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Organization of the
United Nations



East Africa

Animal Feed Action Plan

Sustainably developing livestock-dependent livelihoods in East Africa



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Foreword

Livestock is a crucial source of food, employment, and income for much of East Africa's rural population, as well as generating investment from the private sector and other actors. The subsector contributes significantly to export revenues, national GDPs, and thus the region's broader socio-economic development. Governments across the region recognize the huge potential of the subsector for eradicating hunger and poverty and improving people's welfare. Yet, it faces a wide range of challenges, particularly in terms of ensuring sustainable access to and use of water and feed for livestock.

For the Food and Agriculture Organization of the United Nations (FAO) and the Intergovernmental Authority on Development (IGAD), livestock production and related value chains, when effectively harnessed, can be the foundations of resilience and sustainable development for pastoral and agropastoral populations across the region.

The Animal Feed Action Plan was developed as a means to collectively address some of the constraints in accessing and using animal feed, and provides a guided approach to pave the way for the sustainable production of quality livestock and products, while improving competitiveness and profitability and ensuring appropriate feed resource management across East Africa. Ultimately, the goal of the Plan is to provide guidelines to communities, countries, the private sector and livestock stakeholders to optimally use available feed resources in order to increase the supply and quality of animals, products and by-products, and to maximize the economic and social benefits of the livestock subsector.

The Action Plan is the result of a consultative and participatory process that captures the experiences and lessons learned by a wide spectrum of stakeholders in the public and private sectors, including policy-makers, traders, pastoralist and farmers' organizations, civil society, Non-governmental Organizations and development partners. It builds on the earlier consultative experience-sharing workshop on feed organized by FAO, IGAD, the International Livestock Research Institute and United States Agency for International Development in the region. The Plan provides broad opportunities for partnerships with producers, governments, the private sector, development and humanitarian organizations at the national and regional levels.

A wide range of stakeholders will be involved in implementing the Action Plan to ensure a streamlined and inclusive approach that addresses the multiple challenges facing the animal feed sector. The Action Plan also proposes some instruments for its implementation, such as joint programming where feasible on the identified priority areas, monitoring and evaluation, coordination and communication.

FAO and IGAD are committed to realizing this Action Plan through the promotion of technically feasible actions and advocating for countries to harmonize policies and legislative frameworks relevant to feed to stimulate livestock sector growth in East Africa.

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This Action Plan is the outcome of collaboration between the Food and Agriculture Organization of the United Nations (FAO) and the Intergovernmental Authority on Development (IGAD), led by a core team comprising Paul Opio (FAO), Ameha Sebsibe (IGAD), Markos Tibbo (FAO), AbdalMonium Osman (FAO) and Emmanuella Olesambu (FAO).

The Animal Feed Action Plan for East Africa reflects the combined work and experience of a number of people in both organizations and beyond, and any attempt to compile a comprehensive list of contributors would inevitably remain incomplete.

The authors would therefore like to sincerely thank each of the dedicated individuals who, in one way or another, engaged with and contributed to the development of this Plan. Particular gratitude goes to Professor Harinder Makkar for his technical guidance and feed balance work in Ethiopia and Kenyam which shaped this plan, and to Dr Mutua Stanley (Ministry of Agriculture and Irrigation, Kenya), as well as to Badi Besbes, Shukri Ahmed, Cyril Ferrand, Anne Mottet, Gregoire Leroy and Saskia Reppin (all of FAO) for their constructive review of various drafts, including their relentless encouragement during both the drafting and finalization of the Action Plan.

Finally, we sincerely wish to thank all those from IGAD, the East Africa Community, Member States, pastoralist organizations, development partners, the private sector and FAO colleagues, whose commitment, technical contributions and stimulating discussions were crucial for the finalization of the Plan.

Acronyms

AIBPs	Agro-industrial by-product
AKEFEMA	Association of Kenya Feed Manufacturers
AU	African Union
CBOs	Community-based organizations
CP	Crude protein
DM	Dry matter
EAC	East Africa Community
EAFIA	Ethiopian Animal Feed Industry Association
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FCI	Forage Condition Index
GDP	Gross Domestic Products
GHG	Greenhouse gases
GLEAM	Global Livestock Environmental Assessment Model
IBLI	Index-Based Livestock Insurance
ICARDA	International Center for Agricultural Research in the Dry Areas
ICT	Information and communication technology
IFIF	International Feed Industry Federation
IGAD	Intergovernmental Authority on Development
ILRI	International Livestock Research Institute
LEGS	Livestock Emergency Guidelines and Standards
ME	Metabolizable energy
NDMA	National Drought Management Agency of Kenya
NDVI	Normalized Difference Vegetation Index
NGO	Non-governmental Organization
PEG	Polyethylene glycol
PET	Pictorial evaluation tool
PFS	Pastoralist field school

PLEWS	Predictive Livestock Early Warning System
SNNP	Southern Nations, Nationalities, and Peoples' (Region of Ethiopia)
TLU	Tropical Livestock Unit
UN	United Nations

Executive summary

Livestock are critical to incomes, livelihoods, nutrition, food security and resilience in much of East Africa. Across the region, the increasing demand for livestock products has not yet been matched by a growth in production, implying that there are potential widespread benefits for both producers and consumers if the former can respond to this rising demand.

East Africa has very high annual population growth rates – from 1.81 in Kenya to 3.92 percent in the Sudan – and over the coming years, if production gaps are not addressed, will become increasingly reliant on external markets for foods of animal origin. This would be a missed development opportunity given the widespread benefits that could be generated by inclusive growth of the livestock subsector, particularly for dryland communities in East Africa. In these areas, livestock are largely reared in an extensive range-based system that depends on availability of pasture and water. This production system is constantly challenged by climatic variability. The seasonality of feeds and water means that people and livestock have to move to areas of concentration of these resources, which is increasingly leading to conflict, overgrazing and degradation of rangelands in East Africa. In addition, this herd mobility denies women and children access to milk when herds move, exacerbating already poor nutrition among these groups.

Pastoral destitution in East Africa is largely driven by feed and water scarcity, as the natural resource base in the rangelands is shrinking fast due to prolonged and more frequent climate extreme events. This has been clearly evident in the last five years, with governments and partners investing heavily in livestock feeds and other inputs to protect livestock-based livelihoods in Djibouti, Ethiopia, Kenya and Somalia.

The reality is that as climate-induced events become more frequent and destruction, governments and authorities across the region need to think and act more strategically in relation to feed access and availability in order to mitigate the negative impacts of climate- and human-induced crises on animal production. The Intergovernmental Authority on Development (IGAD) and its Member States have thus called for greater efforts to find sustainable solutions to address animal feeds gaps in the region.

In an attempt to address these challenges, the Food and Agriculture Organization of the United Nations Regional Resilience Team for East Africa in collaboration with IGAD's Centre for Pastoral Areas and Livestock Development undertook multi-stakeholder consultations with Member States, private sector, development partners and community institutions with the goal of developing a **Regional Animal Feed Action Plan**. The Plan has four priority areas, which were discussed and selected by stakeholders:

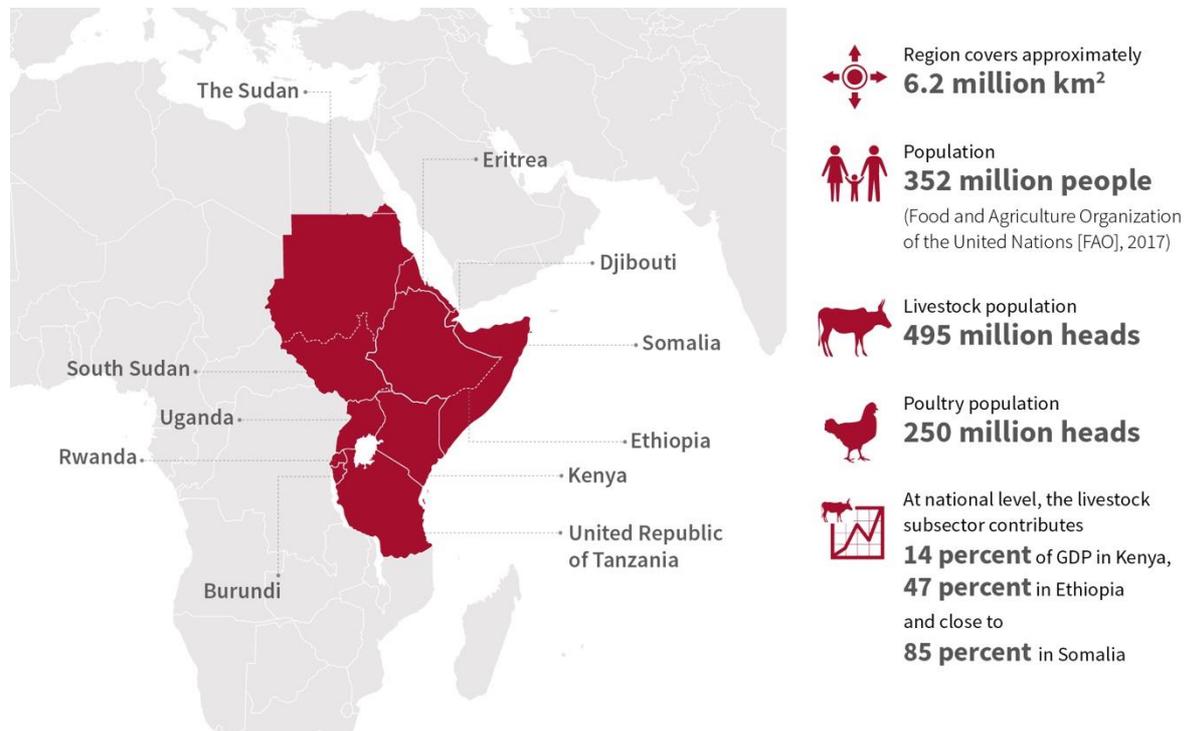
1. Establish/strengthen animal feed data, information, reporting and communication systems
2. Develop sustainable animal feed supply chains
3. Identify status of rangelands and grazing areas and disseminate best management practices
4. Strengthen enabling environment for feed production

The main objectives of the animal feed action plan are to:

- leverage the potential and opportunities provided by animal feed resources to stimulate development and income generation in poor rural communities by improving the efficiency and profitability of the animal feed sector;
- enhance the participation of poor rural communities in the animal feed value chain;
- facilitate private sector-driven animal feed market development, within and outside East Africa, ensuring market access and competitive prices across countries;
- provide a guide for governments to develop enabling policies and regulatory frameworks on feed for enhanced trade between countries in East Africa; and
- exploit the production potential of rangelands and ensure sustainable natural resource use as a key ingredient in the development of the animal feed sector in East Africa.

Introduction

East Africa is home to a diverse and rich culture, resources and opportunities, which have enabled local populations to build varied livelihoods. The livestock subsector in particular plays an important role in livelihoods, food security, nutrition and economies across the region through local, regional, continental and global trade.



In addition to being the main source of meat and milk for domestic markets, the livestock subsector generates more than USD 1 billion annually through live animal and meat exports to the Middle East and North Africa (Intergovernmental Authority on Development [IGAD], 2013). The subsector employs most people (over 60 percent), particularly in arid and semi-arid areas, and has the potential to deliver both the agriculture-led growth and the socio-economic transformation envisioned in the June 2014 African Union (AU) Malabo Declaration on Accelerated Africa Agriculture Growth and Transformation for Shared Prosperity and Improved Livelihoods, which forms a key part of the framework of the AU Agenda 2063.

Most livestock are kept under extensive production systems. Pastoralists and agropastoralists are particularly dominant in the arid and semi-arid lands of Djibouti, Ethiopia, Kenya, Somalia, South Sudan, the Sudan and Uganda. Smallholders dominate the subsistence-oriented mixed crop-livestock systems. Most of the meat consumed locally in East Africa and exported to the Middle East and the Gulf States comes from an open-grazing livestock production system with minimal inputs. Livestock products from the region are highly sought-after products for organic markets.

The subsector is well adapted to the erratic climatic conditions that characterize the region, with the capacity to minimize risks and enhance the resilience of livestock-dependent communities.

However, poor animal nutrition due to inadequate supply of good quality feed critically limits the efficiency of livestock production and reproduction, their health and welfare, human health and the economic benefits derived from livestock-based livelihoods in the region. Livestock feed and feeding systems are constrained by a host of interconnected factors, including recurrent droughts, restrictions of livestock mobility, grassland degradation, overgrazing, land tenure and land use changes, resource use conflicts, encroachment of invasive plant species, soil infertility and inadequate inputs and planting material. Seasonal feed shortages and inefficient feed use by pastoralist and agropastoralist communities are the major challenges affecting livestock productivity in East Africa. In addition, poor feed conservation practices, lack of knowledge on appropriate feed and feeding practices, and inadequate data on estimates of the proportion/number of animals kept within specific production systems constraint the efficient use of available feed resources.

Evidence from the region indicates that pastoral destitution is largely driven by feed and water scarcity. In most countries, the natural resource base in the rangelands is shrinking fast owing to prolonged and more frequent drought events. Reduced precipitation and forage availability imply that men move with herds including lactating goats, camels and cows to distant places for weeks and months in search of pasture and water. This denies milk to the household (including women and children), resulting in poor nutrition for children and the wider family. Feed and water are the foundation of livestock production systems, affecting almost all related subsectors and services. In 2017, for example, drought across most of East Africa resulted in significant livestock losses and massive migration of people and livestock in search of pasture and water – over 50 000 head of cattle migrated from Turkana, Kenya into Karamoja Region, Uganda – with potential impacts on social cohesion and natural resources.

In recent decades, increasing climate change and variability, recurrent droughts and conflicts have exacerbated the feed gap. The slow progress in the development of the subsector, particularly of alternative feed sources such as agro-industrial by-products and unconventional feed resources, has deepened the gap in the availability of and accessibility to animal feed.

The Action Plan

The Regional Animal Feed Action Plan is intended to provide governments, the private sector and livestock producers with a systematic and guided plan to facilitate sustainable and lasting solutions to animal feed challenges in the region. It is hoped that it will guide improvements in feed resources and livestock feeding through increased feed availability year-round, a critical step in building the resilience of livestock-dependent communities in East Africa.

