

# Regional Animal Feed Action Plan for East Africa: why, what, for whom, how used and benefits

P. Opio<sup>1\*</sup>, H.P.S. Makkar<sup>2</sup>, M. Tibbo<sup>3</sup>, S. Ahmed<sup>4</sup>, A. Sebsibe<sup>5</sup>, A.M. Osman<sup>4</sup>, E. Olesambu<sup>4</sup>, C. Ferrand<sup>1</sup> and S. Munyua<sup>5</sup>

**Address:** <sup>1</sup>FAO Subregional Office for Eastern Africa, P.O. Box 30470, 00100, Nairobi, Kenya.

<sup>2</sup>Sustainable Bioeconomy, A-1210, Vienna, Austria.

<sup>3</sup>FAO Subregional Office for the Gulf Cooperation Council States and Yemen, P.O. Box 62072, Abu Dhabi, UAE.

<sup>4</sup>FAO, 00153, Rome, Italy.

<sup>5</sup>IGAD Center for Pastoral Areas and Livestock Development (ICPALD) P.O. Box 47824, 00100, Nairobi, Kenya.

\***Correspondence:** P. Opio. Email: Paul.Opio@fao.org

**Received:** 04 March 2020

**Accepted:** 16 June 2020

doi: 10.1079/PAVSNNR202015044

The electronic version of this article is the definitive one. It is located here: <http://www.cabi.org/cabreviews>

© CAB International 2020 (Online ISSN 1749-8848)

## Abstract

Livestock are a crucial source of food, employment, and income for much of East Africa's rural population. The sector contributes substantially to export revenues, national GDPs, and thus the region's broader socioeconomic development. Livestock production and related value chains, can be the foundation of resilience and sustainable development for pastoral, agro-pastoral, and mixed crop livestock systems in East Africa. Yet, livestock face a wide range of challenges, particularly in terms of ensuring sustainable access to and use of water and feeds for livestock. Inadequate availability and supply of quality feed and water critically limit the efficiency of livestock in terms of production, reproduction, animal health and welfare, human health, and the economic benefits derived from livestock-based livelihoods in the region. Countries in East Africa identified lack of animal feed policy, strategy, and institutional framework to support the animal feed sector as a major constraint hindering subsector growth, livestock productivity, resilience, and trade. In order to address this, the first Animal Feed Action Plan was developed for East Africa through a consultative and participatory process. The Action Plan captures experiences and lessons learned by a wide spectrum of stakeholders. It provides a means to collectively address some of the constraints in accessing and using animal feed and provides a guided approach to establish partnership by countries, communities, the private sector, and stakeholders to enhance sustainable production of quality livestock and products. The Action Plan is believed to set a good example for other regions to develop their feed action plan.

**Keywords:** feed action plan, East Africa, livestock resilience, livestock production, feed sector data, regional strategy

**Review methodology:** All relevant materials were collated using various databases (Scopus, Agricola, CAB Abstracts, Feedipedia, Google Scholar, and Medline). Original research papers from journals, review articles, FAO documents, IGAD documents, stakeholders' consultations, annual reports of Ministry of Agriculture of different countries, and annual reports of Ministry of Animal Husbandry of different countries were also used. This paper is designed as an accessible summary of a larger study: <http://www.fao.org/3/ca5965en/ca5965en.pdf>

## Introduction

East Africa (Fig. 1) has one of the highest annual population growth rates in Africa—ranging from 1.81 in Kenya to 3.92% in Sudan—and hence countries will become

