrition

a. The importance of good nutrition in camels

Nutrition of the camel is fundamental to growth, reproduction and production. Optimum nutrition is essential for it has a profound impact on fertility, foetal growth, birth weight and also the future milk yield. Good nutrition implies that the camel must get sufficient proteins, energy, roughage, minerals and water. Comparative studies between camels and other livestock show that the camel has lower food intake in relation to body weight than any other livestock species.

- Protein is important for growth and milk production
- Energy enables camels to walk around in search of pastures and water
- Roughage enhances feed intake and digestion

- Minerals are important in reproduction, formation of bones, feed digestion and absorption and milk yield, among others
- Water is useful in transportation of nutrients, air and wastes through the body systems and in temperature regulation.

b. Feeding habits

- Foraging camels spread over a large area thus minimizing pressure on a particular forage species and area i.e. low trampling and soil disturbance.
- The cleft on the upper lip helps camels in diet selection i.e. removing leaves from stems and picking acacia pods from the ground.
- The lips are thick and the upper lip is divided and very sensitive, suited to pick leaves from small branches i.e. nibbling. The small tongue is good enough to hold the leaves. The camels can consume even the little branches that contain thorn quite comfortably.
- On the average, protein content of diets selected by camels is higher than for other livestock.
- The long legs and neck enable camels to browse up to 3 m above the ground, a height not reached by other livestock.
- Due to their specific forage preferences and feeding at higher levels, camels are rarely in direct competition with other animals (notably cattle and sheep) for grazing and therefore a combination of these species results to increased productivity per unit of land.

c. Suitable camel feeds

Given the opportunity, camels prefer to feed on shrubs and trees (browsing). However, in the absence of browse forages they can comfortably live on herbs and annual grasses. The concept of planted forages is not applicable in the Kenya situation where camels are reared under extensive free range systems. What is practical is to manage the natural forages in a way that promotes growth of palatable and quality shrubs that camels prefer. Keeping a mixture of camels and small stock or cattle where possible helps in maintaining the required forage composition.

- A camel requires 8-10 hours of grazing daily to be satisfied. This depends on breed, body size and feed availability. They disperse easily therefore the herdsman must be on the look out to keep them together.
- In an ideal situation, camels are able to select a high-quality diet that provides all the nutrients required by the body.
- Camels are also able to survive on low quality fibrous roughages. They adapt well to different diets and dietary conditions.
- During the dry season, when other forages are scarce, camels can browse on the green tips of trees (e.g. Acacia sp.) that other livestock species do not, enabling them to survive droughts.
- It is worth noting that there are some plants that can poison camels e.g. Capparis tomentosa and Solanum spp and areas where such plants are concentrated should be avoided.

d. Some important range forage species for camels

Table 4: Important range forage for camels

Local Names	
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Scientific name	Growth form	Somali	Rendille	Turkana	Samburu	Gabbra
Acacia tortilis	Tree	Abuk Abak	Dahar	Etir Ewoi	Ltepes	Dadacha
Acacia nilotica	Tree	Bili Madow	Gillorit	Ekalapelimet	llkiloriti	Burquqe
Indigofera spinosa	Dwarf shrub	Rufile Maratel	Khoro	Emakwi	Lkitagesi	Korategala Kiltipe
Salsola dendroides	Dwarf shrub	Darran-ad	Hadum	-	Aduung	Durte
Boscia coriacea	Shrub	Ghalangal Dakkiyah	Yoror	Erdung	Serichoi	Galgacha
Balanites aegyptiaca	Tree	Kullen Kidthi	Kulum	Eroronyit	Sarai Ilbulei	Badhan Baddana
Salvadora persica	Shrub	Adde Athei	Hayei	Esekon	Sokotei	Aadhe
Euphorbia tirucalli	Shrub	-	-	Elila	Loile	Anno
Cordia sinensis	Shrub	Mared Mareer	Gaer	Edome	llgoita	Madeera
Barleria Spp	Herb	Gamaadiis Odarol	Geidow Sucha	-	Lkurumbule Sucha	Maadek Shiisha
Blepharis linarifolia	Herb	Quarda Yumarook	Lemaruk Harja	-	Emarak	Kutumbule Baraata

e. Feed digestion

Camels are pseudo ruminants. The camel ruminates, chewing cud mostly at night, but though there are similarities in stomach construction, the camel stomach has only 3 chambers with no clear distinction between omasum and abomasum. Camels digest cellulose better than other ruminants. The camel has no gall bladder therefore no bile salt to assist in digestion of fat. Further, camels have lower metabolic rates than other livestock, helping them to utilize their feed very efficiently and minimize water intake.

f. Mineral requirements

- Camels are known to prefer grazing and browsing on salty plants, suggesting higher requirement for salts.
- Pastoralists are aware that camels require salt and some make efforts to take their camels to naturally occurring salt sources.
- Suggested salt allowances under normal dryland conditions range between 30 and 60 g/day. A camel working hard in the hot season may need as much as 140 g of salt daily.
- Mineral deficiencies adverse effect productivity of camels.
- Research has shown that camels suffer specific mineral deficiencies due to complete lack or inadequate levels in the natural sources, which suggests need for properly formulated and balanced minerals for camels. One option is to buy industrial chemicals especially those

containing phosphorus (dicalcium phosphate), calcium (calcium carbonate) copper, zinc, selenium, magnesium (copper sulphate, zinc sulphate, magnesium sulphate) that will supply key and commonly deficient elements and mix them with natural mineral licks or other livestock salt available in the market. The mixing ratio however needs to be guided by an expert as it depends on the difference between what the camels can get from the grazing resources and their daily requirements. Regular moving of camel herds to places with natural salts (water, licks or plant) for supplementation do help to some extent.

g. Water requirements

Compared to other livestock, the camel is the most efficient in water utilization in the body by being able to reabsorb most of the water in the intestines and kidneys leading to dry feacal pellets and concentrated urine, avoiding water loss through evaporation, among others. Camels also have capacity to utilize metabolic water by recycling urea. Water requirements in camels depends on the water content of the forage and accessibility to water but is lower in relation to body weight than other livestock species.

During wet periods, camels get sufficient water from the feed and may not require direct watering. However, during dry seasons and drought periods, camels require regular watering, the recommended interval being 5 to 8 days. Watering intervals longer than this leads to dehydration which interferes with the functioning of the body systems and may reduce productivity. Watering intervals during drought of up to 14 days have however been reported. Dehydration in camels could be tested by the skin elasticity. This is done by grabbing and pulling out the loose skin e.g. the neck or lower part of the abdomen and then you release. If the skin reverts back to its normal position quickly, it suggests that the animal may not require water.

However, if the skin takes long to revert to its normal position, this suggests significant degree of dehydration.

h. Supplementary feeding in camels

Under normal circumstances camels, can get enough and quality diet from natural vegetation. This implies that in traditional extensive systems with enough browse and water, extra feeding may not be beneficial. However, during periods of feed scarcity or under peri-urban production systems, supplementary feeding would certainly be beneficial to camels particularly the pregnant, lactating camels and calves.

Supplementation can be achieved through harvesting and storage of some feed material e.g. acacia pods especially for the settled households. The nutritional quality of natural vegetation is highest at the time when vegetation is beginning to dry up and this would be the most appropriate harvesting time. Grass hay, minerals supplements and concentrates like dairy cubes could be bought from the market and fed to camels. However, this may prove expensive and only affordable for a few high yielding breeds like Pakistani.

5.10 Herd Management

Management differ among different camel keeping societies, but all try to keep a predominantly female herd. The camels are usually kept in thorny enclosures overnight, where they can be

inspected, milked and generally looked after and kept safe from predators.

Where camels are kept as part of a mixed herd, the watering intervals follow the other animals, but where camels are kept separately, watering intervals may be increased gradually up to 2 weeks, enabling camel herds look for browse from a very large distance from water sources. Well-fed camels, which are kept away from areas with biting flies and tsetse flies rarely become sick, but droughts, excessive rains, lack of browse and other debilitating factors, can lead to diseases in camels.

5.11 Camel diseases - symptoms and control

a. Trypanosomosis

Not all Trypanosomosis parasites are transmitted by the tsetse fly. *Trypanosome evansi* (tryps) is a very serious camel parasite mostly spread by biting flies. The parasite replicates in camels, cattle and water – buffaloes. Equines and dogs are susceptible and usually die from the infection while sheep, goats and antelopes often become infected and act as asymptomatic carriers.

Symptoms: Tryps affects camels of all ages, with a higher incidence of disease in sub-adult camels shortly after weaning. Many environmental and host factors have impact on the course of the disease such as other infections, nutritional status, age, pregnancy, previous exposure, etc. If the several of the following symptoms are present in an animal, it is wise to get it tested and if positive, get it treated:

- Visible weight loss, the hump starts drooping.
- Lack of appetite.
- Swellings (oedema) may appear on feet, brisket, underbelly and eyelids.
- Fluctuating body temperature with initial peaks of fever up to 41degC.
- Shivering.
- Mild diarrhea.
- Different smell of urine.
- Abortion

Diagnosis: The best tool for diagnosing tryps in the field is a battery-operated mini centrifuge for testing the camels' blood. Such equipment should be operated by a vet or other trained animal health officers.

Treatment: The best drug to combat tryps currently is Triquin. In order to calculate the correct dose, the approximate weight of the sick camel must be known (see Bodyweight estimation). NOTE: Triquin is only meant to treat camels. Do not use on any other animal. Examples are known of goats being injected with this drug and dying immediately. Other important camel diseases are:

b. Skin diseases of camels

- Camel Pox.
- Sarcoptic Mange.
- Ringworm
- Ticks
- Flies
- Bacteriological skin infections.