The Action Plan essentially comprises four main priority areas, with a proposed associated series of actions and outputs, as follows:

1. Establish and strengthen animal feed data, information, reporting and communication systems
2. Develop sustainable animal feed supply chains
3. Identify the status of rangelands and grazing areas and disseminate best practices for their management
4. Strengthen an enabling environment for feed production

Priority area 1. Establish and strengthen animal feed data, information, reporting and communication systems

Output 1.1 Regional feed resource requirements and availability assessed and documented

Inventory and mapping of livestock at risk

Successful interventions must be based on a thorough understanding of the livestock population, local context and impact of an event, such as a drought, on livestock-dependent livelihoods. This requires mapping livestock at risk (qualitative and quantitative), including information on type of animal at risk within species and physiological status (e.g. fattening, growing, lactating, breeding, pack animals, etc.).

Updated livestock population estimates are a major challenge. The main national source for such data should be a competent Statistical Authority. FAO's Statistical Database can also be a useful source of information when primary data is unavailable. In addition, FAO provides technical assistance for agricultural surveys (including livestock surveys [World Bank/FAO, 2016], guidelines for which are available [FAO, 2011]). Annex 1 provides a summary of livestock population, by species, in East African countries.

In a crisis, estimates of livestock populations at risk are critical to inform timely decisions on the type and level of support required. The most reliable estimates are usually those used by local authorities. Where current estimates are not available, older figures supported by local information can be used to determine immediate assistance. However, a rapid inventory is still necessary to guide follow-up actions. FAO has developed a manual on conducting livestock-related interventions in emergencies (FAO, 2016).

Key information required includes:

- updated livestock estimates at the local/district level (current herd size, including whether and why there has been an unusual reduction in size), based on type, age, body weight change and seasonal distribution in different ecological zones to better understand feed and inputs needed;
- evidence of and reasons for unusual herd movements (including across borders), direction and type of animals moved, and expected unusual livestock migration in the immediate future;
- assessment of current livestock body condition and estimate of amount of grazing forage available, as well as the breeding condition of females in relation to previous years and any differences observed;
- information on livestock disease outbreaks and interventions (if any), and resulting changes; and
- estimates of livestock losses (number of deaths by type of animal) attributed to the event.

Feed requirements in volume relative to target livestock population

Feed requirement estimates, based on Dry Matter (DM), should be carried out at local, regional and state levels to inform proper planning. Annex 2 provides a calculation of annual feed requirements at national level for East African countries, using the Tropical Livestock Unit (TLU – equivalent to 250 kg live body weight), with examples for daily requirements given for regions in Ethiopia in Annex 3. Similar estimates are needed for the other IGAD countries. These estimates are critical in determining overall feed demand during an emergency. Information on the feed gap should be better refined by locality, with estimates of feeds available and requirements by species and type of livestock.

An inventory of availability of and accessibility to feed resources

Information on available and accessible feed resources (both quantity and quality), as well as on their seasonal fluctuations and location, is paramount for policy- and decision-making. This information is crucial for sourcing feed for an emergency response, as well as for feed resources management and utilization, developing business models, sustainable intensification, market-oriented fattening, and dairy and poultry production.

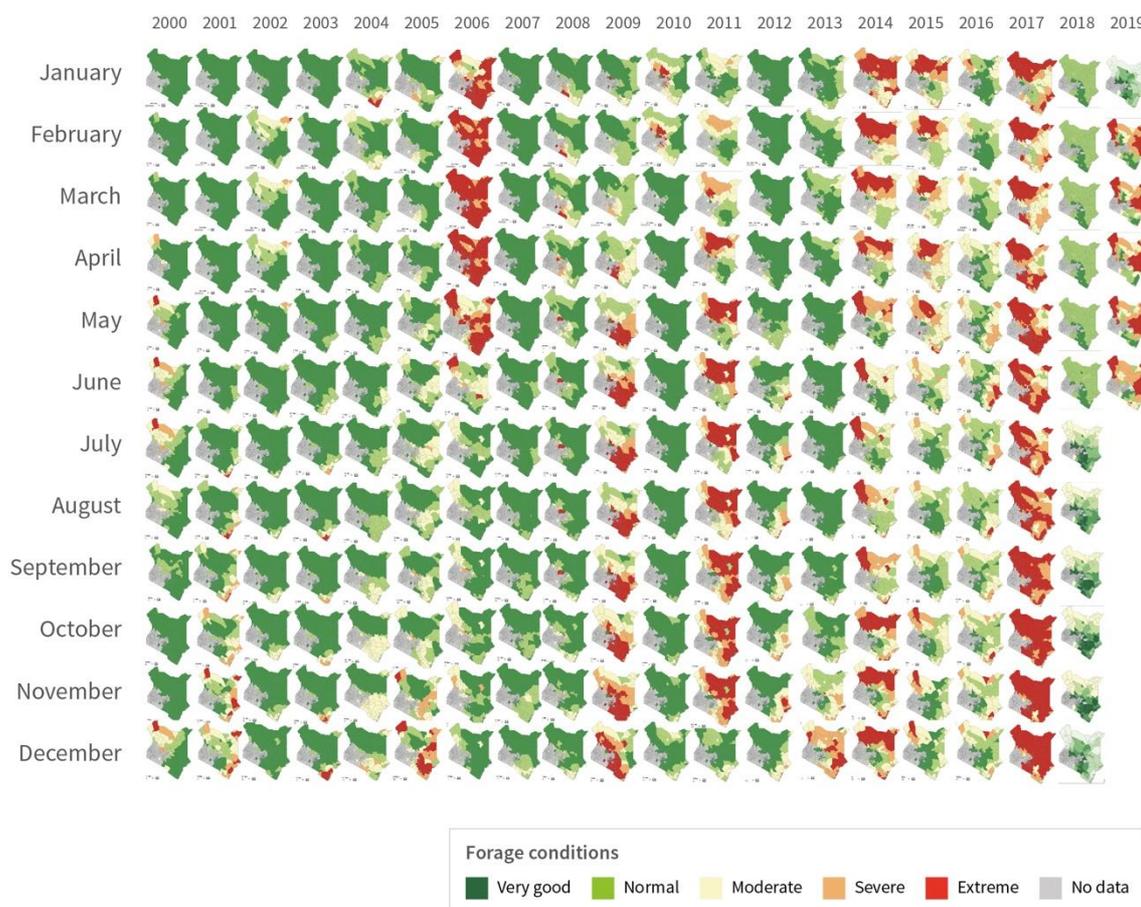
Makkar (2018) has provided methodologies for assessing feed resources and tools to strengthen the quality of feed-related data, including:

- procedures and methodologies to assess crop residues, agro-industrial by-products, cultivated fodders, oilseed cakes and permanent crops; and to calculate metabolizable energy (ME) and crude protein (CP) requirements of different animal species, which are required for the establishment of a national feed inventory and calculation of a national feed balance;
- a tool to capture data on competitive uses of various feed resources, which facilitates a better understanding of uses of various biomasses and conversion of a potential feed inventory to an actual one;
- a template for the characterization of feeding systems, which is required to make feed strategies more efficient and to generate the national greenhouse gases (GHG) inventory based on the Intergovernmental Panel on Climate Change Tier-2 methodology; and
- a template for recording herd structure of small and large ruminants, which is needed to calculate animal feed requirements and GHG emissions from the livestock sector.

Makkar estimated the total annual potential biomass for Ethiopia at 144.48 million tonnes. Forages contributed to 96.6 and 92 percent of total ME and CP availability, respectively, while concentrate feeds contributed little. Based on these calculations, Makkar estimated Ethiopia's national feed deficit at 9 percent as DM, 45 percent as ME and 42 percent as CP, reflecting that Ethiopia clearly lacked good quality feeds.

In Kenya, the predictive module used in the Predictive Livestock Early Warning System (PLEWS) provides a paradigm shift in preparedness by providing actionable information and demonstrating the direct relationship between forage availability for livestock and human malnutrition. The PLEWS provides early warning analysis of forage, water availability and livestock feed biomass. This needs to be systematically scaled up to other countries in the region.

Figure 1. Predictive Livestock Early Warning System (PLEWS) Trends analysis (2000–2019)



Map agro-industrial by-products (AIBPs) and develop strategies for their efficient use

AIBPs are a good source of quality animal feed. A mapping exercise would involve identifying different AIBPs, amount produced, potential feed safety hazards associated with their use, locations and key actors (e.g. small and large producers, small-scale processing units, wholesalers, small retails, etc.). Alongside this, the (formal and informal) value chain – production, aggregation, processing and distribution – should also be mapped. It is important to understand how the products flow along the chain and the volume of product handled by each actor, as well as value addition and amount being lost, wasted or inefficiently used, as this could be channelled to feed production without negatively impacting other competitive uses of by-products. These are critical steps to develop a business model for the sector. For immediate interventions, identifying and sourcing by-products to be procured for emergency responses is paramount (see Box 1). Efficient use of agro-industrial and food processing by-products could be critical in bridging the gap between supply and demand of emergency feeds.

A better understanding of the value chains linked to use and misuse of biomass is important to develop strategies for their efficient use, including for waste reduction. This would also open new avenues and opportunities for green economy development, job creation and environmental protection. Methodologies for assessing AIBPs are available. Surveys on by-products would be invaluable for all countries in the IGAD region, especially those recurrently affected by drought, including millings and by-products of cereals, oilseed cakes, pulses, breweries and malt factories, food industries, horticultural/fruits and vegetables, sugar factories, slaughterhouses, and aquaculture/fisheries. Based on this information, strategies could then be developed to efficiently use by-products and create business opportunities.

Box 1. Availability and use of AIBPs in Ethiopia – a summary

In Ethiopia, these include by-products from flour milling, sugar factory, edible oil processing factories, abattoirs, and breweries. They have a special value in feeding livestock during drought emergencies in pastoral areas, as well as during all seasons in urban and peri-urban livestock systems. The survey assessed the spatial and temporal availability of major AIBPs used for livestock feeding, and estimated their current and potential production capacities. Ethiopia has around 300 milling houses, of which 140 factories are in and around Addis Ababa. The total milling capacity of these factories is estimated at 3.7 million tonnes per year. Over 200 000 tonnes of oilseed cakes are produced annually. A substantial quantity of oil seeds, however, are exported without value addition, representing a huge loss in by-products that could have served as an input for feed. Most agro-industries operate below their potential, largely owing to the lack of quality raw materials (wheat, oil seed, etc.), water and power supply. Breweries across the country produce different by-products; a total of 637 364 tonnes of brewery by-products are produced from modern and local (Amhara and Tigray only) sources, and are generally used as feed relatively efficiently. There is a disproportionately low use of sugar factory by-products mainly due to the use of a large proportion of the molasses for ethanol production and fibrous by-products (Bagasse/cane tops) as fuel in the factories. Abattoir and fisheries by-products are generally wasted, except in Addis Ababa Abattoir, which processes by-products of meat and bone meal as inputs for poultry feed.

Assess infrastructure and enablers

Infrastructure and enablers include feed suppliers, feed sites, roads, markets, transport, storage facilities, and the security situation. Understanding these is fundamental to inform emergency feed response during drought events but also to influence and guide longer-term development of the sector.

In Ethiopia (Makkar, 2018), for example, feed suppliers are predominantly located in Oromia and Addis Ababa regions, which has implications for pre-positioning and feed supplies in an emergency context. To-date, pre-positioning of feeds is limited by the uneven distribution of processing plants, the high cost of transport and inadequate roads and infrastructure.

In order to bring suppliers closer to needs, support could include providing feed processing machinery, equipment and tools across the country, which would help to also modernize the feed industry and facilitate both commercialization of the sector as well as preparedness for and rapid response to frequent droughts, which create high demand for processed feed to protect livestock assets during emergencies.

In addition, storage facilities for food are distributed throughout the country, especially in disaster-prone regions (Logistics Cluster, 2017); however, most are half empty and could be used for storage of animal feeds through stakeholder dialogue and agreements with main government and international players using these facilities.

At the same time, the provision of technical services (including establishment of advanced accredited laboratories to support analyses) to the commercial feed sector is paramount to ensure feed quality and safety.

Another challenge to be addressed in Ethiopia, for example, is the limited availability of hard currency, which has negatively impacted the import of premixes for compound feeds.

Most of these challenges are common to East African countries.

Assess efficient use of alternative feed resources such as pellets, additives, browse enhancers

Across the region, livestock are fed mainly on low quality roughages, including natural grazing and AIBPs, such as cereal straws/stovers, sugarcane by-products and other similar feeds, all of which contain large quantities of ligno-cellulosic material. These feeds are deficient in protein, energy, minerals and vitamins. In addition, the quality of grazing and browse varies substantially according to the season; and livestock productivity consequently declines, and in some cases lactation ceases, unless supplements are offered. The addition of foliage from tree leaves or supplementation with oilseed meals, use of browse enhancers, compound feed and mycotoxin binders and other feed additives can improve the use of low quality roughages, mainly through the supply of nitrogen to the rumen microbes. Assessment of competitive use of these feed resources is critical to provide additional options to feed livestock during times of scarce feed availability in East Africa.

Map zones and systems at risk of feed deficiency/in excess

Mapping of zones and systems at risk of feed scarcity and in excess of feed is vital for early warning, and to facilitate planning and preparedness for early response to emergencies, as well as informing development along the value chain.

FAO's PLEWS tool predicts edible vegetation and surface water availability, using data from a GeoEye satellite, excluding values for inedible species, to produce a Forage Condition Index (FCI). PLEWS was initially developed at the request of Kenya's National Drought Management Agency (NDMA) to support the development of accurate triggers for drought response. Since 2000, FAO has regularly published a PLEWS report (FAO, 2018a) with maps of Kenya. PLEWS has enabled decision-makers to mobilize resources to scale up support (through livestock emergency feed rations) to prevent livestock losses and protect development gains in pastoral and agropastoral communities in Kenya.

In addition, the FCI as a baseline against which other indicators (such as malnutrition, livestock prices and predominant sources of income) can be compared has provided an exceptionally useful insight into the relationship between available feed for livestock, predominant source of income and malnutrition. The potential for this to be used in enabling timely and informed decisions in the future is significant. In Kenya, PLEWS is used in conjunction with a vegetation condition index and monthly data collection to trigger government-led drought responses. The predictive component of the tool was pivotal in demonstrating to the Government the likely severity of the 2017 drought and was used to justify the declaration of a national emergency on 10 February 2017.