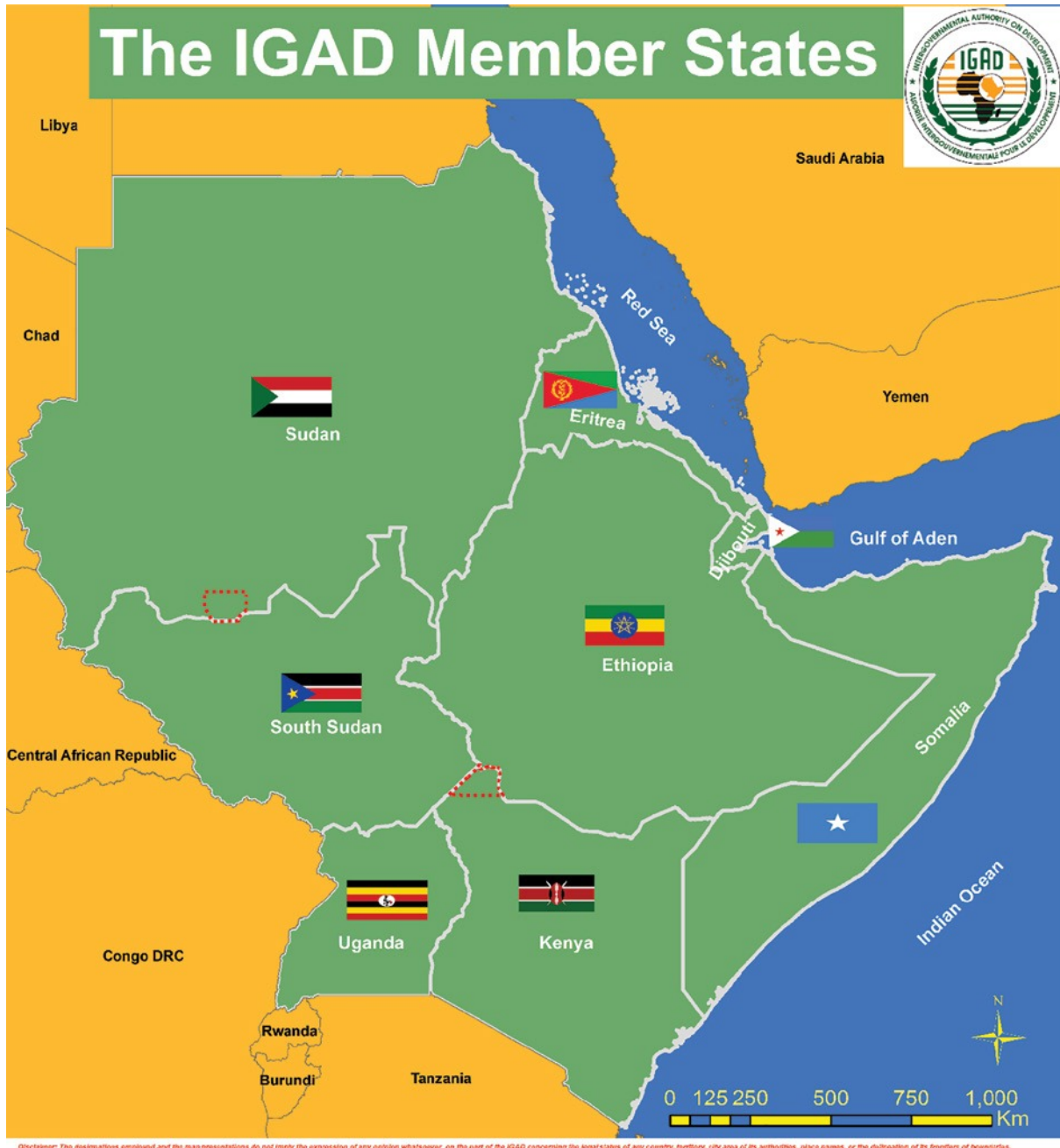
increasingly reliant in the untenable position of relying on external markets for food, including of animal origin, unless food production and productivity gaps are addressed adequately. The increasing demand for animal sourced foods and the yet untapped potential for increases in

## 2 CAB Reviews

livestock productivity imply that both producers and consumers can immensely benefit from proper evidence-based interventions. 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 plays an important role in livelihoods, food security, nutrition, economy, and resilience in much of East Africa. In addition to being the main source of meat and milk for domestic markets, the subsector generates more than US\$ 1 billion annually in earnings through live animal and meat exports to the Middle East and North

Africa. In arid, semi-arid, and mixed crop-livestock producing areas, the subsector employs over 60% of the population and has the potential to deliver both the agriculture-led growth and the socioeconomic transformation [1].

In the arid and semi-arid lands of Djibouti, Ethiopia, Kenya, Somalia, and South Sudan, the Sudan and Uganda pastoralists and agro-pastoralists are particularly dominant, with smallholders dominating the subsistence-oriented mixed crop-livestock systems. Pastoralism is well adapted to the dry and increasingly erratic rainfall conditions that characterize the region. With strategic interventions that



**Figure 1.** Map of East Africa. Countries such as Ethiopia, Eritrea, Djibouti, Kenya, Somalia, South Sudan, and Uganda are marked in green (source: IGAD).

enhance the resilience of livestock-dependent communities, livelihood shocks and disasters can be prevented, risks reduced, and their contribution to the overall economic and social wellbeing increased.