• Abscesses of the skin and external lymph nodes

c. Gastrointestinal helminthes of camels

- Roundworms
- Tapeworms

6. The Modules

This training manual shall offer degrees after a period and level of education to be determined by concern national authorities in the cross-border countries and upon completion of the prescribed courses. It is the first volume work on animal production, TADs control and commodity value chain in the cross-borders of Ethiopia, Kenya and Somalia. It is divided into 6 modules, the first two modules deal with animal production and animal health and TADs control, the 3 modules 4 deal with commodity value chain, in relation to producers/farmers, including feeding and good husbandry, livestock marketing, traders and transporters; to the value addition, processors and importance of LITS and animal welfare while module six deals with veterinary services or epidmio-surveillance system that is key in ensuring constant animal disease surveillance and response are in place. The manual is intended to be used by all those involved in the implementation of the cross-border projects for the benefit of the pastoral and agro-pastoral communities, although organized according to specific issues addressing animal production, animal health and TADs control to public health and commodity value chain.

Assessment of the training modules' effectiveness, adaptability and flexibility will be based on evaluations of the pilot courses, with the trainees being asked to complete pre- and post-course assessment of their knowledge and to evaluate their perceived improvement in comprehension of the subject matter. This is in addition to another evaluation form that will be completed by trainees at the end of each module, ranking the effectiveness of each module on a scale of 1 to 5, with 5 being the highest level.

All with plans to improve or adjust the modules and training conduct from time to time. Training of the trainers (TOT) will proceed training of the trainees who must come or heal from the cross-border communities and who will be trained and employed by the relevant local government institutions on written commitment to remain within the communities after training and employment for a period of, at least, 5 years before being promoted to the next level or allowed to opt for jobs of their choice.

Accordingly, ICPALD undertook the development of the training manual, which has the following 6 (six) concise modules:

7. Module 1: Livestock production, with an introduction to livestock production systems in the cross-border areas of Ethiopia, Kenya and Somalia 7.1 Introduction

This module is, basically, designed to provide background knowledge required for better understanding of the next four modules. At the end of the session, trainees are expected to:

• Know the livestock production systems and environment of the cross-border pastoral and agro-pastoral areas and identify major production systems in the region;

- Describe the status and challenges of livestock and products trade from the cross-border peripheral areas to semi-terminal distant livestock markets in Ethiopia, Kenya and Somalia;
- Understand basic concepts of a commodity value chain and relate the concept to livestock and products trade, together with disease management;
- Comprehend food safety, SPS and quality requirements for live animals and products trade from the cross-border areas, including issues of animal welfare.

The cross-border areas are chiefly inhabited by pastoral and agro-pastorals whose livelihoods largely depend on livestock production and pastoralism. Majority of livestock (cattle, sheep, goats and camels) traded, internally and internationally, in the IGAD region come from these cross-border pastoral and agro-pastoral areas. The region has total land area of 5.2 million square kilometers accounting for 17.3 % of Africa. The total population of IGAD member countries in 2017 is estimated at 267million (26 % of Africa) of which ASALS occupy significant landmass.

The region has great variety of climates and landscapes including mountains, glaciers, tropical forests and grasslands as well as arid and semi-arid areas among other features. The arid and semi-arid lands account for over 80 % of the land mass in the region. The highlands of Ethiopia, Kenya and Uganda are densely populated while the rest of the region is sparsely populated. The region is endowed with many renewable resources among which livestock is one, and is contributing significantly to the livelihood of many.

Livestock is one of the major renewable resource endowments of the IGAD region, which is one of the regions with the highest ruminant livestock concentrations in the world and in Africa. As the region is being 3.5% of the Earth's land surface; with 9.3 percent of the cattle, 12 percent of small ruminants and 60.8 percent of the camel population in the world. Its percentage share from Africa is also enormous; giving about 44.5 percent of the cattle, 38.6 percent of small ruminants and 71.4 percent of the camel population in Africa is in the IGAD region, which accounts for 17.3% of the continents land area.

7.2 Pastoral livestock production system

Pastoralism is defined as a way of life through which people secure their livelihood by keeping livestock on communal rangelands situated in the arid and semi-arid lands to dry to sustain livelihoods. In this system, rains are erratic and unpredictable – affecting the nutritional quality and availability of pastures and feeds hence, rendering pastoralism its own management strategy characterized by constant mobility and flexibility. Sixty percent of livestock and a third of the human population in the IGAD region fall under this pastoralism or extensive production system, in which milk and meat are the two major outputs. Livestock products contribute to subsistence directly via milk and meat for consumption and indirectly via sales to generate cash or to barter for cereals and other crops. Much of the livestock traded for export also comes from this system, where livestock are social, cultural and spiritual assets as they define and provide social identity and security to the owners and communities together.

The pastoralism system involves seasonal or annual mobility of livestock in search of pasture and water and the mobility increases with the level of aridity. Only two mobility patterns are found in the SECCCI project areas; Nomadic or pastoral and agro-pastoral.

Pastoralism is a livelihood and land-use system that is practiced worldwide and that has a central feature of sustainable management of herd mobility to take advantage of the heterogeneous opportunities of rangelands and to manage risk (FAO 2018). All of the indigenous communities in the ASALS, including Turkana County, Marsabit County, Mandera County (in Kenya), South Omo Zone, Bench Maji Zone, Borana Zone (in Ethiopia) and other ASALS in the region, depend on livestock (cattle, goats, camels and sheep) for their livelihoods but to different degrees, with agro-pastoralists of about 90,000 people comprising at least ten ethno-linguistic groups depending on flood-retreat farming for sorghum cultivation along the Omo river (Jennifer Hodbod and Edward G.J. Stevenson 2019). Livestock is a crucial source of livelihoods, food and nutrition security, employment, income and resilience for much of East Africa's rural population; and livestock production and related value chain, when effectively harnessed, can be the foundations of resilience and sustainable development for pastoral and agro-pastoral populations across the region (FAO and IGAD 2019).

This is the set up where the pastoralists migrate depending on the pasture and water availability. The mode of migration varies, with some communities migrating with entire families while others stay at one point with small livestock but the larger herd often migrates with the herders.

Livestock extensive pastoral production is the rural people's greater defense against hunger and malnutrition (FAO 2018); and people with resilient livelihoods have greater and more diverse sources of income from which their families are better fed and nourished; and are better prepared for and can better cope with shocks be they recurrent, protracted or unexpected. Food security, agriculture and rural development are essential elements to achieve zero hunger, build peace and stability; and achieve sustainable development in Africa (FAO 2017).

Characteristics of the nomadic/mobile set up:

- Their livelihood is dependent mainly on livestock.
- Highly mobile: migrate in search of water and pasture due to seasonal variations.
- Can move across international boundaries.
- Prone to insecurity, livestock raids and livestock and human diseases.
- Very hardy and conversant with the environment and local terrain.
- Maintain strong traditional structures/institutions.
- Adequate land mass to practice pastoralism.
- Availability of well adapted livestock to the harsh environment.
- Pastoralists have the knowledge of their landscape and the production system and what they know can be used to further advance production.
- Pastoralists have over time known coping mechanisms that can be used to save their livestock in times of drought or floods.
- Availability of strong traditional institutions that can be used to promote and protect the natural resource base for the benefit of the livestock.

Pastoralism is a production system with three distinct components that are interdependent and interact with each other: the natural resources, the herd, and the family. These three components make up the system itself and are common to all pastoral systems in the IGAD region and beyond. The natural resources comprise the feed and water that livestock and people depend on. The herd is composed of different animals. They are economic assets, but social, cultural and spiritual assets too. The family and other social institutions are the wider network of institutions in which the pastoral family will have different roles to play, and the family itself is set within a wider network of rules, obligations and operations.

7.3 Agro-pastoral (mixed) livestock production system

These kinds of pastoralists are found along main rivers that cut across pastoral areas and highland/lowland interfaces. In extremely harsh pastoral areas, agro-pastoralism is also practiced in the flood plains where mainly crops like sorghum are grown. These pastoralists mainly practice livestock keeping, and crop farming either rain-fed or irrigated cropping. Agro-pastoralists also practice other forms of livestock production such as beekeeping and poultry keeping and fodder production. Characteristics of the agro-pastoral setup:

- Rarely migrate unless under extreme circumstances.
- Part of the herd may migrate while the others remain especially the small stock.
- Settlements are usually located in permanent area such as on hill slopes(high land lowland interface) or close to permanent rivers.
- Combine livestock keeping and agriculture.
- Have other forms of livelihoods fishing, bee-keeping, mining, business, basketry and mats weaving.

Livestock keeping objective in this system is to support crop production. Cattle are the dominant livestock species and are kept mainly for draught power. Sheep and goats are kept to meet small and immediate cash needs. Sheep are more dominant than goats in this production system. The major commodity in this system is meat, while milk is a subsidiary product in some areas. Coarse wool is also produced from sheep in the central and north central highlands. The wool is usually used for the local carpet-making industry. The major feed sources are grazing and crop residues. In some countries, the major supply for domestic consumption comes from the crop-livestock system but varies with countries. Quality is a major issue in the system- particularly for trading and marketing. In some areas, domestic markets have preference for the produce of this system.

The work function of livestock (oxen for draught, equines for transport) is predominant and can be taken as the most important function of livestock, which results in a lower offtake of males for slaughter.

7.4 Intensive livestock production system

Livestock keeping objective in this system is to support crop production. Cattle are the dominant livestock species and are kept mainly for draught power. Sheep and goats are kept to meet small and immediate cash needs. Sheep are more dominant than goats in this production system. The major commodity in this system is meat, while milk is a subsidiary product in some areas. Coarse wool is also produced from sheep in the central and north central highlands. The wool is usually used for the local carpet-making industry. The major feed sources are grazing and crop residues. In some

countries, the major supply for domestic consumption comes from the crop-livestock system but varies with countries. Quality is a major issue in the system- particularly for trading and marketing. In some areas, domestic markets have preference for the produce of this system.