This Regional Animal Feed Action Plan prioritizes the scale up of PLEWS to all the countries in the region alongside the pictorial evaluation tool (PET) and the feed balance calculations described under Activity 2.1.3. The FCI data and other data that is regularly collected by NDMA (such as livestock price, maize price, malnutrition and source of income) will help to inform timely, market-based drought interventions. Given the inherent value in the correlation between FCI and malnutrition data, the use of the tool should be adopted into the Integrated Food Security Phase Classification system and be scaled up to help inform drought response throughout the IGAD region.

Develop feed balance sheet/information system

A feed balance sheet or information system is an important tool for strategic planning, enabling public, private and development actors to make informed decisions on short- and long-term actions. A unified method for feed balance calculations in the region can incorporate all information available on feed resources, using the most up-to-date tools and approaches. The information system should be robust enough to provide the most accurate status at the time, as well as forecast feed balance changes in the following months so that appropriate and timely humanitarian and development actions can be taken.

Output 1.2 Early warning and early action mechanism established

Develop national and regional animal feed resources and information systems for early warning

Real-time data and information on livestock feed in terms of production, processing and marketing would also allow producers, traders, policy-makers to make informed decisions early and chart the next course of action. For example, a simple feed balance sheet or a custom-built-in information system would help trigger an early warning – early response, enabling relevant actors to plan, invest and make the necessary adjustments in feed supply, focusing on priority areas. Appropriate data capturing mechanisms should be in place and coordinated among stakeholders, incorporating for example PLEWS, Normalized Vegetation Difference Index (NDVI), National Oceanic and Atmospheric Administration forecasts, etc. Such data could be established through institutional arrangements at local (county, *woreda* or ward), zonal/regional, national and IGAD levels and reinforced through ground truthing at all levels.

Develop national feed early warning and early action mechanisms

Successful national feed early warning mechanisms are critical in countries where natural disasters are frequent. In the IGAD region, drought and climate-related events have increasingly become the norm. Given the success of the PLEWS in Kenya, this would be an important tool to expand across the region to facilitate early action linked to early warning, especially alongside the PET and feed balance sheet. The PET is a tool to score livestock body condition score and the availability of grazing biomass, which can also assist in determining the extent of a crisis and informing early warning and early response.

Incorporate pastoral crisis indicators in the National Emergency Contingency plan

Possible pastoral crisis indicators include livestock status, market conditions, etc. – for example, a 25 percent reduction in the average price of animals due to drought-induced increases in the number of livestock being sold; unusual food price hikes in pastoral areas; and a sudden drop in milk production, which could be a proxy indicator of the immediate impacts on the nutritional status of pastoral populations, particularly children. When the FCI generated by PLEWS is integrated and used in national emergency contingency planning, it enables accurate triggers for early warning and early drought responses. Given the direct relationship between forage availability for livestock and human malnutrition, such planning would assist in reducing the impacts of drought on pastoral livelihoods and communities.

Assess capacities for pre-positioning feeds

In East Africa, the location of emergencies and access restrictions in pastoral and agropastoral areas is a major challenge to the rapid and cost-effective provision of feed supplies. To reduce the time between crisis and response, governments, the private sector and other relevant actors must ensure the storage of critical livestock feeds at strategic grazing locations or along migratory routes. Pre-positioning feeds would support production continuity, reduce feed delivery lead times, cuts the cost of transportation and overall contribute to a timely response and safeguard livestock-based livelihoods in times of crisis (Logistics Cluster, 2015). Governments must conduct livestock feed storage capacity assessments, including examining various storage facilities already in strategic locations and the conditions for their use as feed storage, including those managed by commercial, humanitarian and public actors, as well as cooperative and farmers' groups. Successful pre-positioning would also involve vendor agreements that make a provision for access when the need arises, loading and discharge costs, and transport capacity.

Assess contingency planning capabilities at regional and national levels

Understanding the national and regional preparedness and response capacity is key to successful livestock emergency action at country and regional levels. An assessment of this capacity should examine livestock preparedness plans and institutional readiness to respond to livestock emergencies and will facilitate advance decision-making on human and financial resources, coordination and communication procedures, and a range of technical and logistical actions. At the regional levels, these assessments would enable the development of a cross-border management tool involving all partners.

Output 1.3 Reporting and communication system developed

Reporting format and communication template

The results of the feed security assessment must be communicated in time to allow producers and the private sector to prepare for anticipated shortages. Complete and harmonized communication templates indicating the current and projected feed situation are key and should include the date the feed assessment was completed and the validity period of the projection. A template therefore includes:

Part 1. A map showing feed resources distribution, using a representative colour scheme, with additional information, such as:

- a chart to represent the aggregated percentage and amount of feed resources by category in each agro-ecological zone;
- key outcomes for the worst-affected area;
- a narrative summary of the causes, context and any key issues that describe the overall analysis – including any cross-cutting issues.

Part 2. Communication of analysis should include brief statements on key findings and issues; recommendations for next steps for analysis and decision-making; and indications for response planning.

Priority area 2. Develop sustainable animal feed supply chains

Output 2.1 Feed assessments conducted by agro-ecological zone/production area

A dedicated national institution and taskforce is needed to lead the feed assessment. This approach should be institutionalized within a dedicated Ministry with other relevant ministries and authorities included in a platform as members. This structure should also be replicated at decentralized levels. Information collected should be detailed and comprehensive – by feed type, in quantity and quality (e.g. energy and protein content), as well as location and seasonal supply fluctuations.

Assess availability of and accessibility to feed ingredients

Each country should conduct a thorough assessment of existing roughages for potential use as feeds. Roughages are plant-based feedstuffs (forages, herbages) that constitute the largest portion of livestock diets in developing countries, depending on the zootechnico-physiological status of the animal to be fed. For example, roughage content of complete diets is 60–70 percent for dry animals, 30–40 percent for high-yielding animals, and 40–50 percent for growing animals. The following information should be included in the assessment: cereal straws, pulse aerial parts, oilseed straw/aerial part, grazing pasture, stubble feeding (aftermath), root aerial parts, permanent crops, industrial crops and their by-products and cultivated fodders. See Activity 1.1.3 for methodologies and tools developed by Makkar (2018).

Estimate livestock energy and DM requirements (modelling and validation)

Knowledge of the energy, protein and DM requirements and consumption of different types of feeds by animal species would inform policy-making, investment and long-term sector development. Although further work is needed on the on-farm component, the FeedMod model (Tallage, 2014) that was developed for European Union (EU) countries provides a good estimate of industrial feed compound. The informed use of such a model could partly address this issue. FeedMod facilitates an estimate of the tonnage of raw materials used to produce industrial and on-farm compound feed. The calculation is based on a process called “least-cost formulation” – the method used to approach the current practices of feed manufacturers. The calculation makes it possible to decide how much of each raw material will be used to make the feed, and the model uses four categories of parameters: the nutritional composition of raw materials, the nutritional level of the formulas of industrial compound feeds, the incorporation rates of raw materials and the price of raw materials. The Global Livestock Environmental Assessment Model (GLEAM) – a GIS-based framework that simulates the bio-physical processes and activities along livestock supply chains under a life cycle assessment approach – could help to quantify production and use of natural resources in the livestock sector. Each country in the region should document spatial information on livestock distribution and crop yields to enable rations to be derived that reflect the local availability of feed resources (MacLeod *et al.*, 2018). The herd model allows livestock statistics to be disaggregated and variation in livestock performance and management to be captured. GLEAM differentiates stages along the livestock supply chains, including feed production, processing and transport; herd dynamics, animal feeding

and manure management; and animal products processing and transport with the aim of calculating GHG emissions. However, it can also be used to estimate requirements. This could be led by a research institute or private sector organization and the generated information used to inform policy making and investment.

Modelling has not been done for any of these countries, but a recent study by FAO (Makkar, 2018) in Ethiopia showed that the country is short of feed as DM, ME and CP. The gap is substantial but could be alleviated by proper harvesting of the biomass available, reducing waste, enhancing nutrient availability using proper feed processing technologies, and extending the feed resource base with new feeds.

Calculate feed balances in normal (baseline) and drought scenarios

Countries in the East Africa are short of dry roughages, concentrate and green fodder. This needs to be documented and clearly mapped to facilitate feed sector development and attract evidence-based investment. Where this has been done (Makkar, 2018), there is a need to consider how to meet these deficiencies. For example in Ethiopia, feed availability varies from region to region and Benishangul-Gumuz and Gambela regions have a positive feed balance related to the low livestock population and higher precipitation. These regions also have high rate of tsetse fly density and trypanosomosis, which may have limited livestock population growth. The positive feed balance in these two region should be carefully analysed, recognizing that the transport cost of the feed could be much higher than the feed itself if it is to be transported long distance to other regions. Investment would therefore need to be informed by a detailed analysis of feed balance at local level and infrastructure available.

Output 2.2 Availability of and accessibility to feed (production, harvesting, conservation and storage) assessed

Identify and map current limits to biomass collection and conservation where seasonal excess exist

The collection and conservation of excess biomass for animal feed faces several technological, institutional, legal, logistical, socio-economic and policy-related challenges.

Technological challenges include:

- Lack of/inadequate machinery or devices: densification (of cereal straws, grasses, hays, etc.) machineries are not manufactured in East Africa. Feed technologies that reduce roughage feed bulk and improve the nutrient availability need to be introduced. Relevant processing machines include harvesters (mowers), hydraulic presses, balers and pellet-making machines. Ultimately, policies and incentives that encourage manufacturing of these will contribute to averting pastoralist crises, as well as facilitating longer-term development. A South-South cooperation mechanism could enable the transfer of relevant expertise and technologies from countries such as China, India and Turkey that manufacture these machines. Popularizing the use of densifying machines among private entrepreneurs or youth groups, alongside building technical capacity for feed processing, would promote their wider use, including of choppers, hammer mills and mixers that could produce total mixed ration.
- Lack of/inadequate technical capacity and know-how to densify feeds: this knowledge is currently inadequate at local level, except in specialized farms, feed manufacturing companies or intensive dairy farms.

Some institutional and logistical challenges include:

- Inadequate institutional capacity to lead animal feed issues in some countries.
- Weak and insufficient animal feed producers' cooperatives or associations: organized farmers and pastoralists could purchase choppers, mixers, and hammer millers and establish fodder banks, and collectively produce marketable forages (e.g. spate irrigated forages).
- Lack of feed banks/reserves: setting up feed banks/reserves would make feed and fodder available in at-risk areas in a timely manner when crisis hits and even during normal periods, given the shortage of biomass in areas recurrently hit by drought. Densified straw-based complete feed rations or compacted hay could be prepared in seasons of biomass availability and transported to the fodder banks. Sudden high demand for feed in an emergency owing to relief interventions can cause an escalation in prices of feed even in regions unaffected by the crisis. Fodder banks improve and stabilize the availability of animal feed and fodder, as well as reducing the volatility of feed prices, especially during droughts.
- Poor roads, infrastructure and transport: most areas hit by droughts are not networked, are less accessible and transporting trucks are less available in these areas owing to poor roads. In addition, surplus biomass is located far away from arid and semi-arid lands. This is exacerbated by the fact that most feeds are not densified, and transporting loose or uncompacted fodder is generally very costly.
- The high cost of transport: densification is one potential way to reduce these costs.

Socio-economic, policy and regulatory framework challenges:

- Lack of national animal feed policy, strategy and implementation arrangements: despite the good natural resource base, favourable conditions and availability of ingredients for animal feeds, East African countries lack animal feed policies and strategies. Where they exist, there are no associated implementation arrangements and budget. Such policies would stimulate increased feed production, ensuring quality animal feeds on the market, reducing production costs and building capacity among the private and public sector for the development of the animal feed industry. Strategies to achieve these objectives must take into account relevant national issues such as decentralization, private sector participation, gender and protection of the environment (Makkar and Ankers, 2014). The policy formulated should increase animal feed production through strengthening research, providing credit to the industry, promoting greater production of raw materials, encouraging the transfer of appropriate technologies and formation of associations (of farmers, pastoralists, and manufacturers) and developing rural infrastructure to increase access to raw materials. Critical issues such as formulation of standards, rules and regulations to govern the industry as well as establishment of an institutional and legal framework to enforce these provisions could be included. Ultimately, the policy should facilitate a developed animal feed industry that contributes to improved animal production and productivity, thus improving the welfare of citizens and the national economy.
- Lack of enabling policy environment for private sectors in the feed value chain at scale: enabling policies are critical to facilitate the involvement of the private sector, which could fill the feed gap, especially in areas of processing (bales and feed blocks) and fodder seed production. These could include tax relief for importing appropriate machines, mobility of feeds from excess to deficit areas and cross-border, etc.

- Failure of technology to meet farmers' expectations, exacerbated by the lack of participatory and inclusive approaches in technology development and absence of farmer-centred research and extension programmes.
- Limitations in partnership among relevant stakeholders (government, private and farmers) including the lack of long-term commitment by key players.
- Fragmentation of land, land tenure system, degree of market orientation, income of farmers also influence the adoption of improved forage production technologies.

Establish and pilot strategic animal feed reserves and banks

A number of countries in the region have strategic grain reserves. The Action Plan recommends the establishment of strategic animal feed reserves and banks. A recent assessment (Bediye *et al.*, 2018) of the Ethiopian feed sector identified priority actions to increase the availability of feed resources that could be applicable to other countries in the region:

- Use vast arable land available to supply feed ingredients for commercial feed processing: Ethiopia has huge land and water resources that could be used to counter the seasonality and severe shortage and high prices of feed ingredients. It could revolutionize livestock production through import substitution and increased compound feeds. Opportunities exist to produce maize and soya bean for feed production using varietal choices and production packages. Surplus animal feed could then be exported to neighbouring countries facing regular animal feed deficits (e.g. Djibouti and Somalia).
- Produce local feed processing machines, equipment and tools: these are currently supplied by a few companies and imported. There is growing demand for feed processing machines and local production would help to revolutionize the feed sector and related value chains.
- Ease double taxation on feed ingredients and compound feeds: double VAT on ruminant feed ingredients and compound feeds discourages the private sector and commercial farms. Removing these taxes would encourage investment until sufficient local supply of ingredients is ensured.
- Strengthen/establish feed safety and quality laboratories: such interventions would increase the confidence of both farmers and consumers. Update feed quality and safety standards, with new (strengthened) laboratory service delivery systems for feed quality and safety assessment. This will help support the future growth of the feed industry and livestock production.
- Support the diversification of compound feeds by feed processing plants: opportunities are emerging and demand is growing for compound feeds for aquaculture.
- Increase opportunities for foreign direct investment in production of premixes, minerals and vitamins locally: Ethiopia and many countries in the region are dependent on imports of feed supplements (premixes, minerals and vitamins) and the imported products are usually generic and not tailored for local purpose. Domestic production of feed supplements is emerging with wider business opportunities due to intensification of livestock production. The production of effective microbes as feed inoculants is currently an entry point with significant business opportunities in the commercial feed sector.
- Support research and extension for the commercial feed sector: support is needed to promote alternative feeds in compound feeds and innovations in import substitution through production of feed supplements locally. Substantial support is needed in forage seeds and feed processing machines, on-farm testing and promotion of compound feeds, and feed safety and quality standards.
- Build capacity of public laboratories for efficient feed quality and safety analytical services: well-equipped and accredited laboratories are needed to meet the needs of the commercial feed sector.