Feed and water are the foundation of livestock production systems, affecting almost all related subsectors and services [2]. 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 [3]. Governments and humanitarian partners have always responded to feed shortages through purchase of feeds (hay and concentrates) from the mixed livestock-crop producing areas and distributing to households in semi-arid and arid areas [4]. Evidence from the region indicates that pastoral destitution is largely driven by climate change impact on feed and water scarcity [5]. For instance, Somalia reported an estimated economic loss of USD 1.5 billion due to the effect of drought on livestock in 2016/2017 [6]. In most countries, the natural resource base in the rangelands is fast shrinking owing to prolonged and more frequent drought events [7]. Reduced precipitation and forage availability imply that herders move with their animals 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 (particularly children), resulting in poor nutrition overall. Deficiency of vital nutrients present in animal source foods causes wasting and stunting and adversely affects the cognitive ability in children [8]. This also affects cognitive development of children with potentially long-term societal costs. Mobility is often associated with competition for land and natural resources in the context of climate change with a repetitive drought cycles, degradation of pastoral and water resources, and destruction of the environment by other economic activities, such as charcoal production.

Poor animal nutrition due to inadequate availability and supply of good quality feed and water 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 [9]. Livestock feed and feeding systems are constrained by a host of interconnected factors, including recurrent droughts and floods, state 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 pasture inputs, and planting material. Seasonal feed and water shortages and inefficient use by communities in pastoral, agro-pastoral, and mixed crop-livestock systems are the major challenges affecting livestock productivity in East Africa [10].

In recent decades, increasing climate change and variability, recurrent droughts, and conflicts have exacerbated the feed and water gaps. The slow progress in

the development of the subsector, particularly of alternative feed sources such as agro-industrial byproducts and unconventional feed resources, has deepened the gap in the availability of and accessibility to animal feed. In addition, poor feed conservation practices, inadequacy of knowledge on appropriate feeds and feeding practices, and inadequate data on estimates of the proportion and number of animals kept within specific production system constrain the efficient use of available feed resources.

Animal feed is an important driver for enhancing resilience and productivity of the livestock sector, promoting livelihood of livestock owners, and increasing income of farmers and agro-based industries by absorbing their byproducts. However, animal feed has so far been neglected by the policy makers and planners attracting low private sector investment. Several animal breeding projects were launched from 1972 to 2000 in Eastern Africa. Then, an era of animal health arose, and it still is in vogue across different countries in the region. An integrated approach of animal breeding, animal health, animal feeding, and farm management would generate much higher and durable impact for not only the livestock sector but also the environment and the society at large. In light of this, East African countries considered vital to develop a Regional Animal Feed Action Plan. To the authors' knowledge, this is the only Action Plan in the area of animal feeding, developed at a regional level [11]. 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), Centre for Pastoral Areas and Livestock Development. The Action Plan is the result of 12 months of consultative and participatory process, building on experiences and lessons learnt by a wide spectrum of key stakeholders. These include stakeholders in public and private sectors, notably, policy makers, traders, researchers, academia, pastoralist and farmers' organizations, civil society, NGOs, and development partners. The Action Plan builds on the earlier consultative experience sharing workshop on feed by USAID, ILRI, IGAD, and FAO in the region.

The Action Plan provides broad opportunities for partnerships with producers, governments, and private sector, and development and humanitarian organizations at the national and regional levels. It provides a guided approach to collectively tackle the problems of animal feed and pave the way for sustainable production of quality animals and products while improving competitiveness and profitability and ensuring sustainable feed resource management for the entire region of Eastern Africa.

## Why

Livestock is a crucial source of food, employment, and income for much of East Africa's rural population, as well as an investment generator for the private sector and other actors. It contributes significantly to export revenues,

## 4 CAB Reviews

national GDPs, and thus the region's broader socioeconomic development. Governments across the region recognize the huge potential of the sector for ending hunger and poverty and improving people's welfare [12]. Yet, it faces a wide range of challenges, particularly in terms of ensuring sustainable access to and use of water and feed for livestock. Several consultations conducted in the region have centered on how this sector can boost economic growth of countries and identified bottlenecks.