The work function of livestock (oxen for draught, equines for transport) is predominant and can be taken as the most important function of livestock, which results in a lower offtake of males for slaughter.

Peri-urban dairying, poultry and feedlots are the major examples of specialized livestock production systems that have largely remain at pilot stages in the cross-border areas. It is a production system, which is expanding and is largely found in the highlands where mixed-crop livestock farming is practiced as well as within urban centers. Economic factors have been dominant in determining the locations of specialized farms. The animals used in this system are crossed breeds and grade animals that produce more than what the indigenous animals can produce. The system rely mainly on relatively expensive purchased feeds and fodder.

7.5 Alternative or complementary livelihoods

- Sedentary pastoralists dependent on small businesses, crafts, basketry, small amounts of livestock.
- Agro pastoralism dependent on both crops, livestock and non-wood forest products such as beekeeping or apiculture.
- Peri-urban pastoralists small businesses, little livestock, crafts, timber for building, supply of acacia pods for goat feeding
- Aquaculture/fisheries as a livelihood dependent on fishing as alternative livelihood, combined with pastoralism, or cropping.
- Non-wood forest products such as mining Gold (mined and alluvial) and precious stones.
- Livestock trade.
- Livestock fattening in irrigated areas and areas where agro-industries (eg Sugar) are established.
- Hides and skins
- Pastoral livestock production system.

7.6 Importance of livestock production in the cross-border areas

Livestock is an economic mainstay and important contributor to household food and nutrition security, not only to the IGAD region but also to the entire Sub-Saharan Africa whose arid and semi-arid rangelands are mainly used by pastoral communities for livestock production (G.M. Roba 2017). Agriculture, in IGAD region, employs about 60-80% of the population, which is in stark contrast with the limitations imposed by conditions in the arid and semi-arid lands (ASALS), which receive less than 600mm of annual rainfall and comprise about 70% of the landmass of the region. Severe scarcity of these natural resources including all-season water shortage leads to competition over accessibility and control of these limited natural resources; and this presents a major factor fueling insecurity that has grown into chronicity.

With the region's population of 53 million in 1960, 230 million today to the projected 400 million people by 2050 (WEF 2019), IGAD is set to support agriculture production, implement regional integration,

enhance livelihood resilience, build stronger cooperation across borderlands, diversify livelihoods and work on peace building and conflict prevention in the region as well as all the IGAD MS recognize the need to create opportunities to nurture agri-preneurships among the growing ranks of unemployed youth.

Livestock is expected to become the largest contributor to agriculture sustainable growth and economic development because of growing demand for high value food items (meat, dairy). In industrialized economies, livestock accounts for half of the agricultural GDP. IGAD member states are endowed with huge livestock population at times the demand for livestock and commodities is steadily growing, with need to enhance opportunities available around livestock resources as it can be used as an engine for development of MS.

Based on its integration with crops, the contribution of livestock to household income is strongly related to land and agro- ecological zones. The livestock production systems in the IGAD region are broadly classified into three categories: pastoral/agro-pastoral mixed Crop-livestock and Urban/periurban or specialized/intensive livestock production systems. The latter includes commercial dairy and poultry, using crossbred and grade animals and feedlot operations.

Livestock marketing is another important element in the management of pastoral herds. In most countries there are three tiers of livestock markets: primary, secondary and tertiary. Primary markets are those markets in small village/towns located in pastoral areas that sell a limited number of livestock. The secondary and tertiary markets are often far away from the production center and receive the livestock from the primary markets of the pastoral areas and larger in size. The supply of livestock to market in the pastoral areas is highly seasonal. Major determinants of supply fluctuation include water and pasture availability, disease outbreaks and availability of food aid (which helps relieve pressure to sell animals for cash or grain purchases). The sells volume increases when drought strikes and disease outbreaks occur. Livestock marketing in the pastoral areas is mainly under the control of the local authorities, middlemen and traders. The middlemen act as negotiators between the traders and the producers and this at most times leaves the producer disadvantaged.

Livestock marketing is important for the pastoral communities. By selling livestock, the pastoral communities are able to purchase other items they require such as grain, foodstuffs, clothing and also pay for services such as school fees and medical care. Besides, some pastoralists also use the income they get from their livestock to set up small businesses at the village level or in big towns. Livestock marketing is also very crucial especially in times of crisis such as during drought as it helps to off-take the livestock from the depleted pastures before the animals lose condition and hence provide an income that would have otherwise been lost if the animals deteriorated or died. Livestock marketing can therefore not be taken lightly as a component of the production process, because in real sense livestock marketing is the driver of production.

Table 5: Contribution of Livestock to Agricultural and National GDP of IGAD Member States								
Contribution	Djibouti	Eritrea	Ethiopia	Kenya	Somalia	South	Sudan	Uganda
to						Sudan		
AGDP	87.4	39	45	46.3	70	14.5	47	18

NGDP	3.1	4.6	18.9	11.2	40	3.4	17	5
Source: Reg	ional Trainir	ng of Traine	ers (TOT) M	anual (2018)			

County/zone	Borane	Marsabit	South Omo	Turkana	Mandera
	zone				
Livestock spps.					
Cattle	2,079,416	415,000	3,841,347	1,932,113	1,076,978
Sheep	1,154,926	1,569,767	1,900,894	3,968,848	1,637,824
Goats	1,923,695	2,174,087	3,961,241	6,033,152	3,929,747
Camels	305,284	548,000	3,115	1,018,135	1,016,790
Horses	2,094	-	v. few	-	-
Chicken	452,630	140,000	16,604,406	228,951	Unknown
Ducks	-	-	Unknown	6,640	-
Turkeys	-	-	-	52	-
Pigs	-	-	Unknown	44	-
Mules	5,092	-	-	-	-
pigeon	-	-	-	67,000	-
Bees hives	43,199	-	-	-	-

Table 6: Livestock population in 2 Kenya Counties and 2 Zones of Ethiopia

Table 7: Livestock population in Borana and South Omo Zones compared to the national livestock population of Ethiopia

Livestock spp.	Zones in Ethiopia	Livestock population	Percentage
Cattle	Borana + South Omo	5,860,763	10%
	National	60,392,019	
Sheep	Borana + South Omo	3,055,820	10%
	National	31,302,252	
Goats	Borana + South Omo	5,384,936	16%
	National	32,738,385	
Camel	Borana + South Omo	0,308,399	7%
	National	4,509,604	

Table 8: Livestock population of Turkana, Marsabit and Mandera Counties compared to the national livestock population of Kenya

Livestock spp.	Counties in Kenya	Livestock population	Percentage
Cattle	Turkana + Marsabit + Mandera	3,424,091	20%
	National	17,265,810	
Sheep	Turkana + Marsabit + Mandera	5,358,615	41%
	National	17,265,810	
Goats	Turkana + Marsabit + Mandera	8,207,239	42%
	National	29,112,050	
Camel	Turkana + Marsabit + Mandera	1,566,136	83%
	National	3,100,000	

7.7 Animal movement control

Movement control or movement permits refer to activities regulating the movement of people, animals, animal products or vehicles and transport facilities used to transport animals and livestock

products to markets for the purpose of safeguarding public health, disease prevention and control. Movement control, therefore, is a powerful tool to control and eradication of animal diseases. It also involves the keeping of records on these movements and considered key component of livestock identification and traceability systems (LITS) as movement permits qualify animal health certificates issued by the national veterinary services. Documentation required for movements of livestock including permits are critical during disease surveillance and diseases outbreak events but may also be used preventively before and following an outbreak. The modes of transmission of disease vary and disease spread, due to the movement of live animals and animal products can be controlled by movement restrictions including quarantine.

Such movement restrictions need to be well supported by legislation and livestock keepers from the cross-border communities should understand the need for movement permits. Although some of trade-sensitive diseases such as CBPP, FMD, CCPP, RVF and PPR are well known, it is difficult to implement movement control in pastoral areas and in areas where insecurity is prevalent and borders and boundaries are porous. For this reason, risk based surveillance along the value chains that cross these boundaries is of paramount importance.

Cross-border movements are important to national and regional economies and food security, particularly in pastoral areas. More than 95 per cent of the regional trade in East Africa is informal trade. In Ethiopia alone, the annual trade of live cattle, camels, sheep and goats sold to Somalia, Kenya and Djibouti generates an estimated total value of between US\$250 and US\$300 million. This informal trade has long co-existed with, thrived and even surpassed the value and magnitude of the formal livestock trade, unacceptable or unrecognized by the cross-border communities who do not recognize national borders arbitrarily created by the European powers and split pastoral communities apart, divided ecological zones and cut through trading routes. This has seriously undermined pastoral productivity and ability to manage drought and thereby contributed to intermittent resource-based conflicts and insecurity.

Unlike West Africa, many governments in the region regard cross-border mobility, particularly of pastoralists, to be illegal rendering on-going seasonal livestock movement and trade to largely remain informal. In order to commercialize livestock production to the benefit of the cross-border communities, a comprehensive policy, legal and institutional frameworks will be required, together with harmonization of national and regional legislation.

Like practiced elsewhere in the region, cross-border mobility is a resilience practice of pastoralist communities as it is primarily motivated by the search for pasture and water as well as a means of avoiding areas affected by livestock diseases or to encamp closer to lucrative livestock markets for trade. The movements vary greatly in distance and may take place within a country and Zone or into bordering countries. In recent years, conflicts between crop farmers and pastoralists have become recurrent. These conflicts arise in the "host" countries or regions into which the herds move.