- Support national and local institutions: the Ethiopian Animal Feed Industry Association (EAFIA), established in 2008 by feed factory owners, private dairy farmers and farmers' unions requires technical, financial and organizational support, as well as capacity for self-regulation to ensure the quality and safety of their products. Support is needed to link institutions such as EAFIA with key actors (research, academia, development organizations, and International institutions) engaged in the feed value chain to improve efficiency and impact.

Output 2.3 Potential animal feeds identified and established for local feed production

Each country should identify and map potential biomass, disaggregated by type of feed resources, as was done by Makkar (2018) at regional states level for Ethiopia. The more detailed at local level the better, as this would inform the establishment of local animal feed centres for feed and forage production. Taking advantage of novel and little-used feed resources would also broaden the feed resource base and help meet the feed deficiency in the region.

Identify and map good practices, innovations and success stories from existing animal feed producers and processors

There a number of good practices that could be up- or out-scaled, which could be shared for example through an annual animal feed knowledge sharing event and using the existing IGAD-established regional animal feed platform to document lessons and good practices in animal feed interventions. Some good practices include densifying feed; preparing urea-molasses multinutrient blocks; formulating total mixed ration; providing urea and molasses and concentrate during dry periods; using lesser-known and locally adapted feed resources. The participation of local communities and key stakeholders should be promoted in the design and mapping of locations for establishing feed banks and densifying units, with the government's local extension system leading the process. Other opportunities include:

- Promote supplementary feeding of livestock with concentrate feed to diversify from dry season feeding strategies that largely depend on grazing pastures and browses. Producers of concentrate feed should thus be identified and mapped, particularly in relation to need. In Ethiopia (Bediye *et al.*, 2018), for example, five main types of enterprises were identified as providing concentrate feed: (i) private feed processing plants; (ii) farmers' union feed processing plants; (iii) supplement importers/producers; (iv) feed manufacturing suppliers/producers; and (v) forage seed producer/suppliers.
- Support local governments to establish fodder/feed banks near places frequently affected by droughts, ensuring the full participation of potential beneficiaries.
- Further develop spate-irrigation for fodder-producing enterprises in river banks and major flood plains. In addition to fodder reserves, spate-irrigated forage once released at the most critical periods could reduce the need for expensive trucking of feed from other areas. Spate-irrigated fodder production provides five times more biomass than natural pasture as shown in Afar Region in Ethiopia; in Somalia, the potential of spate-irrigated fodder production is significant.
- Develop an organized system to secure biomass in a region of excess, for example, grasses to produce hay, densified blocks or pellets, and sugarcane tops and bagasse for preparing densified complete feed blocks. Start with feasibility and feed market studies of target excess biomass regions and develop business model that ensures profitability and sustainability.

- Promote fodder production as a profitable enterprise (as a cash crop) with private sector involvement, including the manufacturing of mechanization tools such as fodder shredders, fodder balers, silo compressors.
- Support agricultural mechanization in the country and at local levels through local production of hydraulic presses, forage harvesters, high-throughput balers, and forage choppers. In doing so, stimulate the establishment of commercial units for multinutrient block production, forage chopping, forage densification and pre-mix production.
- Develop strategies to efficiently use AIBPs, e.g. use of: dryers for increasing shelf-life of brewer's grains, and molasses tanks for storing molasses for use as animal feed, among others.
- Promote the use of urea-molasses multinutrient blocks in the rangelands, near water points, especially when the quality of grazing pasture decreases in dry periods.
- Develop low cost feeding troughs and promote their use to decrease feed wastage.
- During extreme drought when pasture is unavailable, use polyethylene glycol (PEG)-containing multinutrient block to enhance the use of *in-situ* browses.
- Develop public-private partnerships with the feed industry and assist the industry in using good manufacturing and good hygiene practices; and promote strategic establishment of animal feed manufacturing plants in feed-deficient regions.
- Harvest and crush Prosopis pods for use in the diets, as ingredient in total mixed ration – total mixed ration to not exceed 50 percent for cattle and 25 percent in small ruminant diets.
- Plant thornless cactus species in rehabilitating degraded rangelands, including in the areas where mostly invasive Prosopis species has been uprooted
- Encourage private sectors in forage seeds production and distribution (include drought- and saline-tolerant varieties).
- Promote agroforestry, focusing on multipurpose trees that are useful as animal feeds.

Select potential priority areas for fodder production using irrigation

Irrigation is very limited in most of East Africa, with most irrigated areas used for crop production. The Plan of Action thus proposes countries to map areas that could potentially be used for irrigated fodder production. For example, in Ethiopia the share of irrigated land is just 10-12 percent of the total irrigable potential in the country (Ethiopian Ministry of Agriculture, 2011), meaning there is enormous potential to expand irrigated fodder production.

The main constraints to small-scale irrigation (Sisay and Abebe, 2017) include institutional, technical, financial, socio-economic and marketing related issues, including lack of technical know-how on water collection and irrigation technologies and operations, mainly in pastoral settings. Where irrigation is practiced, there are insufficient spare parts and support services to maintain equipment, like motorized pumps. As a result, farmers report frequent breakdowns which lead to delays in agricultural activities and dissatisfaction with the technologies. Smallholders also lack technical capacity to construct and manage rainwater harvesting infrastructure.

To support and implement spate irrigation for fodder production at scale, there is therefore a need to:

- Undertake technical and financial feasibility studies of water collection systems, particularly for micro-irrigation to inform water harvesting and irrigation planning.
- Support clear organizational goal setting and planning for irrigation departments at various levels, as well as structural support to ensure coordination among institutions working on irrigation development. Overall, inter-sectoral and inter-ministerial collaboration is needed to ensure efficient natural resource management and environmental sustainability.

- Provide adequate on- and/or off-the-job training for small fodder producers on irrigation use and maintenance of equipment.
- Ensure access to credit to allow poor farmers and pastoralists to access irrigation technologies; such opportunities should consider credit arrangements and supportive initiatives to enable farmers to access these technologies without collateral or proof of future income.
- Extend and reinforce market and road infrastructure.
- Assign adequate budgets to modernize irrigation schemes where farmers cannot afford to manage these costs themselves. This is especially important where diversion schemes from rivers with large width and deep gorges are too costly for small-scale farmers and pastoralists.
- Support the establishment of producers' or water users' associations, which will have better bargaining power for inputs and prices. In addition, water users' associations can play an important role in managing any potential conflicts over the use of water resources, especially with proper training and adequate support in conflict resolution and negotiation.
- Establish rental markets, encouraging the private sector to engage in the sale of spare parts and after-sale services, particularly in water-lifting technologies, would counter price bottlenecks for smallholders.

Strengthen linkages between fodder producers and markets

In East Africa, a number of issues influence the way fodder producers, market actors and supporting markets do business and secure their livelihoods. To reinforce market linkages, countries and region should:

- Facilitate linkages between fodder producers and input markets through negotiation with seed companies/input dealers, and implementing programmes that strengthen input dealers, especially at local level.
- Link fodder producers to output markets through creating linkages directly to livestock export traders or traders' agents. For example, establishing a network in cross-border areas and in the region would facilitate a fodder marketing business model that links livestock traders and fodder producers to build trust and transparency.
- Link fodder producers with financial services, for example through mainstreaming village community banking and village savings and loans within fodder producers' organizations and providing additional training to strengthen their capacity.
- Support fodder producers' groups with other training focusing on good agricultural practices, linking to related projects and awareness campaigns, as well as behaviour change communication mediums such as radio and pictorial-based curricula on the importance of growing pasture for enhanced year-round livestock production and income.
- Connect fodder producers' groups and cooperatives to market information through information and communications technology (ICT) providers, as well as other ongoing projects or programmes that are using ICT to facilitate these linkages.

Building these linkages would help increase the income and strengthen the livelihoods of rural, smallholder fodder producers by improving fodder production and post-harvest handling and enhancing access to buyers willing to pay a premium for quality products.

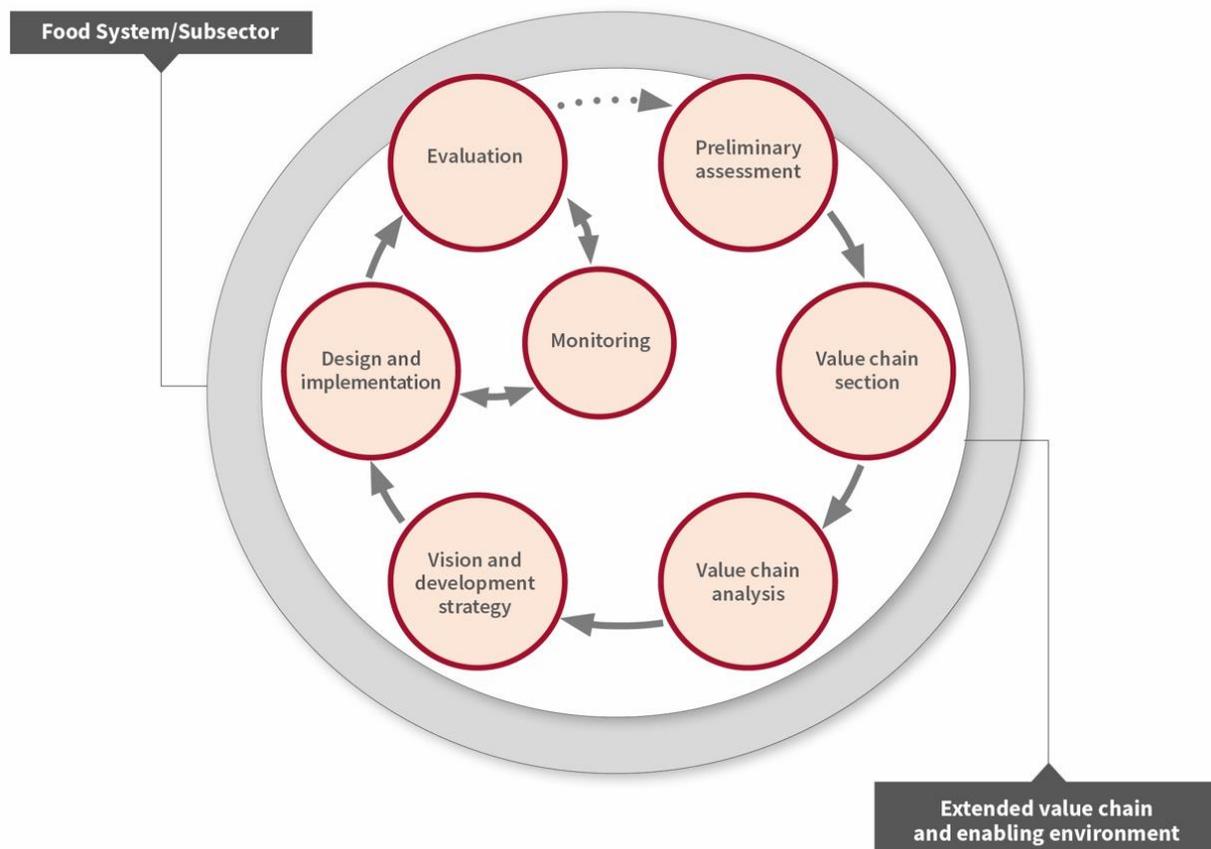
Output 2.4 Animal feed business centres identified and operationalized

The feed value chain involves the full range of activities required to bring a feed product to livestock, from production to processing and delivery, taking into account the physical, social and economic enabling environment around the value chain. Feed value chain analysis is the first step in understanding markets, their relationships, participation of different actors, and the critical constraints that limit the growth of the feed sector (and hence livestock production) and consequently the competitiveness of smallholder farmers or pastoralists. This must also seek to understand variations by gender in access to markets and distribution of risks and gains along different stages of feed value chains of producers; processors (access to processing technologies and information); market agents (access to transportation, safe market spaces, etc.); and according to the economies of scale (bringing producers together to improve their market position).

Traditional marketing channels should be further developed by creating coordinated links among farmers, processors, retailers and others. A balanced approach that takes into account both competitiveness and equity issues is paramount.

FAO has developed specific handbooks for sustainable food value chain development (FAO, 2014), including more specific to livestock systems (FAO, 2018b). Value chain diagnosis and upgrading involves several steps, as illustrated in Figure 1. The process is more dynamic than linear, with continuous monitoring and management of the upgrading process allowing adjustments as needed.

Figure 2. Detailed value chain livestock development cycle (adapted from FAO, 2018b)



Preliminary assessment

This is the first step to understand the needs and context in which the value chain operates (species/commodities, beneficiaries and instruments, strategic partners, time and resources, etc.).

Value chain selection

Depending on the context assessment, the value chain development may have to be restricted to a given area or product (e.g. concentrates). A prioritization process may then be applied to assess value chains of interest on the basis of inefficiencies identified, relevance, and potential for change and impact through well-designed intervention.

Value chain analysis

The selected value chain should be characterized and mapped, based on the predefined objectives and scope of intervention. This involves:

- defining a value chain's overall size;
- identifying pathways from source to end-market(s);
- measuring how costs rise as the product moves along the value chain;
- considering the market chain's previous and potential development; and
- identifying the value chain's comparative advantage and areas of potential growth for sales or profitability, as well as its resilience to economic and environmental shocks.

This analysis should also seek to better understand the value chain's governance, economic, social and environmental sustainability, and the incentives and capacities of value chain actors.

A variety of different economic and non-economic tools, including from the livestock sector, can be used according to the scope of the analysis and the data available. A diagnosis should be made of the root problems, leverage points and opportunities for upgrading the targeted value chain.