Countries in East Africa identified the lack of national animal feed policy, strategy, and institutional framework to support the animal feed sector in the region as major constraint hindering the feed sector growth. Despite the good natural resource base, favorable conditions, and availability of ingredients for animal feeds, these countries lack animal feed policies and strategies. Where they exist, there are numerous systemic issues that constrain the growth of the feed value chain. Though there are animal feed sector institutions, mandated to address the sector issues in some countries, capacity and resource constraints, as well as overlapping mandates, have incapacitated these institutions from effectively addressing systemic feed issues holistically. It is clear that appropriate policies and strategies would stimulate increased feed production, ensuring quality animal feeds on the market, reducing production costs, and building capacity among the private and public sectors for the development of the animal feed industry.

### For whom

The Action Plan is intended to provide governments, private sector, and livestock producers with systematic and guided priority areas and activities, and outcomes to facilitate sustainable and lasting solutions to animal feed challenges in the Eastern Africa region (Table 1).

### Objectives

The main objectives of the 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 the 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 the sustainable natural resource use as a key ingredient in the development of the animal feed sector in East Africa.

### Priority areas

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

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

### Outputs

Each of the above priority areas is expected to deliver several outputs. In order to achieve the identified output, the Action Plan proposes several activities, which are listed under each output.

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

The focus is on the importance of various feed-related data, the development of sound methodologies and tools, their use for generating the data, and reporting. The aim is to generate robust feed-related data at the national and regional levels, so that informed decisions could be made.

#### **Output 1.1. Regional feed resource requirements and availability assessed and documented**

##### *Establish feed inventory*

There is a famous management quote: "If you cannot measure it, you cannot manage it." 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 [13]. 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.

FAO [14] also provides methodologies for assessing feed resources and tools to strengthen the quality of feed-related data, including:

- procedures and methodologies to assess crop residues;
- a tool to capture data on competitive uses of various feed resources;
- a template for the characterization of feeding systems, which is required to make feed strategies more efficient

**Table 1.** An overview of the Regional Feed Action Plan.

Priority areas	Expected outputs	Objectives
1. Establish and strengthen the animal feed data, information, and reporting and communication systems	<ul style="list-style-type: none"> <li>Regional feed resource requirements and availability assessed and documented</li> <li>Early warning and early action mechanism established</li> <li>Reporting and communication system developed</li> </ul>	<ul style="list-style-type: none"> <li>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</li> </ul>
2. Develop the sustainable animal feed supply chains	<ul style="list-style-type: none"> <li>Feed assessments conducted by agro-ecological zone/production area</li> <li>Availability of and accessibility to feed (production, harvesting, conservation, and storage) assessed</li> <li>Potential animal feeds identified and established for local feed production</li> <li>Animal feed business centers identified and operationalized</li> <li>Feed supply chains established, and emergency mechanism specified</li> <li>Emergency livestock feed supply coordinated with other interventions</li> </ul>	<ul style="list-style-type: none"> <li>Enhance the participation of poor rural communities in the animal feed value chain</li> <li>Facilitate the private sector-driven animal feed market development, within and outside East Africa, ensuring market access and competitive prices across countries</li> <li>Provide a guide for governments to develop enabling policies and regulatory frameworks on feed for enhanced trade between countries in East Africa</li> </ul>
3. Identify the status of rangelands and grazing areas and disseminate the best practices for their management	<ul style="list-style-type: none"> <li>Status of rangeland and grazing areas determined</li> <li>Evidence-based best practices on rangeland and grazing management disseminated and adopted</li> <li>Improve governance and management of rangelands</li> </ul>	<ul style="list-style-type: none"> <li>Exploit the production potential of rangelands and ensure the sustainable natural resource use as a key ingredient in the development of the animal feed sector in East Africa</li> </ul>
4. Strengthen an enabling environment for feed production	<ul style="list-style-type: none"> <li>Policy, institutional, and process frameworks and standards supported</li> <li>Capacity for feed production, processing, and marketing strengthened</li> </ul>	

A brief of the activities is presented in this article. For detailed activities, refer to FAO and IGAD [11].

and to generate the national greenhouse gases (GHG) inventory; and

- a template for recording herd structure of small and large ruminants, which is needed to calculate animal feed requirements and greenhouse gas emissions from the livestock sector.