To promote and secure cross-border livestock mobility in the cross-border areas, a purposively tailored policy and legal framework need to be developed at both local and national levels. Such a framework will support implementation of the Regional IGAD Transhumance Protocol and must

unequivocally address pastoral land use, livestock mobility, conflict resolution, crop livestock integration and the integration of customary and modern institutions to create a more effective governance framework capable of mediating the interests of all livelihood groups. It is essential that this be designed with the full and informed participation of pastoral communities and other actors including farmers, local government authorities and national institutions. However, legal protection of cross-border mobility is not in itself adequate.

Finally, it is essential to harmonize the wider institutional and development framework, largely focused on growth through the modernization of the national agricultural sector, to ensure it complements and supports cross-border animal and human mobility in the cross-border areas of the neighbouring countries.

8. Module 2: Animal Health and TADs control, with an introduction to animal health and diseases, their control that includes prevention (vaccination) and control (treatment) measures

8.1 Introduction

Animal health connotes that farmed or reared animals are healthy, disease-free and well managed with an overall goal to ensure livestock production and productivity are maximized and that public health is protected. Constant monitoring and prevention of infection with pathogens and disease outbreaks is vital to the economy, safety of food supply chain and to stability of consumer prices. On the other hand, a disease is an impairment of the normal state of an animal that interrupts or modifies its vital physiological functions.

Nearly two thirds of human infectious disease and majority of emerging infectious diseases exerting heavy public health and economic burden to the global community originate from animals (Kemunto et *al.* 2018). Animal diseases result in poor body condition and low quantity and poor quality of milk and meat and, as a direct result, animals often die if infections happen without prevention and control measures in place. At the end of the session, trainees are expected to:

- Understand how livestock, natural resources and pastoralists interact with each other to make a living out of the variable and unpredictable environment of the ASALS.
- Describe issues/factors affecting quality and health status of animals at producers' level
- Identify interventions to improve the quality and Animal health status of animals at producer level.

8.2 Animal disease control measures

Almost all known animal diseases are prevalent and endemic in the cross-border areas of Ethiopia, Kenya and Somalia. Although injectable drugs are available in the markets, vaccines are preferred as an important part of a herd health programme as they can aid in the prevention of disease. Vaccines do not always provide 100% protection but they will help to maintain herd health by reducing the risks associated with diseases and help to avoid economic loss due to illness and death. The following vaccine guidelines can help to minimize the risk of adverse reactions:

- Develop a vaccine schedule with your veterinarian. Follow it or consult them before diverging or if circumstances change.
- Read instructions provided by the vaccines manufacturers.
- Do not mix vaccines in the same syringe.
- Do not use expired vaccines.

- Disinfect vaccine site with 70% alcohol swab.
- Use sterile needles and syringes.
- Use the needle and syringe for one vaccine and group of animals being vaccinated against one disease.
- Only vaccinate healthy animals.
- Keep good vaccine records; including vaccine types and producers, site of administration, animal ID, who administered, date of administration, date of required booster.
- Properly dispose needles and vaccine vials as biomedical wastes.

8.3 Animal health issues at the producer level

Animal health issues associated with livestock production include management or husbandry in place. N cross-border pastoral and agro-pastoral areas, husbandry is purely pastoral that is constantly confronted with pasture and water scarcity, which very much contribute to poor health and lower production and productivity. Modern livestock production management does not exist within the pastoralism system and hence pose issues related to food safety human and animal health as key challenges.

The livestock value chain in the cross-border areas is faced with a number of feeding related constraints, with the biggest being the burden of animal diseases. Poor quality feeds and feeding and water related issues are mainly associated with livestock production and productivity to the introduction and establishment of diseases in herds/flocks and spread to others herds/flock around through contact or distant locations through trading and as being aided by poor body condition. The dynamics of a pastoral herd contributing to introduction and spread of diseases is a common place. Purchased animals for whatever purposes, raided animals, inherited animals, unsold animals from markets etc are major cause of disease introduction to the herd/flocks. In the same way, pastoralists tend to dispose sick animals through sales and this is a potential risk for spread of diseases to distant locations.

8.4 Disease surveillance for disease control

Surveillance should involve the collection and analysis of disease/infection data such that the Veterinary Services have confidence that animals in any given establishment comply with the defined status of animal health. A surveillance system that is able to ensure early detection in the event that the agent enters the herd is essential. The surveillance system should comply with the general national guidelines for disease surveillance in the country and the specific guidelines for surveillance for the priority disease of interest.

Depending on the disease of interest, many different combinations of testing and surveillance may be applied to achieve the desired confidence in disease control. The surveillance methodology will usually follow AU-IBAR or OIE guidelines but may utilize a demonstrably equivalent method. Based on an assessment of risk factors, a country may choose to sample with greater intensity in areas of higher risk and less so in other areas that have a documented lower risk. In general, an appropriate combination of active (ongoing laboratory-based testing) and passive (observation and intermittent reporting or testing) is necessary to achieve the surveillance goals described above. A system for feedback or reporting back the results of surveillance testing must be established so that veterinary officials and trading partners can be informed of positive tests, abnormal clinical signs and production observations that are included in the surveillance strategy. The cross-border pastoral community and field veterinary officials responsible for surveillance and monitoring of the disease must report surveillance information immediately to the Veterinary Services.

8.5 Diagnostic capabilities

Designated county and zonal laboratory facilities complying with the national disease prevention and control should be available for sampling and testing. The national veterinary authorities should audit all laboratory tests and procedures, in particular, laboratories and personnel performing the tests should be trained and certified by the national reference laboratories as to their competency. Periodically, the laboratories and personnel should go for refresher short courses to complete a proficiency test to verify continuing competence. Reporting of test results should be transparent.

8.6 Emergency response, control, and notification capability

Timely and rapid diagnosis, reporting, and notification of diseases are critical to minimizing risk from outbreaks. The structure of the cross-border pastoral communities must be such that pastoralists and NGOs are aware of the notifiable diseases and procedures for reporting. Likewise, each laboratory that conducts surveillance testing must have systematic procedures in place for rapid reporting of disease results to both local and national veterinary authorities. The Veterinary Authority must then have standard operating procedures for onward reporting to other pertinent international bodies.

9. Module 3: Commodity value chain, in relation to producers or farmers in the cross-border pastoral and agro-pastoral areas: (a) Husbandry practices (b) Interventions required to improve feeds/feeding in the cross-border pastoral and agro-pastoral areas

9.1 Introduction to the module

A value chain links the steps a product takes from producer to final consumer. The livestock value chain can be defined as the full range of activities required to bring a product (live animals, meat, milk, eggs, hide/skin etc.) to final consumers, passing through the different phases of production, including processing and delivery. A commodity chain is a process used by firms to gather resources, transform them into goods or commodities, and finally, distribute them to consumers. It is a series of links connecting the many places of production and distribution and resulting in a commodity that is then exchanged on the world market. In South Omo -Turkana, Moyale-Marsabit and Mandera, which are arid and semi-arid lands, livestock production is predominantly extensive dominated by pastoralism. It is considered both an economic and social system, and highly dependent on raising and herding of livestock, which is core to pastoral livelihoods that is the main contributor to commodity value chain and in the larger IGAD MS being addressed in this manual.

The core process of a value chain includes production, processing, distribution and wholesaling, retailing and final consumption. Besides the core process, value chain is supported by a network of support service providers and is influenced by external factors. The support functions of a value chain include input supply, financial services, transport, packaging, market research and advertising. Various actors in the value chain, including inputs suppliers, producers, processors, packagers, distributers, wholesalers and retailers provide these support functions.

Good feeding is fundamental to growth, reproduction and production. Optimum feeding with quality feeds is essential for it has a profound impact on fertility, foetal growth, birth weight and the future

milk yield. Good feeding implies that the animals must get sufficient proteins, energy, roughage, minerals and water. Comparative studies between small ruminants and other livestock show that small ruminants, especially goats, are more adaptive to aridity and poor pastures than any other livestock species.

- Protein is important for growth and milk production
- Energy enables camels to walk around in search of pastures and water
- Roughage enhances feed intake and digestion
- Minerals are important in reproduction, formation of bones, feed digestion and absorption and milk yield, among others
- Water is useful in transportation of nutrients, air and wastes through the body systems and in temperature regulation.

In this section, aspects of quality and SPS requirements of high end domestic and export markets that can be influenced by traders and transporters will be covered. At the end of the session trainees are expected to:

- Understand the SPS and quality requirements that can be influenced by live animal traders and transporters.
- Describe the various measures to be taken to address SPS/animal health and quality requirements
- Understand the basic concepts of animal welfare and the importance of Livestock identification and traceability in disease management and livestock trade.

9.2 Feedlots and ranching

There are feedlots in the cross-border pastoral and agro-pastoral areas where SECCCI project is being implemented and the concept of feedlots in the cross-border areas remains a dream but one that if introduced, with members of the pastoral households from local areas running them, would change the lives and livelihoods in these remote areas. Feedlots should be designed and built in a way that reduces stress on the animal and protect its body from physical damage. In feedlots that receive animals at night, sufficient source of light should be installed on the ramp and its surrounding. Proper handling of animals reduces stress and has an impact on health and weight gain. The processing facility need to have a collection area and hydraulic operated facility to grip animals and hold them tight for easy operation of all the required tasks. When such a facility is constructed, it is important to consider the natural way of animal movement. This has double advantages. The first advantage is that an animal will not be too stressed when it moves in a rounding way. The second is that the animal will not see what is being done to the animal at beginning of the queue in the chute.

Feedlots receive cattle from a wide range of areas and provide the animals with high-energy diets to grow them to an acceptable size with an appropriate degree of finish for the slaughter market. Cattle arriving at a feedlot are usually processed on arrival to ensure their health and productivity while in the feedlot. Processing commonly consists of vaccination, parasite control, application of growth promoting implants, and other procedures such as dehorning, treatment and application of animal identification. Depending on their arrival weight, cattle may spend anywhere from 3 to 4 months in a feedlot. Typical feedlot stays are slightly less than 4 months.