Value chain development should address the following:

- how to empower poor and vulnerable men and women to produce high-quality, sustainable feed with an identified market destination; for example by ensuring adequate access to basic production inputs, credit, capacity-building, market-related information;
- how to improve access to markets as a catalyst for rural poverty reduction; for example by improving business management skills and marketing strategies, ensuring that they have the knowledge and technologies required to meet feed quality and sanitary standards, providing adequate infrastructure;
- how to ensure that the economic gains in feed value chains are fairly distributed among the various actors, including poor farmers and pastoralists; for example, by reducing marketing distortions, building relationships among various actors, strengthening farmers' organizations and livestock traders' associations.

Major challenges facing value chain development include:

- Lack of feed processing machinery, equipment and tools, which are currently supplied by just a few companies. Given the demand to modernize the feed industry from an increasingly commercialized livestock subsector, there will be high demand for such equipment.
- Feed safety and quality: weaknesses in or absence of analytical labs for feed quality and safety and the lack of regulatory systems for feeds produced locally is a bottleneck to the successful development of the livestock value chain. There is thus a need to establish reliable and decentralized laboratory services.
- Lack of appropriate feed and enforcement mechanisms: for example, in Ethiopia, proper labelling guidelines that enable customers to assess the quality of feeds are absent. There is no requirement for the feed industry to mention important quality parameters such as CP and ME on the labels.
- Weakness of research and extension to support feed sector feed value chain development, including alternative feed resources as feed supplements.
- Lack of a national institution that can bring together all actors. In Ethiopia, EAFIA was established in 2008 by feed factory owners, private dairy farmers and farmers' unions but remains weak after nearly a decade. In Kenya, the Association of Kenya Feed Manufacturers (AKEFEMA) is in a similar situation with many members not accredited by the national regulatory agency for feeds, S-Mark.

Identifying business opportunities for the animal feed value chain is an important step in developing sustainable feed supply chains. However, this means addressing issues such as the cost of producing raw materials and subsequent price of finished feed products, availability of raw materials for feed millers and finished products for end users, and the quality of raw materials affecting the quality of finished products.

For example, in Ethiopia, an opportunity could be establishing densification units. There are significant amounts of sugar tops and sugarcane bagasse available in Southern Nations, Nationalities and Peoples' (SNNP) Region and Oromia Region, while excess grass hay is available in Benshangul-Gumuz and Gambela, as well as hay/crop residues in most regions except Afar, Somali, and Tigray. Fodder/feed banks could be set up in Afar, Somali, Oromia (southern) and SNNP (southern) regions. If just 50 percent of the sugarcane tops and bagasse, as well as grass hay, produced in the two regions with a positive feed balance were used, the feed requirements of 3.1 million TLU could be met for three months (Makkar, 2018). In the Sudan, a five-year programme on rangeland management (2015–2019) includes upgrading the value of crop residues, aiming to provide easy handling, increase nutritional values and intake of crop residues and encourage private sector investment in the pastoral sector, among others (Sudan Ministry of Animal Resources, 2015).

Vision and development strategy

The analysis should then form the basis of a vision, development strategy and action plan for the value chain. The analysis performed in previous steps should help identify the goals to be realized in the vision.

For example, the vision could be: increase access to feeds and implement strategies for their efficient use in fattening units run by private or community-based groups to increase pastoralists' incomes, or facilitate the establishment of pastoralist livestock fattening cooperatives and link them to animal feed producers.

Results from the value chain analysis will help to prioritize the key constraints to be resolved in order to achieve these goals, thus formulating the strategy. The action plan operationalizes both vision and strategy, and breaks down the specific activities required.

Design and implementation

Actions should be appropriately sequenced so as to build capacity and address constraints in a logical manner. Project design should also be flexible enough to adapt to changing circumstances. For example:

Establishment and strengthening of feed production cooperatives/feed marketing associations

This involves setting up or strengthening cooperatives and associations engaged in feed production, storage and marketing of the feeds, including focusing on input services, relationships, quality standards, business development services, market information, knowledge (capacity building), equity, competitiveness, communication and transport.

Facilitation of animal feed/private sector investment

Once business opportunities have been identified, information on investment opportunities should be disseminated to relevant stakeholders, primarily potential investors in the animal feed sector. This could be supported by various actors, including United Nations (UN) agencies, development banks, large Non-governmental Organizations (NGOs), resource partners, international and national professional associations, governments and regional bodies (e.g. IGAD, AU), etc., with a particular emphasis on small-scale producers to ensure a more inclusive and equitable approach to sustainable development of the feed sector.

Monitoring, evaluation and scaling-up

In parallel, a monitoring and evaluation system should be put in place to track the performance and effectiveness of the actions implemented. This contributes to accountability and enables adaptation of activities as needed. Project evaluation should consider the scalability of the value chain, not only as regards its replicability across a wider geographical area, but also in terms of institutionalization involving new partners or policies. It is important to document and share the successes and potential application of activities in different contexts. It is also essential to consider the sustainability of interventions beyond the project/programme duration.

Output 2.5 Feed supply chains established and emergency mechanism specified

Depending on the level of emergency and complexity, a number of preparations and interventions are required to establish emergency feed and forage supply chains at country, region and county levels.

Make use of available guidelines for feed supplementation

This involves identifying and using existing fodder banks (and identifying new ones), as well as producing feeding blocks and densified feeds. To minimize the time lost in procuring and transporting feed across long distances during a crisis, feed densification and processing should be promoted alongside setting up of feed and fodder banks in or near crisis-prone areas, enabling a supply of feed in the shortest possible time. Given that biomass shortages are common in drought-prone areas even during normal periods, the feed reserves in fodder banks would be available on demand at all times. Densified straw-based complete feed rations or compacted hay could be prepared (FAO 2007, 2011b, 2012) in seasons of biomass availability and transported to the fodder banks.

Urea molasses multinutrient blocks should be prepared and stored well in advance to be distributed as supplementary feed during droughts. There are a number of useful documents available on animal feed processing, as well as guidelines on feed and forage supplementation (Thorpe and Duncan, 2012, and Negash, 2017), including FAO's Manual for Good Practices for the Feed Industry to implement the Codex Alimentarius Code of Practice on good animal feeding (FAO, 2010). Support should also be provided to local research organizations to adapt established feeding technologies to local conditions using locally available resources.

Organize stakeholders' consultations to define roles and their responsibilities in the feed supply chains establishment

This involves identifying and building trust among all stakeholders (including government, private sector, communities) to ensure their ownership of the initiative. In Kenya, for example, these would include the Ministry of Agriculture, Livestock, Fisheries and Irrigation, the State Department for Livestock, Kenya Bureau of Standards, Ministry of Public Health, Ministry of Trade, policy research organizations, AKEFEMA, producers' organizations, private laboratories and others. These stakeholders could establish a joint platform to discuss the state of the feed value chain and the feed industry and identify interventions to address constraints, such as the raw material supply chain, feed laboratories for quality control and implementation of feed regulations, establishment of a feed manufacturers' registration, licensing and enforcement of good manufacturing practices (ABS TCM, 2013).

Establish contractual arrangements and legal framework

It is important to establish partnerships with suitable commercial feed producers, processors and cooperatives for the production and storage of feed and forage, provision of equipment and machinery for feed blocks, chopping of fodder, molasses storage tanks, etc. to support the effective management and response to animal feed emergencies. A balanced contractual arrangement and legal framework is needed to ensure a sustained supply of feed. Such arrangements could include the provision of equipment and machinery for densifying feed resources. The Plan of Action is intended to encourage countries in the region to pursue such arrangements to minimize livestock losses during drought. For example, the EU has recently issued a code of conduct on contractual relations (Byrne, 2018), with guidance on the rights to access and use of agricultural data. This includes questions such as:

- Is an agreement/contract in place?
- What obligations are there? What warranties and indemnities are there for each party?
- What data is collected?
- Who owns/controls access to the data?
- What services are delivered?
- Will my data be used for purposes other than providing me, the data originator (e.g. farmer/pastoralist), a service? Is it clear what these are? Can I agree/disagree? What are/is the benefits/value for me (as data originator)?
- Is the data shared with other parties? What rules do the external parties adhere to? Can I agree/disagree with sharing data with other parties?
- Can the service provider change the agreements unilaterally?
- What happens when the service provider changes ownership?
- Can I retrieve my dataset from the system in a usable format?
- Will I be updated on security breaches?

- Can I opt out of the service and have my data deleted from the system?
- Is there a contact point to assist me with any questions that I may have?
- Do I need insurance?
- What are the confidentiality terms?

Similar codes of conduct could be used when preparing contractual agreements with feed product/service providers.

Procurement and distribution of feed aid

This involves advocating for and facilitating fast-track procurement processes. A flexible procedure should be formulated for crises to hasten the process of procuring and distributing animal feeds to protect livestock assets of the poor. Currently, in countries in the region, the average time from purchase requisition to purchase order is 30 days. If a re-delegation is requested, procurement lead time could take from 45–50 days. Field delivery takes from 1–4 weeks. It is therefore recommended that procurement activities be enhanced at regional level by bulking the purchasing necessary to increase delivery in the field. This Action Plan proposes the establishment of a regional procurement unit. Logistics partners should be engaged to compare the goods cost and not the aggregate cost. Such a partner would help increase efficiency, tracking and speed.

Post-distribution assessment of emergency feed supplied

The post-distribution assessment should examine the timeliness of the feeds distributed, the regime given, palatability of the feed and forage supplied, the quantity of waste generated, the quality of the feed and forage received, the cost of distribution of the feed to beneficiaries, etc. This should be done at the right time and at local level to ascertain the effectiveness and benefit–cost of the intervention and document lessons learned to enhance future interventions.

Output 2.6 Emergency livestock feed supply coordinated with other interventions

Access to water for livestock and livestock feeding

Water and feed are the two critical determinants of livestock survival in dry areas and during droughts. The distribution and type of water points and watering schedules are major determinants of range use. In the region, pastoralists and their livestock have remained mobile, largely dictated by water and feed availability. Traditional practices have often involved unrestricted livestock access to rivers and seasonal surface water ponds, pans and dams used to provide water and feed within reach of these water resources. However, unrestricted stock access causes disturbance and pollution, resulting in environmental degradation and loss of productivity. Alternative outlets along the canals can restore river and ensure clean water for livestock. Water points for livestock are key sites or locations for delivering livestock extension services, such as vaccination, treatments, marketing points or defining trade routes.

They have also been used to regulate the density of livestock grazing in a particular time; a strategy for managing rangelands and pasture by evenly distributing livestock across pastures and rangelands. Any water development project should thus consider drought-proofing of communities and pre-positioning watering facilities within particularly vulnerable areas, for example, along or near livestock migration routes, near markets, etc.

This Plan of Action proposes that countries in the region promote the use of PEG (a tannin-binding agent), which can be added to water or blocks to enhance the use of unconventional feed resources such as Prosopis and acacia pods, and browses. This is important, as during drought the quality of range feeds reduces significantly. In addition, multivitamin blocks can be supplemented in the rangelands near water points, especially when the quality of grazing pasture decreases. Livestock watering points can be established along canals, with careful monitoring of the salinity. Dry pastures and high protein supplementary feed may reduce the salinity tolerance of the animal due to the lower moisture content of the feed and higher salt content (Ayers and Westcott, 1985). In terms of water requirements, for example, about 50 litres of water is required for each TLU (Peden *et al.*, 2003). The calculated requirement of water for all Ethiopian livestock (camels, cattle, sheep and goats) was 4.2 billion litres of water each day. During droughts, as a complement to feeds/seeds, water could be distributed using bladder water tanks on trucks (e.g. in Somalia) or specialized water-transport trucks in areas with critical water deficiencies.

Animal health services and livestock feeding

A major challenge in pastoral areas is limited animal health services and extension advice, including inadequate supplies and quality of veterinary vaccines and drugs, and poor quality control of these. Efforts to strengthen animal health services in rural areas need to take into account alternative service providers such as community-based animal health workers, private sector actors and livestock value chains, while the regulatory role is played by relevant government authorities for animal resources.

In emergency contexts, animal health services must take into consideration livestock body conditions. Key animal health activities should include internal and external parasite control, while others such as emergency vaccination should be carefully considered at the peak of animal feed and water deficiencies when livestock condition is poor, and are probably better implemented at the recovery stage. If such assistance is combined with animal identification and recording systems (FAO, 2016b), it would assist in distinguishing the vaccination status of herds or individual animals as well as monitoring the impacts of animal health interventions and feed supplementation on the performance of the herds/flocks. For example, there is sufficient evidence that good nutrition mitigates secondary bacterial infection, hence decreasing the need for animal health services, and enhances the efficacy of clinical approaches including vaccination (Makkar, 2016).

Cash injections in the target area/cash-for-work and livestock feeding interventions

Various humanitarian and development actors, including FAO, have cash and voucher programmes (FAO, 2016c) that benefit smallholders affected by natural hazards, market volatility, conflicts and protracted crises. These play a critical role in response to crises when smallholders can no longer purchase food, agricultural inputs or livestock because their assets have been damaged or depleted. They include cash-for-work and voucher schemes that enable affected people to identify for themselves what their most pressing needs are and decide which goods and services they wish to purchase in local markets. Such

interventions provide relief to farmers, while also helping them to protect their livelihoods from future shocks, overcome cash shortages and improve their food security and nutrition. They can be used to distribute animal feed, as well as to promote labour-intensive activities, such as spate irrigation for pastures and forages, clearing invasive species from irrigation canals and rangelands, rehabilitating water points, etc.

Slaughter and commercial destocking

Destocking of livestock before and during drought has been used and promoted by a number of partners in the region (FAO, 2016a). Briefly, destocking programmes should be implemented as soon as a slow-onset emergency such as a drought arises, but is usually done late when livestock have lost substantial body condition. In this situation, short-term supplementary feeding may be required if their condition is so poor that they cannot be sold for meat. Destocking during drought has the advantage that livestock keepers receive cash/food from the sale or slaughter of destocked animals that would otherwise require continued feeding, management, veterinary medicines, etc. or might die from nutritional stress or disease. Impact assessments show that where animals are sold for cash in times of drought, most cash is used within the local economy to purchase food and protect remaining livestock through the purchase of veterinary medicines and fodder, and by transporting shock-affected animals out of the affected area. This reduces the demand for fodder or grazing of the remaining herd, which may result in improved rates of survival of core breeding livestock. Commercial destocking forges links between pastoral communities and livestock traders, which may result in traders expanding their businesses into remote areas that they previously did not reach, opening channels for producers to benefit from improved livestock marketing opportunities throughout the year. When destocking is commercial, fewer external inputs are required, making this a cost-effective and sustainable option, and traders may become involved in purchasing and positioning fodder at buying sites, which is beneficial in the longer term. To consider destocking as an option, the availability of fodder or closure of a market should be assessed, among other information, including the availability and purchase price of different types of feed (fodder, concentrates and by-products); the projected increase in feed prices, based on the result of previous shocks; current accessible markets and the associated costs of moving the livestock to the markets; and market prices for different livestock species and types.