Accordingly, each country should conduct a thorough assessment of potential feed resources and establish competitive uses of feed resources, actual feed inventory using the information generated. From feed availability and feed requirement data, feed balance as dry matter, energy, and protein can be established. These could be for different regions, states, or counties in a country, and for the East Africa region as a whole. Such an exercise would promote intercountry feed and feed ingredient trade. An example of feed inventory and feed balance is available [14].

The feed inventory exercise should also map agro-industrial byproducts (AIBPs) because they are a good source of quality animal feed. A mapping exercise would

involve identifying different AIBPs, amount produced and processed, potential feed safety hazards, and locations and key actors of their utilization. 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 channeled to feed production without negatively impacting other competitive uses of byproducts. These are critical steps to develop a business model for the sector. Efficient use of agro-industrial and food processing byproducts could be critical in bridging the gap between supply and demand of emergency feeds. This would also open new avenues and opportunities for green economy development, job creation, and environmental protection. Methodologies for assessing AIBPs are available [15]. Surveys on byproducts would be invaluable for all countries in the IGAD region, especially those recurrently affected by drought, including millings and byproducts 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 byproducts and create business opportunities.

*Assess feed requirements relative to target livestock population*

Feed requirement estimates, based on dry matter (DM), should be carried out at the local, regional and state levels to inform proper planning. Feed requirements as metabolizable energy (ME) and crude protein (CP) should also be generated, if possible. These complement the decisions made based on the DM requirements. These estimates are critical in determining overall feed demand during emergency and normal times and for making projections and developing informed scenarios. Information on the feed gap should be better refined by locality, with estimates of feeds available and requirements by species and type of livestock. Tools for generating data on feed requirements as DM, ME, and CP are available in Ref. [14]. These have been used for Ethiopia and 23 arid and semi-arid counties of Kenya and currently being out-scaled to the remaining 24 counties in Kenya.

*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.

A dedicated national institution and taskforce are needed to lead the feed assessment, feed requirement, and feed balance sheet. 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.

*Inventory and mapping of livestock at risk*

Successful interventions must be based on a thorough understanding of the feed availability, livestock population, local context, and impact of an event, such as a drought, on livestock-dependent livelihoods. In such a crisis, estimates of livestock populations at risk are critical to inform timely decisions on the type and level of support required.

*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 not only to inform emergency feed response during drought but also to influence and guide longer-term development

of the livestock sector. In Ethiopia [15], for example, feed suppliers are predominantly located in Oromia and Addis Ababa regions, which have implications for prepositioning and feed supplies in an emergency context.

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 and preparedness for rapid response to frequent droughts. For feed production in the commercial sector in Ethiopia, the most common challenges and suggestions to overcome those are available in Refs. [14, 16]. Most of these challenges are common to countries in East Africa.

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

Across the region, livestock are fed mainly on low quality roughages, including natural grazing and AIBPs, such as cereal straws/stovers, sugarcane byproducts, and other similar feeds. These feeds are generally 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 as pellets or mesh, 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 supplements available would help increase livestock productivity.

*Map zones and systems of feed deficiency/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. Feed inventory and feed balance information, which also integrates FAO's PLEWS (Pastoral Livestock Early Warning System) tool for assessing rangeland biomass, would map zones of feed access and deficiency. For additional information, see Output 1.2 and Priority area 3. The information generated through such systems assists in implementing appropriate interventions and policy options at a subnational, national, or regional level.

**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, and 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 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. PLEWS 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). The predictive component of PLEWS was pivotal in demonstrating the likely severity of the 2017 drought to the Government and was used to justify the declaration of a national emergency. Incorporation for grazing biomass available and forecasting, for example, using PLEWS, Normalized Vegetation Difference Index (NDVI), and National Oceanic and Atmospheric Administration forecasts, are critical to arrive at sound early warning feed and livestock management systems.

Successful national feed early warning mechanisms are critical in countries where natural disasters are recurrent. 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 Pictorial Evaluation Tool (PET) and feed balance sheet. The PET is a tool to score livestock body condition and grazing biomass availability at a local level, which when integrated into FAO's Feed Security Assessment Tool [17] assists in determining the extent of a crisis and informing early warning and early response.

#### *Incorporate pastoral crisis indicators in the National Emergency Contingency plans*

Possible pastoral crisis indicators include livestock status, market conditions, and so on—for example, a 25% 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 and the feed insecurity situation assessed by the Feed Security Assessment Tool as minimal, stressed and crisis are integrated and used in national emergency contingency planning, and they enable accurate triggers for early warning and early drought responses.