On arrival at feedlots, animals must be thoroughly inspected and assessed to ease the transition of the animals into the feedlot environment and to ensure their subsequent health and productivity. Processing varies from feedlot to feedlot, but usually includes:

Control and prevention of diseases in cattle feedlot depends on purchased animal health status, transportation system that minimizes stress, a comfortable feedlot pen environment, and an adequate feeding and watering system; establishing a good surveillance system; and judiciously using vaccines and, when necessary, antibiotics.

Bio-security is a plan to keep livestock and their products safe from infectious agents (pathogens) and from any hazardous material, which is a threat to animal and consumer health. Bio-security and bio-containment are key words describing measures directed towards preventing introduction of pathogen to premises and control/disinfection should they prevail.

Bio-security has three major components: isolation, traffic control and sanitation. Isolation prevents contact between animals within a controlled environment. This includes control of commingling and movement of animals. Traffic control includes traffic onto livestock facilities and traffic patterns within the facilities. This includes control of the movement of vehicles, animals, people, pet animals, wildlife, rodents and birds, etc. Sanitation addresses the disinfection of materials, people and equipment entering livestock facilities and the cleanliness of people and equipment inside the facility.

10. Natural Resources

Natural resources on which animals in pastoral areas depend include; grasses, shrubs, trees, water, and saltpans. The availability, quantity and quality of these resources have important implications on the health and productivity of the livestock and pastoral livelihoods. Understanding and identifying factors determining the availability, quantity and quality of natural pasture in pastoral areas helps to understand the rational underpinning pastoralists' management decisions and strategies. Season (dry and wet season), even in wet season- variation in rainfall amount and distribution in time and space, inter-annual variability, and pasture management practices (the interaction between pasture and livestock) are some of the major factors affecting availability, quantity and quality of natural resources for livestock.

The variation in moisture for the plant growth between the wet and the dry season have an important influence on the quantity and quality of pastures between these seasons. Grasses in wet season pasture contain more water and are richer in protein and minerals and have higher digestibility. In contrast, during the dry season, many grasses have either completed their life cycle (annuals) or are dormant (perennials) and have very little water content, lower protein and digestibility.

This variation has implication for pastoralists. During the wet season, because grasses are of higher nutritional value, animals put on weight, produce more milk and are in a better condition. In the dry season, however, because grasses are of lower nutritional value livestock loose weight and are less productive. In dry lands these fluctuations are normal and are not a result of bad pastoral management. Rather pastoralists learn and integrate this variability into their livestock management strategy.

Low nutritional content of grasses during the dry season means that trees and shrubs are important for the livestock diets during dry seasons and droughts. During the dry season, trees and shrubs generally have higher level of water, protein and minerals and digestibility than the surrounding grasses (Fig 5). Access to trees and shrubs during the dry season can thus provide livestock with higher nutritional diets, thereby reducing livestock weight loss and maintaining a level of productivity that would not be possible if they only graze on grasses.

In ASALS region, rainfall is unevenly distributed within the rainy season. The amount of rainfall that falls in any given rainy season is highly variable in time and space. Furthermore, the distribution of rainfall from one year to the next is also highly variable in time and space - no one rainy season has the same rainfall pattern as another. This means that in the ASAL region not only is rainfall highly variable, but it is also highly unpredictable.

Even if the total annual rainfall is roughly the same from one year to the next, it is not necessarily the case that that the same amount of pasture will be produced from one year to the next. This is because rainfall in the wet season tends to come in a start- stop fashion of varying amounts. In some years, the distribution of the timing and amount of rain is such that it supports the reproductive cycle of pastures, while in other years the patter of the rainfall is such that seeds do not germinate, or if they do, the subsequent distribution does not enable them to survive and complete their cycle. Therefore, the timing, and amount of rainfall can affect seed germination and the subsequent growth of the plant through to maturity and the production of new seeds. This has also implications for potential pasture growth the following year.

The scattered and start stop nature of the rainfall also means that pasture do not grow everywhere at the same time, and pastures are at different stage in their growth cycle during the rainy season. Different pastures will therefore vary in their level of nutritional quality. Therefore the rangelands in pastoral areas are made up of a mosaic or patchwork of pasture areas each at different stages of growth, producing different amounts of grass and more importantly, each offering different level 0of nutritional quality.

This variable distribution in pasture is necessarily a constraint for livestock production and productivity. Pastoralists have several strategies to exploit this variability to increase the productivity of their animals. Some of the important strategies are:

- Livestock mobility: through mobility, pastoralists are able to lead their animals to those areas where pasture is at the peak of its nutritional content. In this way they are able to feed their animals on a more constant diet of high nutritional pasture throughout the rainy season than would be the case if they did not move.
- Selective breeding: pastoralists selectively breed animals that are not only able to reach distant pastures (mobility), but once they are there those which carefully chose those plants that are most nutritious(selective feeders) and produce more.
- Maintaining species diversity: most pastoralists keep several different species of livestockcamel, cattle, sheep and goats to enable them to make optimal use of the variable range lands and pasture

One of the defining characteristics of pastoral areas is a high level of variation in rainfall from one year to the next. Large variation in annual rainfall and frequent droughts are common in pastoral systems of the IGAD region.

Climate change models predicted increased variability of rainfall in the future. In the medium term - there are likely to be successive years of poor rains, increases in drought related shocks, and more unpredictable and sometimes heavier rainfall. In the longer term, seasons are likely to shift in time with more intense rainfall.

10.1 Pasture management

In this section, the interaction between plants and animals under pastoral settings is seasonally interplayed by moisture and water availability. Once the rainy season is over there is little or no new pasture growth. Annual grass species will die, and perennial grass species lie dormant. Grasses during rainy season therefore represent the feed supply over both rainy and dry season.

The amount of grass that remains at the start of the dry season is called the standing biomass/standing hay for grasses. The standing biomass at the end of the rains represents the total amount of pasture available for livestock during the dry period-or- until the next rainy season. Managing the speed at which this standing biomass is eaten over the dry season before the arrival of the next rainy season is very important.

If eaten quickly, livestock will suffer and there may be soil erosion due to water and wind as the soil surface is exposed. If standing biomass is not eaten, it can hamper the sprouting of the fresh pasture, and overtime lead to bush encroachment. Ideally, the standing biomass should be consumed gradually over the dry season to ensure it lasts until arrival of the rains and growth of fresh new pasture. Management to avoid overgrazing (when pasture is exposed to intensive grazing for extensive period without sufficient time to recover) is important. There must be minimum residual level of plant cover (both annuals and perennial). This helps to avoid soil erosion, soil compaction affecting germination, and loss of seed bank and enable the re-growth of perennial grasses.

Overgrazing and degradation of rangelands can occur under the following specific conditions:

- At the start of the rainy season- specially when annual are dominating- when seeds begin to germinate and animals are continually grazing and trampling over and over again so that the plants could not complete their life cycle
- At the end of the rainy season before the annual and perennial grasses have had a chance to produce their seed for the next crop.
- When animals are sedentary and graze the same area through out the rainy season- like the rangelands around homesteads
- When animals repeatedly walk along the same path as this will contribute to gully formation and soil erosion.

On the other hand, water is one of the major challenges to livestock production in the ASALS and cross-border. Appropriately locating water infrastructure in rangelands to allow efficient and balanced utilization of pasture and water without environmental degradation is an important requirement. The 'water-pasture balance' is critical for pastoralism resilience as a livelihood. For example, all season water availability can lead to food security, good health and population increases, permanent settlement but also to prevalence of parasitic diseases, conflict and land degradation. Much greater importance need to be given to governance and ecological considerations of range management, compared to a focus on the individual water technologies.

Steps to be followed to achieving water-rangeland balance.

- Mapping out livestock routes and grazing areas;
- Make sure each area of livestock encampment has balanced water points;
- Ensure each area implements elements/rules from the IGAD regional Transhumance Protocol; and

• Has an effective governing body.

Customary pastoral institutions are made up of social bonds of mutual assistance, exchange, obligations and reciprocity within and between families and constitute the social and cultural fabric of communities. Today pastoral institutions are a combination of both customary institutions and modern institutions established by government and development agencies. Pastoralists have developed complex mechanisms and institutions that govern mobility, resources use and access that allow pastoralists to make effective use of their variable environment. The institutionalized practices include:

- Setting aside pastures
- Preserving water resources
- Protecting trees
- Ensuring pasture self-seed before it is grazed

Rules and institutions are enforced, and sanctions can be applied to those, knowingly or unknowingly, breaking the rules. As traditional institutions breakdown and loose authority, and government institutions are either absent or ineffective, conflict can result over access to, and control over, important resources.

10.2 Animal Welfare

Although animal welfare is an issue of growing importance in the national and international trade for livestock and livestock products, it is yet to be introduced to the cross-border areas. At urban areas and secondary or terminal livestock markets, there is an increasing awareness among consumers and producers about the effects that breeding and farming and animals transport techniques may have on animals, on their health and welfare and on the environment. More and more, consumers claim their right to make informed choice between products, including products produced to different welfare standards. To enable them to make such a choice, they want to be informed about how farm animals are kept, transported and slaughtered.

To fulfill the growing demand for live animals and products, large numbers of animals are required to be slaughtered each year. This results in mishandling and excessive sufferings of animals. In more recent years, the issue of humane treatment of animals is becoming a growing concern in many countries. For this reason, trading countries are required to comply with sanitary and welfare requirements of importing countries. Humane treatment of animals does not only reduce unnecessary suffering but it also reduces loss of foreign exchange earnings as a result of poor quality and value of meat.