Priority area 3. Identify status of rangelands and grazing areas and disseminate best management practices

Output 3.1 Status of rangeland and grazing areas determined

Collect information on current range condition in rangeland and grazing areas

Rangeland degradation/deterioration refers to soil and vegetation and is generally defined as the reduction of the economic or biological productivity of lands. Loss of plant cover, undesirable change in herbaceous species composition (e.g. annual grasses replacing perennials), soil erosion associated with intensification of grazing and woody encroachment have been dominant features in the rangelands of IGAD countries, which have different implications for pastoral productivity. Due to the lack of monitoring, estimating the level of degradation of rangelands and grasslands, is difficult. Rangeland degradation is not a spatially uniform process; there are substantial off-site effects. Some landscapes are more prone to degradation than others because they have erodible soils and palatable species, which attract more grazing activity or both. In general, degraded rangelands are characterized by sustained reduced biological and economic productivity associated with improper or unsustainable human land uses and the impact of this on hydrology, soil processes, and vegetation composition. Rangeland degradation could be caused by climate change, government policies, overgrazing and decline of traditional resource management practices, population pressure, encroachment of cultivation lands and bush encroachment.

Several techniques are available for assessing the level of rangeland degradation. A combination of satellite imagery and grazing pressures assessment is advocated (Prasad Paudel and Andersen, 2010). Scientific knowledge when supported by experiences of indigenous communities (Behmanesh *et al.*, 2016) would provide the facts, especially when the rangeland situation is assessed with the following indicators: the rate of decrease of vegetation yield, loss of phyto-diversity, removal of palatable plants, increase in poisonous plants, emergency of invasive species, decrease of shrubs, increase in annual plants, decrease of ground cover, increase in the distance between plants, soil salination, loss of litter mass, soil muddiness, decrease of plants height, decrease of soil sandiness, decrease of soil infiltration, increase in soil looseness, increased risk of wildfires, increased risk of pest damage. Data and information sharing mechanisms need to be designed and operationalized so that delivery institutions can access reliable data and information when designing interventions.

Agro-ecological zoning and assessment

Before any restoration or rehabilitation, agro-ecological zones and production areas in which the rangeland restoration is to be conducted must be identified. It is important to assess limitations associated with land tenure and access for grazing, which may have affected stocking rates (spatial and temporal) with negative impact on rangelands' rehabilitation and sustainability of the system. The following are critical interventions, depending on the situation of the rangelands and grasslands.

Manage, restore or rehabilitate degraded rangelands by targeting the underlying causes of degradation:

- Prevent rangeland degradation and enhance productivity through comprehensive rangeland management techniques (for areas that have not yet degraded or are in fair condition).
- Reseed or allow the progression of natural regeneration.
- Undertake soil and water conservation measures.

- Implement water harvesting techniques.
- Introduce appropriate rangeland management laws.
- Monitor rangelands so that timely and appropriate measures could be taken.
- Restore degraded habitats by ceasing activities that are causing degradation (where the damage is not severe) or use biotic manipulation such as reintroduction of animal or plant species that have been eradicated from an area (where the damage is too great).
- Collect and document evidence-based good practices.

Re-vegetate degraded rangeland in areas where prolonged heavy grazing pressures combined with recurrent drought have changed the rangeland to bare soil. In such extremely degraded rangelands, reseeded is mandatory (Musimba *et al.*, 2010, Van den Berg and Kellner, 2005, Opiyo *et al.*, 2011). Reseeding of Rhodes grass (*Chloris gayana*) with simple tillage and manure application has been successful. Reseeding involves collecting seeds from existing grasses and then sowing them on bare ground. The reseeded approach would involve ground preparation using fertilizers and ongoing nurturing, as well as encouraging pastoralists to collect enough seeds in the growing season to sow the land when needed. Use native grasses when re-vegetating degraded grasslands (Oba and Kotile, 2001).

Prescribed fire can rehabilitate degraded rangelands. For example, plots burned at Dida Hara pastoral association of Borana rangeland, Southern Ethiopia in 2005 demonstrated that the cover of highly valued grass (*Themeda tiandra*) increased from 18 to 40 percent of the basal cover and the amount of bare ground was accordingly reduced after burning (Gebru *et al.*, 2007). Pastoralists traditionally use fire to control the expansion of bush cover and ticks, to improve pasture quality, and to facilitate livestock movement.

Bush encroachment control (through a combination of rangeland management, mechanical, biological and chemical methods) disrupts the invasive woody plant community structure through transformations of biotic environments and habitat conditions in which colonization of the disturbed microhabitat takes place (Lesoli *et al.*, 2010 and Belachew and Tessema, 2015). In doing so, a suitable habitat can be created for grazers as herbaceous vegetation increases with reduction of woody species.

Rangeland enclosures have been successfully tested in restoring degraded rangelands, whereby grazing is excluded for a specified period of time. For example, enclosures in Ethiopia restored degraded rangeland but needed defined users, resource boundaries and realistic bylaws or rules (Mohammed *et al.*, 2016). Long-term enclosures can also lead to proliferation of bush encroachment compared to regularly grazed rangelands. A combined scientific and indigenous knowledge in managing rangeland enclosures would prevent unintended results.

Grazing management involves maintenance of livestock numbers with available forage supply, uniform distribution of animals within the range, vegetation maintenance through alternating periods of grazing and rest, and use the most suitable kinds of livestock. Therefore, promote grazing management as a best practice to sustain productivity and health of rangelands through reducing stock numbers and controlled grazing to lower grazing pressure in order to facilitate rehabilitation. Controlled grazing management is beneficial in conditions of poor vegetation cover, overgrazed and degraded soils and is the most promising sustainable land management practice to restore degraded rangelands, enhance the vigour of mature perennial grasses, and improve the functioning of hydrological systems in drylands, contributing to the protection and restoration of biodiversity (Woodfine, A. 2009).

Output 3.2 Evidence-based best practices on rangeland and grazing management disseminated and adopted

Scale up good practices for pasture restoration and improved grazing management

Strategies could include reseeding, over-seeding, irrigation, fertilization, rotational grazing, grass and legumes enrichment. Guidelines on how to manage grasslands and rangelands are available, as are key considerations and best practices on: (i) grassland development, improvement and rehabilitation; (ii) pasture development methods; (iii) herd management; and (iv) social, economic and environmental factors. The following recommendations are based on previous consultations in the region:

- Plant thornless cactus as part of rangeland rehabilitation (including in areas where *Prosopis* is being uprooted) and develop local businesses around this because of its multiple uses.
- Through fodder producers and cooperatives, facilitate fodder production in the identified sites including sites from where *Prosopis* bushes have been cleared; use *Prosopis* and acacia pods and leaves as animal feed by applying browse-enhancers; and use *Prosopis*-pod crushing machines to disintegrate the pods before using as animal feed.
- Use browse-enhancers to efficiently use *in situ* browse biomass available during droughts.
- Map specific area-size and intensity/volume of the flood for potential irrigation in a spate irrigation system to be devoted for fodder production; establish spate irrigation to facilitate fodder production by cooperatives and commercial entities and make provision for livestock water outlets along canals; support production of cultivated fodder through spate irrigation and around perennial rivers, and transport after chopping, drying and baling to reduce bulk and thus transport costs.
- Map areas along the river most suitable for production of improved forage crops, and support communities in planting and managing upgraded fodder production (alfalfa, Sudan grass, green panic grass, Rhodes grass etc.).
- Within the developed schemes, promote agroforestry with the introduction of dual-purpose crops, legumes, horticulture, dates, fruit trees and nuts within and between fodder production to enhance income from cash crops, food security and dietary diversification; and support integrated fodder production with soil and water conservation (terracing, soil bunds, check dams).
- Where physical infrastructures cannot be developed for forage/feed storage, identify potential retreat areas where the growth of pasture under natural condition will allow the conservation of fodder *in situ* for use during short or extended dry spells.
- Through community consultations, design and implement sustainable community-based management systems for fodder production, conservation and sustainable use in the enclosed potential retreat/contingency areas; and build capacity of the communities in these operations.
- Support the establishment of pastoralist grazing cooperatives and community groups to manage community contingency grazing, fodder production and use in the conserved areas.
- Map blocks of land for rangeland rehabilitation (preferably using dry grazing areas and along traditional stock routes) with legumes and grasses.
- Promote best traditional practices for managing grazing lands focusing on productivity improvement and halting degradation.
- Where possible, use best local varieties for reseeding and production of high biomass on degraded rangelands

Scale up drought-resistant grass and legume varieties for feed production

Drought-resistance is an inheritable trait and some varieties of grasses and legumes are drought-tolerant (e.g. White clover, *Festuca spp.*) and can be used to improve the productivity of rangelands and fodder production. There are a number of efforts by governments, partners and communities to improve rangelands and fodder production; for example, in Mandera and Dollow, Somalia communities are producing fodder for commercial purposes. These initiatives need to be scaled up into a sustainable and business model.

Pasture and Rangeland Research and Development in Ethiopia (Yami *et al.*, 2011) compiles 60 years of grasslands research and development efforts by various stakeholders, identifying key technical and policy gaps in sustainable grasslands management.

Output 3.3 Improve governance and management of rangelands

Map existing governance structures and identify their challenges and gaps

Most pastoralists manage their rangelands communally, benefiting from greater flexibility and seasonal access to resources. Inadequate knowledge and understanding of local governance structures and their role in the (mis)management and use of rangeland resources, however, has prevented evidence-based technical, institutional and policy support to the pastoral system. Good governance at community, state, and international levels is needed not only to prevent degradation of rangelands but also to reverse the degradation and ensure sustainability of the ecosystem. For this, systematic mapping of existing governance structures is needed, identifying bottlenecks and gaps to be addressed. This must take into account the unique features of rangelands, issue of scale, ecological disequilibrium and seasonality, etc.

Incorporate lessons learned into good governance

Lessons learned and best practices, when contextualized and shared, can support a significant change in rangeland governance (see Herrera *et al.*, 2014 for some lessons), including:

- Strengthen participatory methods for community-based natural resources management.
- Protect transhumance mobility corridors.
- Rebuild pastoral governance (invest in human, social and political capital).
- Strengthen pastoral governance (compile basic information, recover ancestral knowledge, update traditional systems, empower women, enhance social cohesion and grassroots organizations among pastoralists, develop bylaws based on traditional rules and regulations, approve specific pastoralist laws, build on pastoralist professionalism, improve image of pastoralists, support collaborative perspectives of rangeland management such as the Hima system, promote multiple functions of rangelands, preserve pastoral heritage and properties, etc.).

Establish or reinforce management structures (water user associations, communal grazing committees)

Sustainable development of (agro)pastoralist-managed rangeland systems in East Africa requires the establishment of legally-recognized cooperatives or users' associations capable of sustainably managing, operating and maintaining grazing areas in a democratic manner and to the satisfaction of users (Lempériere *et al.*, 2014). A number of such committees exist in the region. Strengthening their capacity and linking to a national support structure is key to reinforce and spread their mandate at community level.

Priority area 4. Strengthen enabling environment for feed production

Output 4.1 Policy, institutional and process frameworks and standards supported

Assess existing mechanisms for quality and safety control and propose improvements

Quality and safety control for animal feeds is crucial to ensure they meet international standards. Knowledge of the infrastructure and human skills available in-country, including at subnational levels, is needed to guide improvements to enforce these quality and safety standards. FAO has published a number of guidelines (de Jonge and Jackson, 2013 and FAO, 2011c) on animal feeds quality control to support these activities.

For example, a recent assessment (Makkar, 2018) of available skills and infrastructure for quality and safety control in Ethiopia found gaps, identifying a need to: (i) build skills of laboratory personnel to quantify mycotoxins and pesticide residues (using high performance liquid chromatography and gas chromatography); (ii) introduce wet chemistry facilities for determination of crude protein, fibre, minerals such as calcium and potassium, and urea as they do not currently exist in the feed analysis laboratory; (iii) ensure timely procurement of chemicals for running the equipment; (iv) strengthen quality control systems for various analyses; and (v) update the feed quality and safety standards by the national Standards Agency (FAO can assist in this activity).

Develop harmonized regional feed quality and safety standards' certification procedures

Countries in the region must align their practices to existing protocols on transhumance and identify gaps in their compliance with international standards, such as the sanitary and phytosanitary standards, toxicity norms, and Codex Alimentarius for feed safety and quality requirements. The Code of Practice for Good Animal Feeding approved by the Joint FAO/World Health Organization Codex Alimentarius Commission must be followed. Given the direct links between animal feed and the safety of foods of animal origin, feed production and manufacture must be considered an integral part of the food production chain. Like food production, feed production must be subject to the quality assurance of integrated food safety systems. The FAO/International Feed Industry Federation (IFIF) Manual on Good Practices for the Feed Industry (FAO and IFIF, 2010) assists producers and all stakeholders along the production and distribution chain to apply the Codex Alimentarius Code of Practice on Good Animal Feeding.

In 2011, FAO issued a manual on quality assurance for animal feed analysis laboratories (FAO, 2011c), which provides a comprehensive account of good laboratory practices, quality assurance procedures and examples of standard operating procedures as used in individual specialist laboratories. The adoption of these practices and procedures will assist national laboratories to acquire the recognition of competence required for certification or accreditation, and enhance the quality of data reported by feed analysis laboratories. In addition, ensuring good laboratory practices will enhance the safety of laboratory workers, protect the environment from laboratory-discharged pollutants and increase the efficiency of laboratories. There is therefore a need to harmonize official certifications for feed quality in compliance with international standards in East Africa and at local levels.

Support national institutional building and policy development

Factors that contribute to low levels of adoption of new technologies include the failure of the technology to meet producers' expectations, a lack of participatory approaches in technology development and absence of producer-centred research and extension programmes, limited partnership among stakeholders (government, private and farmers), and lack of long-term commitment of key players. On the other hand, key factors that influenced the adoption, for example, of improved forage production technologies have been availability of land, land tenure system, degree of market orientation, and income of producers.