Animal welfare means how an animal is coping with the conditions in which it lives. An animal is in a good state of welfare if it is healthy, comfortable, well nourished, safe, able to express innate behaviour, and if it is not suffering from unpleasant states such as pain, fear, and distress. Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and humane slaughter/killing. The welfare of an animal includes its physical and mental state, and good animal welfare implies both fitness and a sense of well-being. Any animal kept by humans must, at least, be protected from unnecessary suffering.

An animal's welfare should be considered in terms of 'five freedoms'. These freedoms define ideal states rather than standards for acceptable welfare. They form a logical and comprehensive framework for analysis of welfare within any system together with the steps and compromises necessary to safeguard and improve welfare.

- Freedom from hunger and thirst by ready access to fresh water and a diet to maintain full health and vigour.
- Freedom from discomfort by providing an appropriate environment including shelter and a comfortable resting area.
- Freedom from pain, injury or disease by prevention or rapid diagnosis and treatment.
- Freedom to express normal behaviour by providing sufficient space, proper facilities and company of the animal's own kind.
- Freedom from fear and distress by ensuring conditions and treatment which avoid mental suffering.

11. Module 4: Commodity value chain, in relation to livestock marketing, traders and transporters (a) local livestock markets and traders (b) local abattoirs and slaughter slabs

11.1 Introduction to the module

Live animal is the most important livestock value chain commodity traded in cross-border pastoral or ASALS areas where these are further traded and exported from IGAD region to the Middle East and North African (MENA) countries. While ASALS of Ethiopia, Somalia and Kenya have continued to feed livestock regional terminal markets, Sudan and Somalia are the major exporters of live animals to distant terminal livestock markets in MENA followed by Ethiopia, Djibouti and Eritrea. Kenya is net importer of animals, only exporting very few animals. South Sudan and Uganda are not exporting live animals to the MENA countries, at the moment.

Kingdom of Saudi Arabia, UAE and Yemen from Middle East and Egypt and Libya from North African countries are the most important destinations of live animals from the IGAD region. The live animal trade in the region is seasonal and export peaks only during religious pilgrimages.

In a commodity value chain marketing system, there are actors (input suppliers, producers, processors, traders, consumers, etc.) and channels (the flows through which commodities move and are transformed, from production to consumption). In this system, farmers/ pastoralists are linked to the needs of consumers and work closely with suppliers and processors to produce the specific goods required by consumers. Using this approach, and through continuous innovation and feedback between different stages along the value chain, pastoralists/ farmers can enhance their market power and profitability. Rather than focusing profits on one or two links, players at all levels of the value chain can benefit. Well-functioning value chains are reported to be more efficient in bringing products to consumers and, therefore, all actors, including small-scale producers and poor consumers, can benefit from a well-developed value chain.

It is now a common knowledge that in the wake of globalization, many countries, including the traditional trading partners of IGAD region, are moving to rapidly integrate trade-related SPS and WTO principles. As a result, countries are reviewing their policies and practices and major changes are underway that will have an important impact on livestock trade. These escalating standards for livestock and livestock products, with all their auditing and certification requirements, present a growing challenge for IGAD countries seeking access to external markets.

Multi-national supermarkets, food suppliers and restaurant chains are a principal growth sector in the IGAD member states and MENA region. Major international supermarket chains with private standards that surpass government standards are already invested in the region. As countries embrace the WTO principles, this trend will probably accelerate rapidly. These organizations procure many products on a regional basis and often operate on private standards that surpass national standards and international guidelines. Over the medium to long term, products regulated by private commercial standards will probably dominate the main market.

In this section, aspects of quality and SPS requirements of importing countries for live animals and meat influenced at the level of feedlots and abattoirs will be covered. At the end of the session trainees are expected to:

- Understand the application of feeding regimes to meet market quality requirements;
- Describe the various health measures to be taken in feedlots to meet SPS/health requirements of importing countries.
- Understand the SPS requirements of importing countries for live animal /meat.
- Describe the measure need to be taken to comply with SPS requirements of importing countries.
- Understand the basic requirement for an approved abattoir
- Understand minimum standards for controlling and maintaining the cold chain of meat during dressing of carcasses, processing, packaging, handling, storage and transportation.
- Understand personal hygiene requirements for those who produce, store, prepare and handle meat and meat products.
- Explain the concepts of business skills and describe the skills and abilities required to expand business and meet customer requirements

11.2 Livestock markets in the cross-border areas

Market centers and their associated infrastructures are important factors that have to be considered in the move to increase the supply of livestock for both domestic and regional markets. Due to the wider geographical location of pastoralists, some important sources of livestock are very far from market centers. Pastoralists from the border areas need to travel long distances to reach these market areas.

Livestock marketing is another important element in the management of pastoral herds. In most countries, there are three tiers of livestock markets: primary, secondary and tertiary. Primary markets are those markets in small village/towns located in pastoral areas that sell a limited number of livestock. The secondary and tertiary markets are often far away from the farms or production centres

but regularly receive live animals from the primary markets of the pastoral areas and larger in size. The supply of livestock to market in the pastoral areas is seasonal in practice influenced by the availability of market information, interest of the brokers, fluctuation in water supply and pasture availability, disease outbreaks and availability of food and nutrition centres closer to the livestock markets. In the cross-border lands, sells volume increases when drought strikes and disease outbreaks occur. Livestock marketing in the pastoral areas is mainly under the control of the local authorities, middlemen and traders. The middlemen act as negotiators between the traders and the producers and this at most times leaves the producer disadvantaged.

Livestock marketing is important for the pastoral communities as by selling livestock, the pastoral communities are able to purchase other items they require such as grain, foodstuffs, clothing and also pay for services such as school fees and medical care. Besides, some pastoralists also use the income they get from their livestock to set up small businesses at the village level or in big towns. Livestock marketing is also very crucial especially in times of crisis such as during drought as it helps to off-take the livestock from the depleted pastures before the animals lose condition and hence provide an income that would have otherwise been lost if the animals deteriorated or died. Livestock marketing can therefore not be taken lightly as a component of the production process, because in real sense livestock marketing is the driver of production.

Livestock marketing, though quite important, is faced by some challenges, which in essence also hinder the production process. The challenges facing marketing in pastoral areas are:

- Exploitation of the producers by middlemen and traders Poor prices offered by traders and middlemen,
- Poor market infrastructure,
- Poor road infrastructure reducing accessibility to markets by traders,
- Poor market information system,
- Theft and insecurity in pastoral areas in general and markets in particular.
- Diseases -- no system to prevent entry of unhealthy or sick animals to the market.
- Livestock traders are key players in the Livestock Value Chain
- They play an important role in getting the animal from the point of production to a) a feedlot or b) the processor or c) the exporter
- They can buy the animal directly from the Pastoralist or from the primary, secondary or tertiary market
- They buy the animals and transport them by trucks, train or trek the animals on hoof
- Brokers play an intermediary role between the seller and the buyer
- They provide some kind of guarantee to both the buyer and the seller in terms of quality of the animal as well as financial guarantee
- They operate between the buyer and the seller based on trust and mutual social connections
- They are useful in ensuring a smooth transaction between buyers and sellers of livestock
- They also guarantee availability of animals from the seller's side and the availability of cash from the buyer's side

Traders often cannot move their trucks to producer areas, while livestock owners complain that traders and their trucks never reach their areas—which forces them to trek long distances. Another trade-related, transport infrastructure issue involves the use of general-purpose tracks to transport livestock. While these tracks are sturdy and carry both imports such as grains and other goods into lowland areas and livestock animal exports out, they are not ideal for moving livestock. Animals lose condition, are often injured and are in some cases die.

11.3 Cross-border livestock transport

Though most of live animals traded in the cross-borders are trekked on hooves, SECCCI's goal to commercialize and enhance cross-border trade and increase earnings will rest on addressing the challenges in live animal transport between local primary and secondary or terminal markets throughout the supply channel. Changing public opinion about the importance of good animal welfare during transport and applying legislative actions will be important.

With regard to meat transport, an integrated cold chain that encompasses the management of the movement of perishable meat from the abattoir through the entire postharvest chain to the final consumer needs to be developed. A cold chain for perishable foods such as meat is the uninterrupted handling of the product within a low temperature environment during the postharvest steps of the value chain including harvest, collection, packing, processing, storage, transport and marketing until it reaches the final consumer. IGAD MS and private operators must work together to promote the use of cold chain technology, improve logistics, maintenance, services, infrastructure, education and management skills, and create sustainable markets for the design, use and funding of cold chains for reducing perishable food losses.

In the ASALS, land transport of animals is often undertaken using non-livestock transport vehicles. As a result, livestock are transported in a manner that encourages injury and maximizes stress throughout the journey. Poor transportation can have serious effects on the welfare of animals and it can lead to significant loss of meat quality and production. Some of the effects of improper transportation of animals include stress which lead to poor color and taste of meat, bruising which is the most serious and significant production waste in the country, dehydration and exhaustion as a result of long distance travel without proper watering feeding and injuries such as broken legs, horns, etc.

The private and government animal health inspectors and the owners are responsible for the overall health and welfare of animals during their transportation.

All individuals, including animal health personnel, involved in transporting and handling of animals should receive appropriate training.

11.4 Cross-border abattoirs and slaughter slabs

Concurrent with growth in international trade of livestock products, consumer preference for safe and wholesome food has increased quite considerably. Contamination of livestock products can occur at various stages in the supply chain i.e., production, processing and distribution. By practicing good abattoir hygiene and slaughtering techniques, the levels of carcass contamination can be kept low or even reduced. The design and layout of an abattoir or slaughter slab and equipment used shall facilitate the hygienic processing of meat and meat products and any inspection or auditing necessary during or after production. For this reason, the location, design, layout and construction of abattoir premises and the choice of fixtures, fittings and equipment are crucial to ensure that the abattoir can operate under hygienic conditions and produce meat safely. Poorly designed and constructed buildings and equipment are potential source of physical, chemical and microbiological hazards. Such hazards could cause illness or injury to consumers and so must be prevented or minimized.