Enabling policy and institutional arrangements are critical to ensure a sustainable feed sector. For the National Feed Inventory and National Feed Balance to be conducted annually, there should be an identified institution (Makkar, 2018) that leads this work. The inventory and balance require data to be collected on annual crop production (all seasons), animal numbers and herd structures – originating from the lower administrative level across the country. In Ethiopia, data is collected at *woreda* level (equivalent of a district) and fed into zonal level, then collated and transmitted to the regional institution. This then feeds into the national feed inventory and balance by a designated institution or feed directorate (in a line ministry). For Kenya, sub-counties collect similar data to be collated at county level to be then passed on to the designated institution for updating the national feed inventory and balance.

Evidence-based animal feed policy-making requires a review of the agriculture and livestock sector policies and analysis of constraints and opportunities facing the animal feed industry, including benefit–cost of such policies on the national economy, natural resources and the environment.

Formulated policies should promote the participation of the private sector, provide a conducive environment for good manufacturing practice and quality control, promote and stimulate a competitive animal feeds industry, provide a conducive fiscal and regulatory basis for the growth of the industry and put in place a suitable institutional framework and infrastructure for delivery of support services.

The animal feed policy should reflect the key priorities and specificities of a country, including, to stimulate increased feed production, ensure quality animal feeds on the market, reduce production costs and build capacity among private and public sector actors for the development of the animal feeds industry. To-date, Uganda is the only country in the region that has a National Animal Feed Policy. Lessons can be learned by neighbours in formulating policies and implementation arrangements (see Box 2).

Box 2. National Animal Feed Policy formulation – an example from Uganda

Uganda's policy was formulated in 2005 to stimulate increase feed production, ensuring the availability of quality animal feeds on the market, reducing production costs and building capacity among public and private sector actors. The main statements of the Policy were:

- Promoting increased and sustainable animal feeds production and availability will improve the nutrition of animals and increase productivity of farm animals.
- Assurance of quality animal feeds will protect farmers and their animals against improperly formulated, contaminated and deceptively packaged feeds.
- The reduction of costs of animal feeds will increase the profitability of enterprises for feed producers and farmers alike.
- Capacity building for production of quality animal feeds will ensure sustainability in supply and maintenance of required standards for the domestic and export markets.

Key approaches for achieving this include strengthening research, availing credit, encouraging production gains in raw materials for feeds, transfer of technologies, formation of farmers and manufacturers' associations and developing rural infrastructure to increase access. The document contains: the animal feed policy, strategies for its implementation, funding of the industry, and legal framework, as well as strategies for compliance, including formulation of standards, rules and regulations to govern the industry and proposed establishment of an institutional and legal framework to enforce these.

Both public and private sector actors have important roles to play in implementing the policy. For example, the public sector in guiding, supporting and regulation, including providing support services and creating an enabling environment for private sector investment. The private sector leads the production and marketing of animal feeds as well as providing support services, where possible.

In a recent regional policy dialogue in Naivasha, Kenya – supported by Swedish Development Cooperation through the IGAD-FAO Partnership Programme – IGAD Member States agreed to:

- advocate for policy makers' buy-in to establish and operationalize national feed reserves, learning from national food reserves for humans;
- develop concept notes on enhancing scale up of successful interventions for resource mobilization at national levels;
- create an enabling environment in trade policies in agricultural raw materials for feed manufacture; and
- develop clear data, using available tools (FAO tool, FEAST/FeedBase – International Livestock Research Institute [ILRI]) on yearly animal fodder and feed demand, available supply and deficit and carry out awareness creation in order to enhance resource allocation by government, attract private sector investment and development partners' support.

IGAD also agreed to:

- develop a regional rangeland strategy, based on which Member States will review/develop their national strategies; and
- create a dedicated page for the platform, where Member States can share best practices and achievements in promoting commercial fodder production, rangeland and feed processing at national levels.

FAO, together with IGAD and other relevant partners, can provide the needed support in animal feed policies and regulatory framework for effective implementation of this Plan of Action.

Establish/strengthen pastoral unions/federation and associations/cooperatives

Pastoral associations and unions can provide an effective means to manage and use animal feeds and other natural resources. They can be key players, alongside other pre-existing traditional institutions, in transforming the livestock and animal feeds industry in the pastoral system. In addition, they can work to justify forms of territorial anchorage and identity claims of pastoral territories, and compensate for the disengagement of the state from their socio-economic issues. In doing so, pastoral associations and unions can protect their communal resources through their increased bargaining power to counter new access systems and adaptation demands that may be imposed on transhumant livestock keepers (pasture lands, water points, river banks, boreholes, etc.). Through local associations they can amicably resolve local issues, including transboundary ones, and make decisions about pastoral development and the protection of community spaces, irrigated forages (e.g. floodwater/spate irrigation, groundwater, rivers, lakes, etc.), or in-kind royalties from sugar plantations on pastoral lands (in the form of densified fodder).

A number of initiatives on rangelands have been fragmented. Policies and strategies are limited or non-existent. Where they exist, they have not always been translated into action. In the Sudan, for example, the Pastoralist (Producers') Trade Union was mandated to handle pastoralist issues and render services at county and state levels; however, its currently mandate is not known due to recently introduced changes. The Government was to facilitate animal feeds' production and trade by creating supporting structures, an enabling environment (legislation, infrastructure, marketing support, credit facilities, feed quality control [through analytical lab services], micro-finance policy, etc.). FAO has recently published a good practice on restoring the livelihoods of livestock-dependent communities through improved pasture management in Kenya and Ethiopia using pastoralist field schools (PFS).

Existing forums such as Pastoralists' Day – celebrated regularly in some countries in East Africa – can be an opportunity to strengthen pastoral unions. Such an important event should be introduced at IGAD level as a Regional Pastoralists' Day. Support must be provided to community-based organizations (CBOs) that are promoting collective actions in favour of natural resource management, including rangelands, pastures and water resources. A number of traditional pastoralist institutions exist whose roles need to be defined by lead ministries in the Action Plan priorities, taking into account local practices, customs and norms.

Support the development, validation and alignment of national feed strategies and action plans with the regional framework

East Africa experiences frequent droughts, with the 2016/17 drought among the most severe in decades. Drought strains pastoral livelihoods, leading to loss of livestock, separation of families, migration, ecosystem disintegration and community conflicts, with considerable implications for the survival of the pastoral system. Following various requests for technical support to address the dire situation of pastoral livelihoods, including ensuring feed security within the pastoral system, FAO organized a consultation on the topic (June 2017), which triggered country-level workshops (Kenya – November 2017 and February 2018; Ethiopia – November 2017; Somalia – December 2017). The Plan of Action has incorporated the recommendations from these, which are in line with the outcomes of IGAD’s high-level meeting on the same topic. An additional meeting in FAO on “Pastoralism in crisis” focused on identifying gaps and pastoral communities’ needs with a view to harmonizing approaches at national, regional and global level.

To implement this Plan of Action, technical, institutional and policy support are needed at local, national and regional levels. Countries, international organizations, NGOs, CBOs, public and private sector actors need to come together to realize this ambitious but immediate priority for East Africa.

Support the scaling-up of livestock-based insurance schemes

A livestock-based insurance scheme that has been tested in the region is the Index-Based Livestock Insurance (IBLI), which has so far been used in northern Kenya and southern Ethiopia for pastoralists (CGIAR, 2018). IBLI uses the NDVI collected by satellites to develop an innovative new insurance scheme. NDVI has a high correlation with forage availability and serves as an indicator in the area. It has also been shown to serve as a proxy indicator for livestock mortality in Kenya. An index was calibrated using data on livestock mortality, collected at monthly intervals. The index was then based on the relationship between predicted livestock mortality and forage availability. The index triggers a pay-out¹ when cumulative deviation of NDVI falls below the 15th percentile of historical vegetation growth in a given season. IBLI programme was launched in Marsabit in northern Kenya in January 2010 and currently reaches three regions in northern Kenya (Marsabit, Isiolo and Wajir), as well as Borana Region of southern Ethiopia. Studies confirmed that participating households are less likely to sell livestock, more likely to buy livestock from others, and more likely to become self-reliant for food consumption. IBLI has proven to enhance the resilience of pastoralists due a reduction in the short-term risk of asset loss or sale resulting from seasonal droughts in the arid and semi-arid lands of Kenya and Ethiopia.

IBLI can be improved through concerted actions of FAO and partners working with and for pastoralist communities. The approach could be scaled out, customized and modified as more and more data is made available to help arid and semi-arid regions in East Africa.

¹ [Largest-ever micro-insurance payout made to Ethiopian pastoralists](#)

Promote and advocate for public-private partnerships

Public-private partnerships and, where appropriate, multi-stakeholder partnerships would improve the production of quality and safe animal feeds. Opportunities for investment are considerable; however, promotion and advocacy are needed to develop effective partnerships – at local, national and regional levels – to ensure that sufficient and quality feeds are always available. Depending on the context, multi-stakeholder partnerships could be more useful at national and regional level, with more targeted public-private partnerships at local level. Capacity development is needed to ensure the capacity of individuals and organizations, and facilitate an enabling environment.

Feed safety multi-stakeholder partnerships are a FAO-led capacity development initiative that seek to strengthen the ability of relevant stakeholders along the feed and food value chain to produce and supply safer feed. These partnerships address feed safety across the feed and food continuum, including feed ingredients, inputs, feeding practices, feed handling, packaging, transport, storage and manufacturing, taking into account all relevant areas of capacity building (technical, institutional, social, economic and policy) must be taken into account. For example: technical capacities to ensure feed quality and safety, through using good agricultural, manufacturing, marketing and laboratory practices; and functional capacities to facilitate the uptake of and maintain changes at governmental, farm, industry and professional level to ensure that the technical know-how is embodied in local systems and processes in a sustainable way. Social capacities are developed at the individual level (through training, knowledge sharing and networking) and lead to changes in skills, behaviours and attitudes. Organizational capacity development involves improving the overall functioning and performance of an organization or institution and directly impacts on how individuals within the organization develop their competencies and use their capabilities. The enabling environment includes: political commitment and vision; policy, legal and economic frameworks; budget allocations and processes; governance and power structures; incentives and social norms.

Such partnerships result in:

- closer collaboration among stakeholders (through multi-stakeholder policy and technical dialogues);
- increased scientific information and data (e.g. on risks, hazards associated with animal feed);
- effective communication and advocacy;
- broader exchange of data and information and knowledge among all stakeholders (through the development of databases, case studies and the production of publications);
- enhanced technical expertise and know-how (as a result of training); and
- adequate legislations and their effective implementation.

Regional partners can be from the public sector, private sector, civil society or academia and research institutions. Each member country should identify and understand the roles of NGOs, schools, other platforms and associations and promote public-private partnerships in animal feeds.

Output 4.2 Capacity for feed production, processing and marketing strengthened

Capacity development implies a number of different types of support, from training to facilitating access to the appropriate technologies and equipment to ensuring an enabling environment and strengthening value chain linkages. In particular, effective training and knowledge sharing would transform the sector at local and national levels. Trainees and the type of training most relevant would be determined at country or local levels, depending on needs, but would likely include communities themselves, extension providers, private sector actors and emergency support providers, among others.

The Action Plan recommends that this training include:

- Approaches for estimating feed requirements for livestock in emergency situations (Makkar *et al.*, 2018) – partners such as FAO and IGAD can support countries in resource mobilization, as well as in providing technical assistance in preparing such trainings.
- Hands-on training on supplementary feeding in emergency contexts, for example using FAO’s “how to do it” manual (FAO 2016a), which outlines important considerations in supplementary feeding of animals during crises. A number of factors need to be assessed before proceeding with supplementary feeding during drought and the Livestock Emergency Guidelines and Standards (LEGS) decision-making tree for feed options (LEGS 2nd edition – Figure 6.1) could help in deciding the appropriate intervention regarding provision of feed. A training module should be designed around this to meet the needs of target trainees.
- Feed processing and the use of densifying machineries and their use, targeted at private entrepreneurs or youth groups; tailored trainings on feed processing machinery (hydraulic presses, balers and pellet making machines) could also address the considerable logistical challenges and costs associated with this equipment.
- Production of urea-molasses multinutrient blocks to be stored before drought.
- Fodder production, for example, using spate irrigation, which could be converted into hay, baled and stored in fodder banks. Manuals for fodder production and complementary feed processing technologies are available and should help to up- and out-scale training to increase the availability of feed in the countries in the region. In this training, conservation or preservation of feed resources should be emphasized. The guidance should enable the incorporation of fodder and seed production into the farming systems of smallholders. One example is the “Fodder and fodder seed production manual” that was produced in Zambia (Land O’Lakes International Development, 2014). Training should also consider issues such as access to finance so that individuals or associations embarking on such an activity know where and how to access and manage such resources.
- Alternatives to increase the feed resource base, for example through planting and propagating thornless (spineless) cactus, which is rich in carbohydrates and water, yields a high biomass in harsh conditions and when consumed decreases animals’ daily drinking water requirements; or in the processing and use of Prosopis and acacia pods.
- Sustainable rangeland management and associated conflict prevention. A clear guideline on how to manage grasslands and rangelands should be developed and made available. Other manuals can be used as a reference (see References section). Best practices identified are in areas of: (i) grassland development, improvement and rehabilitation; (ii) pasture development methods; (iii) herd management; and (iv) social, economic and environmental factors. Capacity building and training along with structural support to improve communities’ capacity for resources management, coordination among institutions working on the development and rehabilitation of rangelands is paramount.
- Simple technologies such as the use of appropriate feeding troughs and chopping of fodder, as they reduce wastage of feed and increasing nutrient use.

- Backyard forage production using fodder trees, which could also contribute to addressing the shortage of conventional feed that generally occurs during times of drought.
- Market-oriented animal feeding – this requires specialized guidance notes to train communities on identifying the potential of such feeding in improving their income and resilience in the face of climate change and increasing droughts.
- Improved community capacity for rangeland management and conflict
- Developing capacity of: (i) feed manufacturers on good manufacturing practices, and (ii) feed regulators on enforcement of quality and safety standards.

Over the years, the dissemination of research outcomes, technologies and innovations has stalled due to limited policy support and insufficient linkages between research and extension services, exacerbated by inadequate communication means among extension officers and their frontline workers. Comprehensive capacity building throughout the research-farmer/pastoralist-extension system is thus needed. This would be reinforced by efforts to continuously disseminate the latest technologies, adapt and apply existing tools like the LEGS and PFS, and the development of simple manuals and guidance notes on topics including use of browse enhancers, spate irrigation, agroforestry with dual-purpose crops, and community-based management of natural resources, among others.