For instance, food premises that are sited in inappropriate locations (e.g. one that is prone to flooding or adjacent to a plant using toxic chemicals or producing a lot of dust) could increase the likelihood of food becoming contaminated. Badly designed buildings and equipment could create 'dirt traps' and make future cleaning and maintenance difficult, if not impossible, and thus become a source of microbiological contamination. Poorly constructed abattoirs and slaughter slabs and equipment might allow pest entry. Contamination could also be caused by water leaks, condensation or poor drainage. The use of inappropriate construction materials might result in surfaces that could not be kept clean, or which deteriorate and shed dirt, dust and other particles onto meat. Insufficient space for the operations being carried out or for the quantity of meat being handled would produce cramped conditions where cross contamination would be likely. Lack of adequate hygiene facilities, such as toilets and hand-washing basins, would prevent staff from following personal hygiene procedures and could lead to product contamination. Poor layout e.g. inadequate separation between 'clean' and 'dirty' areas or inappropriate flow lines for food in relation to waste, people ...etc would increase the chances of microbiological cross contamination of meat by food poisoning bacteria, such as Salmonella.

In general, an abattoir should be designed to ensure the flow of operations from the live animal holding area through to shipping areas. Each function in the slaughter process has a fixed status in terms of "clean" or "dirty" areas which are separated by distance, physical barriers and in certain cases by time. In other words, meat products should proceed progressively through cleaner areas of the operation, without backtracking to areas where the product was previously handled. The layout of the premises and building must be designed so that the production process moves in one direction without any cross flow of products, which may adversely affect the hygiene of the product. For instance, live animals are received at the "dirty" end of the abattoir and meat is out loaded from the clean side of the abattoir. In planning an abattoir, provisions for expansion should not disrupt the flow of operations or interfere with efficient processing.

Site Selection The choice of a suitable site for an abattoir is the most important aspect. Therefore, the factors listed below must be taken into account when selecting an appropriate site. **Lighting**



Figure 6: Live animals and meat displayed for sale in a feedlot and abattoir

12. Module 5: Commodity value chain, with an introduction to concepts of valueaddition, processors and traders; and brief animal welfare and LITS issues

12.1 Introduction to the module

A commodity chain is a process used by firms to gather resources, transform them into goods or commodities, and finally, distribute them to consumers. It is a series of links connecting the many places of production and distribution and resulting in a commodity that is then exchanged on the world market. In South Omo-Turkana, Moyale-Marsabit and Mandera which are arid and semi-arid lands, livestock production is predominantly extensive dominated by pastoralism. It is considered both an economic and social system, and highly dependent on raising and herding of livestock, which is core to pastoral livelihoods that is the main contributor to commodity value chain and in the larger IGAD MS being addressed in this manual.

Therefore, live animals, meat, milk, eggs and hide/skin, in addition to manure, draught power, blood, hooves and bones are some of the commodities that circulate in a value chain of 60-70% arid and semi-arid landmass of all the eight IGAD member states. Therefore, livestock value chain is a full range of activities required to bring a product (live animals, meat, milk, eggs, hide/skin etc.) to final consumers, passing through the different phases of production, including processing and delivery. It often applies the "farm-to-fork" concept indicating that a food product moves from upstream in the chain, where farmers/ pastoralists grow/ rear and harvest it or take it to the market through intermediaries including producer organizations, processors, transporters, wholesalers and retailers and on to the downstream level of consumers.

This modules complement modules 3, 4 but specifically highlights roles and responsibilities of the feedlot operators together with those of the abattoirs and slaughter slabs in ensuring meat hygiene and meat quality,

12.2 Livestock identification and traceability system (LITS)

Animal identification and traceability requirements are important for livestock trade and public health considerations. Countries that have introduced animal identification and traceability programmes have better prepared to improve public health, prevent and control animal diseases, but also enjoy comparative advantages in terms of exports in relation to countries without such systems. The lack

of a proper system of animal identification and traceability may result in loss of competitiveness and access to certain markets.

To successfully contain or respond to an outbreak of an infectious animal disease, a system for identifying and tracking animals is a prerequisite. To be effective a LITS system requires two basic components, an identification system (for example brands, marks or a device) and a system that tracks an animal, or groups of animals, along the value chain to the final destination. It is only when these components are all put together that a LITS system becomes functional and effective.

The following elements need to be adhered to when implementing a LITS:

- The Ministry for livestock should be the authority that runs the system.
- A national database should be established and managed by a competent national institution to collect all the required identification, ownership information and to track the movements.
- The necessary movement and disease control documents needs to be developed.
- A legal framework is required.
- The implementation must be supported by a programme that educates the industry on associated economic and health benefits.
- A proper monitoring, enforcement and evaluation and audit procedures must be put in place.
- Finally, a query system, if an animal Identification is put into the database, must be implemented that uses the database to enable the history and whereabouts of individuals or group of animals to be identified.

Implementing and running a LITS system requires a high level of organization within an industry where all actors in the value chain must cooperate to make it work. Whilst the Ministry responsible for livestock should manage the system, the task is usually given to a smaller task team employed by the ministry and/or private sector and who are given full time responsibility to implement the system. This task team should also ensure that all stakeholders adhere to and support the implementation of the system and assist with the running of the system. All industry stakeholders must be committed to abide by the rules, which must be supported by a legal frameworks or bills. These legal frameworks must enforce strict penalties on interest stakeholders who do not comply.

At the same time the ministry responsible for livestock, through the appointed task team, must have the capacity to be able to provide all actors in the value chain with a high level of support, especially in the education of the various industry role players, and ensure that all industry stakeholders understand their roles and are on board.

For many consumers of livestock products and importing markets, food safety is a major concern and it is now becoming a prerequisite for countries that import live animals, or animal products. The exporting country has to prove that the animals are free of disease or have been vaccinated and have been monitored throughout a significant part of the value chain. Health Certificate for each animal, enabled by LITS, should be issued.

The livestock Industry and especially pastoralists in developing countries will usually support a LITS system if it can clearly demonstrate that there is a direct benefit to their livelihood. For example, if it can be demonstrated that a LITS will prevent cattle rustling, and is possibly supported by a

vaccination program, the potential added financial value accrued per animal usually allows this sector to become supportive of a LITS.

For the more commercialized sector or smallholder sector of the industry, it must be demonstrated that there is an added financial benefit for supporting a LITS. Many livestock producers in the commercialized sector for example, already identify animals but usually cannot envisage how they can benefit from LITS financially in the short to medium term and look at government to subsidize the system. If these benefits can clearly be demonstrated to the role players, this sector will also become more supportive.

a. LITS devices

Depending on the code structure and the animal species, different identification devices such as tattoos, tags or electronic devices are used for identifying animals. It is important that the identification is easily visible. Typically, identification should be visible for the human eye. In some situations however, visible identification is supplemented by electronic identification (electronic ear tags, ruminal boluses, chips). In the case of animals identified individually with ear tags, it might be useful to use larger font for a number of digits (e.g. the last five digits) that can serve as a relevant working number for the animal.

Identification devices should be tamper-proof or at least tamper-evident. Tamper-proof means that the devices cannot be opened without destroying the locking mechanism in a way that they cannot be reused. Tamper-evident means that the devices cannot be opened and reused without clear indications, such as marks, or scratches, on their reuse. In addition, identification devices should not pose risks to animal welfare during the lifetime of the animal.

Туре	Readability	Cost	Durability	Transcription	Central control
Hot brand	Poor	Cheap	Good	Manual	No
Cold brand	Poor	Exp.	Good	Manual	No
Tattoo	v. poor	cheap	good	Manual	No
Тад	Good	Ok	Fair	Manual	Possible
Tag bar code	Good	Ok	Fair	Electronic	Possible
Tag EID	Good	Exp.	Good	Electronic	Possible
Implant	Excellent	Exp.	Good	Electronic	Possible
Bolus	Excellent	Exp.	Good	Electronic	Possible
Genetic	Difficult	Exp.	Good	Electronic	Essential

Table 6: Means of animal identification and devices

Many countries in the IGAD region are in the process of considering or piloting some type of LITS program and there is a clear willingness to follow a regional approach to a LITS implementation. At the same time it must be recognized that each country has its own specific requirements, and in some instances unique challenges and specific production systems. However, it is clear that a general framework and guideline should be developed for the region that considers the major production systems and the economic status of each country.

Most countries that have implemented national LITS systems have attempted to thoroughly test the efficacy of the Identification device. As mentioned previously in this document, the identification device used forms the backbone of a LITS system and significantly influences the cost of the whole

system. Most countries in the developed world started with Hot Iron Brands, then moved to normal visual Identification tags. In the Seed stock or pedigree registry sector, tattoos became mandatory. When. National Identification systems were proposed, some countries implemented a tamperproof tag (Namibia and Canada for example) before implementing the RFID tamperproof tag, whilst others moved straight from normal visual tags to RFID tags and the industry and government absorbed the costs. All these countries could justify the costs because they had access to the "high end" markets for meat and meat products. A LITS system must be supported by a legal framework making it mandatory for animals to be tagged and penalties must be enforced if the device is removed. The system must be linked to an Animal Health Certificate. A Single, National Database is implemented.

The financial benefits accrued across the industry should outweigh the costs for the system to be viable in the long term. The challenge is that RFID devices are expensive to implement and maintain. The Regional Guidelines on Livestock Identification and Traceability (LITS) in the IGAD Region. Alternative is to implement a cheaper device such as a normal ICAR approved ear tag that is also tamperproof but realize that all animal details will need to be written down on paper forms before they are entered into a database. National government's implementing a LITS usually subsidizes the device, database and administrative costs to get the system implemented. Thereafter, it needs to be self-sustaining.

12.3 Animal Welfare

This training manual will give a course on animal welfare as a mandatory course as there is an increasing recognition of the existing strong link between animal welfare and animal health. It is already evident that poor animal welfare results in an increased susceptibility and vulnerability of animals to diseases and rise in animal diseases results in economic losses. Therefore, animal welfare has strong links to animal health, food safety and economic development.

- Animal welfare is a core mandate of the veterinary community generally and veterinarians individually.
- This concept has well been articulated by many veterinary organizations in their Code of Practice, Veterinary Oath or other statements of commitment.
- Such statements centre on the common theme "a veterinarian should be dedicated to the benefit of society, the conservation of animal resources and the relief of suffering of animals and to promote animal wellbeing".

The objective of this document is to introduce the concept of animal welfare to be taught together with outlined modules as laid down in the World Organization for Animal Health (OIE) Terrestrial Animal Health Code (Terrestrial Code) (4) – to help facilitate trade in live animals from the cross-border pastoral areas to secondary and terminal livestock markets.

13. Module 6: Veterinary Services and epidemio-surveillance system, ensuring both active and passive disease surveillance that operates to timely inform national veterinary authorities with recommended responses 13.1 Introduction to the module

The Veterinary Services, with responsibility to oversee both national and international trade, provide movement permits and health certificates, in addition to carrying out routine active and passive surveillance, periodic inspections of live animals and livestock products, enforcement of biosecurity measures and sampling procedures and records keeping. Veterinary Services should regulate conduction of surveillance and sampling and should also undertake or oversee laboratory diagnosis. The extent of oversight and frequency of inspections must be adequate to provide reasonable confidence in livestock traders and consumers to ensure appropriate level of protection.

Veterinary service providers (private, public), known as epidemio-surveillance system, are involved in various steps of the value chain, from supplying quality inputs (drugs/biologicals) to protecting consumers from hazards that originate from animals. It is generally involved in the following areas:

- Detection, prevention and rapid response to control diseases.
- Diagnosis and treatment of sick animals.
- Provision of quality inputs (drugs, vaccines).
- Export reagents and testing kits and certification of animals, products, biologicals, drugs etc.
- Ensuring import and export procedures are adhered to.
- Public health protection and food safety.
- Implementation of livestock identification and traceability system (LITS).
- Animal welfare.
- AMR issues.

In addition to animal diseases whose majority are zoonotic, which affect both animals and humans, including food borne diseases, have currently showed food safety concerns. Nowadays, importing countries are increasing internal food safety standards.

Although most of the cross-border areas are remote, highly insecure and distant from capital cities, they are rarely covered or serviced by the national veterinary services, and have no clear policy and guidelines to support the management and running of livestock services.

During routine inspection, each animal must be identified immediately, preferably with a colourcoded and numbered plastic ear tag that is easily visible from a distance. In many feedlots or ranches, each animal is not identified individually but instead receives a tag with a lot number (group) or pen number. Systems are now in places that individually identify animals with tags that can be read electronically from a distance. Information maintained on individual animals through this technology may include performance, vaccination, and treatment history. These tags remain on animal until slaughter, at which time the identification from the ear tag can be transferred to the bar coat.

Farm animals, generally, may be affected with acute disease but show no obvious clinical signs while others may appear fatigued and gaunt but are not affected with clinical disease. Identifying animals with acute infectious disease that should have been treated early to minimize mortality can be difficult. The body temperature of high-risk cattle is often measured at processing. Animals with high body temperatures > 40°C may be treated with an antibiotic and treated animals may be tagged

and noted in the individual animal database, or the total number of animals treated (total amount of drug administered) in a group or pen may be recorded.

A basic vaccination schedule should be prepared by the feedlot management with type of vaccines to be used recorded depending on the risk involved and the rigin of the animals. criteria to consider include: the disease is enough of a risk that prevention is necessary, and data are available to support the use of vaccines to prevent disease.

The veterinary inspector needs to have local knowledge on the situation of TADS in the cross-border areas where the animals have come from. For this reason, s/he should regularly contact and obtain adequate information from the nearby Woreda and animals destined for trade should avoid areas reported or rumored TADs outbreaks.

- For FMD, animals should be sourced from areas where there has not been outbreak of the disease for the past three months and the disease has not occurred within a 10 km radius of the purchase area.
- For PPR, CBPP, CCPP and Anthrax, only animals vaccinated or from clean areas should be sourced for trade and consumption;
- For RVF, animal should be sourced from areas where there were no clinical diseases in animals or humans within the past six months.

The inspector should inspect each animal both at rest and in motion because certain abnormal signs, such as labored breathing, are easier to detect while the animals are at rest. Other abnormalities, such as lameness, may not be detected until s/he observes the animals in motion.

Healthy animals have a shiny appearance of their hair coats and are well muscled and with not prominent ribs and pelvic bones; and with eyes that are clear, bright and moist. The muzzle is slightly moist and cool and the skin of a healthy animal is smooth, supple, flexible, and free of any lumps, loose scabs, flakes or debris. Under normal circumstances, the mucous membrane around the conjunctiva and inside the mouth is pink in color, smooth and it glistens. Healthy animals walk in balanced rhythms with the head swaying or nodding slightly in time with the animal's movement. When standing, the animal is comfortable on all four feet. In the absence of a physical exertion, the movement of breathing in and out should be silent. However, the respiration rate can also increase following exercise or an increase in environmental temperature or humidity.

Signs that indicate a condition or disease in an animal can be associated with body movement and action, body position, condition, function, surfaces, discharges, and body odor.

13.2 Improving animal health situations

The following area summarizes interventions that need to be implemented to improve the animal health situation in the cross-border areas:

• Strengthen disease surveillance system and participation of the pastoral community-based animal health workers (CBAHWs) or farmer field schools (FFSs) or extension officers.

- Introduce risk based disease prevention and control system for major transboundary animal diseases (TADs).
- Make use of signed existing regional bilateral MOUs to harmonize disease control and prevention programmes with neighbouring countries with involvement of SECCCI project and the full participation of the pastoralists
- Enhance animal health services delivery suited to the pastoral way of animals production (mobile veterinary service delivery)
- The focus of animal health services delivery should be on primary animal health care and prevention and control TADS
- Introduce mobile advisory services that build on both local ethno knowledge and conventional science and have been created for pastoral communities, acceptable to them and have bigger impact than with the conventional.

13.3 Modules in detail: Module structure

This subsector, on the module structure, may not be conclusive but shows some detailed essential courses that will be offered during the expected training and repeated in refresher trainings or regularly updated as may be required.

Module 1: Animal Production, with an introduction to livestock production systems in the crossborder pastoral and agro-pastoral areas of Ethiopia, Kenya and Somalia.

- 1. Introduction
- 2. Animal production systems
 - Extensive
 - Intensive
 - Pastoralism
 - Agro-pastoralism
 - Nomadic/transhumance
- 3. Pros and cons of each production system
- 4. Rangeland condition and use
- 5. Animal feeds/feeding, including watering
- 6. Importance of security to the pastoral and agro-pastoral systems
- 7. Importance of the livestock-crop farming interface
- 8. Importance of peace and harmony within the communities for sustainable livestock production and marketing

Module 2: Animal Health and TADs control, with an introduction to animal health and diseases control that includes prevention (vaccination) and disease control (treatment) measures.

- 1. Introduction
- 2. Animal behaviours (healthy/unhealthy animal) and socialization
- 3. Basics of animal anatomy, animal body parts and their functions
- 4. Basics of animal physiology
- 5. Basics of animal pathology
- 6. Common animal diseases
- 7. Wounds treatment and minor surgical procedures
- 8. Diseases prevention and control
- 9. Vaccination (prevention, detection and response)
- 10. Drugs and administration, including methods of injection: I/V, I/M, orally etc.

- 11. Disease surveillance, monitoring and reporting
- 12. Common poultry diseases
- 13. Importance of veterinary laboratories for sampling, testing or diagnosis
- 14. Animal welfare

Module 3: Commodity value chain, in relation to producers or farmers; (a) husbandry practices and (b) interventions required to improve feeds/feeding in the cross-borderpastoral and agropastoral areas

- 1. Introduction
- 2. Principles of value chain
- 3. Husbandry practices
- 4. Roles of producers and required interventions
- 5. Feeds and feeding with quality consideration

Module 4: Commodity value chain, in relation to livestock marketing, traders and transporters; (a) local livestock markets and traders and (b) local abattoirs and slaughter slabs

- 1. Introduction
- 2. Live animals supply chain
- 3. Meat supply chain
- 4. Livestock marketing
- 5. Value addition and its importance
- 6. Communication/extension

Module 5: Commodity value chain with an introduction to the concept of value-addition, processors and traders:

- 1. Introduction to principles of commodity value chain
- 2. Roles and responsibilities of processors and livestock traders
- 3. Feedlots and feedlot operators
- 4. Feeds/feeding in the feedlots
- 5. Finishing and finished animals/right weights to sell animals
- 6. Roles and responsibilities of abattoirs and slaughter slabs
- 7. Meat hygiene, meat quality and SPS
- 8. Use animals (cows, sheep and goats) for practical
- 9. Communication/extension

Module 6: Veterinary Services and epidemio-surveillance system; ensuring both active and passive disease surveillance that operates to timely inform national veterinary authorities with recommended responses:

- 1. Roles and responsibilities of the Veterinary Services
- 2. Understanding of Epidemio-surveillance system (ESS)
- 3. Key transboundary animal diseases and their control
- 4. Key zoonotic diseases and their importance in the region
- 5. Prevention and control of zoonotic diseases
- 6. Tools and equipment used in treatment of diseases, including dosages
- 7. General public health education and protection
- 8. Importance of national Veterinary Services in control of zoonotic diseases
- 9. Animal welfare
- 10. Sanitary and phytosanitary standards
- 11. Communication/extension