The Action Plan also recommends that investments be made to improve extension services in terms of transport and use of modern technologies (mobile apps) to make the flow of information to field staff more effective. Traditional but still useful methods include research, extension, farmers/pastoralists and relevant stakeholders participating in joint tours, field days, demonstrations, pre-extension trials, fodder bulking sites, visits to research centres, correspondence with farmers, media, lectures, seminars, scientific papers, publications, agricultural shows and Advisory Committees. Such activities could be further adapted, for example through the use of new approaches (mobile applications) to deliver trainings tailored for farmers, pastoralists, private sector, traders, etc. on new and existing technologies for feed processing, storage, feed bank, business model and overall feed resources management and use.

Implementation arrangements

The implementation of the Animal Feed Action Plan requires a concerted effort on the part of the governments in the East African region, international and national NGOs, research institutions, academia, private sector, civil society organizations, pastoralists, farmers, etc. Within the countries, there is a need for high-level intersectoral and inter-ministerial collaboration. An intersectoral/inter-ministerial joint platform on animal feeds and feeding, led by a designated line ministry, may also be needed. The platform would discuss the feed security situation (or including feed industry and livestock sector), constraints, timely interventions (including this plan of action) necessary to address issues such as raw material supply chain, feed laboratories and implementation of feed regulations, feed manufacturer's registration, licensing and enforcement of good manufacturing practices, etc.

Partnership and stakeholders

This Plan of Action requires that all stakeholders are engaged throughout its implementation, including public and private sector entities and communities involved in the subsector. The first step is to identify and document stakeholders, including roles and responsibilities, and build trust around the Plan to ensure their ownership of the process.

For example, in Ethiopia key stakeholders include: the Ministry of Agriculture and Animal Resources, Central Statistics Agency, the Veterinary Drug and Animal Feed Administration and Control Authority, Ministry of Public Health, Ministry of Trade, EAFIA, UN organizations, ILRI, Ethiopian Institute of Agricultural Research and regional research institutions, feed industry, feed traders, farmers, pastoralists, financial institutions, farmer and pastoralist associations and networks, private laboratories and other relevant institutions. In Kenya, they would include the Ministry of Agriculture and Irrigation, Kenya Bureau of Standards, Kenya National Bureau of Statistics, Ministry of Public Health, Ministry of Trade, Policy Research Organizations, AKEFEMA, UN organizations, ILRI, Kenya Agricultural and Livestock Research Organization and regional research institutions, producers' organizations, pastoralist associations and networks, private laboratories and other relevant institutions.

Coordination and technical support

This Action Plan defines the framework for countries to intervene in the animal feed sector for the purposes of ensuring a continuous, steady supply of quality animal feed to facilitate a strong, productive livestock subsector.

At regional level, implementation of the Plan will be coordinated by IGAD with support from the East African Community (EAC) and FAO through the IGAD regional range and feed platform. FAO will provide the required technical support for implementation of the Plan, while IGAD and EAC will ensure coordination and policy support is provided to their Member States in the adaptation and implementation of the framework in their own contexts. Through the regional range and feed platform, IGAD, EAC and FAO will organize annual stakeholders' meetings to review progress by Members and partners in the implementation of the Action Plan. Specific support will be provided to countries in East Africa to implement this plan based on requests and needs from the national coordination platform. Through the regional livestock and pastoralist coordination group, co-chaired by IGAD and FAO, lessons learned and best practices derived from the implementation of this Action Plan will be regularly shared.

Resource mobilization

Implementation of the Action Plan will rely on resources mobilized through multi/bilateral cooperative arrangements led by Member States with strong support from FAO and IGAD. For regional activities, FAO and IGAD will take the lead in coordination with their Member States. Resource mobilization activities include identifying resource partners and matching the various priorities of the Plan with those of resource partners, as well as preparing grant-winning proposals in a coordinated manner to avoid competition among partners.

Capacity building trainings should be organized to assist Member States and decentralized office personnel in mobilizing resources.

A resource mobilization advisory group may be needed to ensure scaled-up and balanced interventions, which would allow a more meaningful resource partnership that can be sustained over time and that is sufficiently flexible to accommodate additional innovations/aspects that emerge in the course of implementation. The Action Plan should be integrated into national agricultural development strategies, strategic programmes on livestock development, food security and national disaster risk reduction strategies.

Monitoring and evaluation

The Plan will be used largely as a framework for countries to adapt to their own specific context and needs. Depending on local capacity and resources, a phased approach could be used for implementation. IGAD Member States that reviewed this Plan of Action proposed key indicators for measuring success and identified roles and responsibilities (summarized in Annex 4), with associated timeframes. Activities in each priority area can be started simultaneously.

In monitoring, the following can be developed:

- protocols to measure impact of feed and forage supply chains on livestock and household vulnerability;
- protocols to measure impact (cost-effectiveness) of emergency response on household livelihoods, related to livestock survival and performance; and
- protocols to measure impact of improved rangelands and grazing management on resilience of livestock farmers and herders.

Annexes

Annex 1. Livestock population (thousand head) and TLU estimates for East African countries (2017)

Species	Burundi	Djibouti	Eritrea	Ethiopia	Kenya	Rwanda	Somalia	South Sudan	Sudan	Uganda	United Republic of Tanzania	Total
Ass		8 408		8 439 220			22 471	360 207	663 268	19 454	187 001	9 700 029
Camel		70 996	373 752	1 209 321	3 222 593		7 221 998		4 826 059			16 924 719
Cattle	623 031	301 737	2 119 098	59 486 667	20 529 190	1 205 715	4 838 336	11 830 800	30 559 650	14 800 046	27 015 712	173 309 982
Chicken	1 678 000		1 120 000	59 495 000	43 796 000	5 137 000	3 670 000	15 000 000	47 746 000	35 881 000	37 260 000	250 783 000
Goat	1 821 626	514 408	1 810 405	30 200 226	26 745 916	2 869 507	11 692 227	13 568 841	31 325 105	15 587 911	18 721 705	154 857 877
Horse				2 158 176	2 088		889		790 086			2 951 239
Mule				409 877			22 167		638			432 682
Pig	333 925			34 975	504 395	1 165 225	3 763			2 626 405	516 912	5 185 600
Sheep	229 272	469 076	2 405 631	30 697 942	18 983 760	682 369	11 771 916	17 591 983	40 552 860	2 073 150	6 225 812	131 683 771
Total	4 685 854	1 364 625	7 828 886	192 131 404	113 783 942	11 059 816	39 243 767	58 351 831	156 463 666	70 987 966	89 927 142	745 828 899
TLU	724 777	384 764	2 289 924	55 774 814	22 706 503	1 483 603	13 020 164	11 727 746	34 847 220	13 019 956	21 975 233	177 954 704

Source: FAOSTAT (29 June 2018)

Tropical Livestock Units are livestock numbers converted to a common unit (Janke *et al.*, 1982). Conversion factors are: Camels = 1; Cattle = 0.70; Sheep = 0.10; Goats = 0.10; Horses = 0.80; Mules = 0.70; Asses = 0.50; Pigs = 0.2; Chickens = 0.01.

Annex 2. Annual feed requirements (in thousand tonnes) per livestock species for East African countries

(calculated based on livestock population estimates in 2017)

Species	Burundi	Djibouti	Eritrea	Ethiopia	Kenya	Rwanda	Somalia	South Sudan	Sudan	Uganda	United Republic of Tanzania	Total
Ass	-	38	-	38 504	-	-	103	1 643	3 026	89	853	44,256
Camel	-	648	3 410	11 035	29 406	-	65 901	-	44 038	-	-	154 438
Cattle	3 980	1 927	13 536	379 971	131 130	7 702	30 905	75 569	195 200	94 535	172 563	1 107 018
Goat	1 662	469	1 652	27 558	24 406	2 618	10 669	12 382	28 584	14 224	17 084	141 308
Horse	-	-	-	13 785	13	-	6	-	5 047	-	-	18 851
Mule	-	-	-	2 244	-	-	121	-	3	-	-	2 369
Pig	1 524	-	-	160	2 301	5 316	17	-	-	11 983	2 358	23 659
Sheep	209	428	2 195	28 012	17 323	623	10 742	16 053	37 004	1 892	5 681	120 161
Total	7 390	3 511	20 804	501 812	204 979	16 306	118 497	105 784	312 903	123 050	198 879	1 613 914

Source: Author(s) calculation based on FAOSTAT (29 June 2018) – annual feed requirements are calculated by converting daily requirements into annual (365 days) using the TLU (250 kg body weight) @ 2.5% of body weight per day = 6.25 kg DM per day (70% hay/straw and 30% concentrate), i.e. 4.4 kg hay/straw and 1.85 kg concentrate per day.

Annex 3. Livestock population and the corresponding daily feed requirements (in tonnes) per livestock species and administrative regions of Ethiopia

(calculated based on estimates of 2017)

Regional State	Livestock population (head)				Daily feed requirements (tonnes)*			
	Cattle	Sheep	Goats	Camels	Cattle	Sheep	Goats	Camels
Tigray	3 791 194	1 344 093	3 064 383	37 747	16 586	840	1 915	236
Afar	643 407	705 732	1 123 437	255 359	2 815	441	702	1 596
Amhara	14 901 790	10 050 436	5 703 235	40 507	65 195	6 282	3 565	253
Oromia	26 275 125	11 050 966	8 588 010	300 826	114 954	6 907	5 368	1 880
Somali	690 889	1 246 990	1 764 038	297 923	3 023	779	1 103	1 862
Benshangul-Gumuz	492 881	104 173	392 274	-	2 156	65	245	-
SNNPR	12 325 594	5 769 439	4 743 474	-	53 924	3 606	2 965	-
Gambela	258 097	30 570	44 229	-	1 129	19	28	-
Harari	53 094	5 960	48 285	-	232	4	30	-
Dire Dawa	54 594	63 831	202 109	9 143	239	40	126	57
Total	59 486 667	30 697 942	30 200 226	1 209 321	260 254	19 186	18 875	7 558

Source: Author(s) calculation based on FAOSTAT data and Agricultural Sample Survey 2009/10 by the Central Statistical Authority of Ethiopia

*TLU (250 kg body weight) @ 2.5% of body weight per day = 6.25 kg DM per day (70% hay/straw and 30% concentrate) i.e. 4.4 kg hay/straw and 1.85 kg concentrate per day; TLU is livestock numbers converted to a common unit (in 2005 – See Chilonda and Otte, 2006); conversion factors for: camels = 1; cattle = 0.7, sheep = 0.1, and goats = 0.1.

Annex 4. Key indicators per output and responsibility

Priority area	Output	Key indicators	Responsibility	Timeline	Resources	Deliverables/outputs
1. Establish and strengthen animal feed data, information, reporting and communication systems	1.1	Harmonized and disaggregated livestock population data	Member States' agencies responsible for national statistics	1 year	Financial, human, technical capacity, statistical tools	Livestock inventory
		Harmonized and disaggregated animal feed requirements data	Member States' ministries responsible for animal feeds	1 year	Financial, human, technical capacity, statistical tools	Requirements for animal feed resources
		Harmonized and disaggregated livestock feed availability and accessibility data	Member States' ministries responsible for animal feeds	1 year	Financial, human, technical capacity, statistical tools	Inventory of livestock feeds resources availability and accessibility
		Feed balance determined	Member States' ministries responsible for animal feeds	1 year	Financial, human, technical capacity, statistical tools	Livestock feed balance sheet
	1.2	Timely and quantifiable feed gap identified, disaggregated by unit of analysis	National disaster risk management agencies	Continuous	Financial, human, technical capacity, statistical tools, PLEWS, PET	Feed gaps identified
	1.3	Reporting format and communication templates developed	Member States' agencies responsible for national statistics	Continuous	Financial, human, technical capacity, statistical tools	Reporting format and communication templates
2. Develop sustainable animal feed supply chains	2.1	Feed assessment report for each country	Ministry of Agriculture/ Ministry of Livestock or Animal Resources	4 years	Human, technical capacity	Annual feed situation report
	2.2	Feed banks established		3 years		Strategic feed banks and reserves established
	2.3	Feed balance determined		5 years	Financial	Feed balance
	2.4	Business opportunities from feed production to use identified by countries	Led by private sector (including cooperatives) with conducive environment ensured by relevant line ministries	3 years	Financial, human, technical capacity	Animal feed value chain opportunities identified
	2.5	Feed supply chain established and mapped	Ministries responsible for animal feeds	1 year	Financial and technical capacity	Feed supply chain
	2.6	Emergency feed supply chain established and contracts signed	Ministries responsible for animal feeds	1 year	Financial and technical capacity	Emergency feed supplier contracts with private sector

3. Identify status of rangelands and grazing areas and disseminate best management practices	3.1	Rangeland and land use map	Member States Development partners Research institutions (e.g. ILRI, ICARDA, universities, etc.), Communities	1 year Continuous Continuous	Financial, human, technical capacity	Rangeland and grazing baseline
	3.2	Good practices documented and shared	Member States Development partners Research institutions (e.g. ILRI, ICARDA, universities, etc.), Communities	1 year Continuous Continuous	Financial, human, technical capacity	Repository of good practices in rangeland management
	3.3	Agreements and Memoranda of Understanding (MoU) signed between communities	Member States, IGAD Development partners	1 year Continuous		Regional and cross-border agreements, MoU on rangeland resources' sharing
4. Strengthen enabling environment for feed production	4.1	Policies and strategies supported	Member States, regional economic communities, FAO, NGOs, private sector, traditional institutions (including pastoralists' associations, unions), communities	5-10 years		Feed policies and regulatory framework
	4.2	Number of people or countries whose capacities are developed for a stronger animal feed value chain		3-5 years		

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Further resources

Guidelines on managing grasslands and rangelands: <http://www.fao.org/agriculture/crops/thematic-sitemap/theme/spi/scpi-home/managing-ecosystems/management-of-grasslands-and-rangelands/grasslands-how/en/>

Codex Alimentarius for feed safety and quality requirements: <http://www.fao.org/fao-who-codexalimentarius/thematic-areas/animal-feed/en/>

Feed safety multi-stakeholder partnerships: <http://www.fao.org/3/a-br874e.pdf>

Saving livelihoods saves lives

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