#### *Assess capacities for prepositioning feeds*

In East Africa, the location of emergencies and access restrictions in pastoral and agro-pastoral areas is a major challenge to the rapid and cost-effective provision of feed supplies. To reduce the time between crisis and response, governments, private sector, and other relevant actors must ensure the storage of critical livestock feeds at strategic grazing locations or along livestock migratory routes in pastoral and agro-pastoral systems. Prepositioning feeds support production continuity, reduce feed delivery lead times, cut the cost of transportation, and overall

contribute to a timely response and safeguard livestock-based livelihoods in times of crisis. Governments must conduct livestock feed storage capacity assessments.

#### *Assess contingency planning capabilities at the regional and national levels*

Understanding the national and regional preparedness and response capacity is key to successful livestock emergency action at the country and regional levels. An assessment of this capacity should examine livestock preparedness plans and institutional readiness to respond to livestock emergencies. This facilitates advance decision making on human and financial resources, coordination and communication procedures, and a range of technical and logistical actions. At the regional levels, the 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. 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.

Data and information sharing mechanisms need to be designed and operationalized so that institutions delivering the inputs can access reliable data and information when designing interventions.

### **Priority area 2. Develop the sustainable animal feed supply chains**

This priority area aims at using the methodologies discussed in, and further treatment of the macro-level data generated through, Priority area 1; generation of new information at a local level and in specific settings; and putting in place appropriate interventions. The aim is to strengthen resilience and sustainably develop livestock sector.

#### **Output 2.1. Feed ingredient assessments conducted by agro-ecological zone/production area**

##### *Assess availability of and accessibility to feed ingredients*

In order to make the efficient use of feed resources at a local level, it would be prudent to scale down assessment

and accessibility of feed resources from the national and state levels to agro-ecological zone or/and production area, depending on the type of feed ingredient. Information on the availability and accessibility of the feed ingredient at the area/site of use is also vital. Equally important is the characterization of feeding systems, that is, what and how various feed resources are being currently fed. This would allow arriving at informed decisions on efficient feeding and environmentally sound management of feed resources at a local level. Besides, estimation of greenhouse gas emissions from livestock in a production system or under a particular management system would also be possible.

*Calculate feed balances in normal (baseline) and drought scenarios for business development*

Countries in East Africa are short of dry roughages, concentrate, and green fodder. Their mapping and documentation, as envisaged in Priority area 1, would facilitate feed sector development and attract evidence-based investment. Approaches and businesses need to be developed to make use of the abundant feed resources available in an area or in a season. 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 [14]. Recognizing that the transport cost of the feed could be much higher than the feed itself, densification is one potential way to reduce the high cost of transport if feed is to be transported long distance to other regions.

**Output 2.2. Enhance 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 exists*

The collection and conservation of excess biomass for animal feed face several technological, institutional, legal, logistical, socioeconomic, and policy-related challenges. Identification and characterization of the constraints are a prerequisite for their successful alleviation.

Among the technological challenges are the lack of inadequate machinery or devices for forage harvesting and densification, and technical capacity and know-how to densify feeds. Feed technologies that reduce the roughage feed bulk and improve the nutrient availability need to be introduced. Infrastructure for proper storage of harvested and densified feeds also needs to be improved. In addition to infrastructure required, skills and expertise to harvest, conserve, and store feeds need improvement.

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; and lack of feed banks/reserves, among others.

Socioeconomic, policy, and regulatory framework challenges include lack of animal feed policies and strategies despite the good natural resource base, favorable conditions, and availability of ingredients for animal feeds in East African countries.

Enabling policies are critical to facilitate the involvement of the private sector. Tax relief for importing appropriate machines is one example of such policies. 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 across borders, and so on.

*Establish and pilot strategic animal feed reserves and banks*

The Action Plan recommends the establishment of strategic animal feed reserves and banks; the use of vast arable land available to supply feed ingredients for commercial feed processing; and the production of local feed processing machines, equipment, and tools. These are currently supplied by a few companies and are imported. Huge 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. Feed banks improve and stabilize the availability of animal feed and fodder, as well as reducing the volatility of feed prices, especially during droughts.

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

Each country, after identifying and mapping potential biomass, disaggregated by type of feed resources, as was done by FAO [14] at the regional state level for Ethiopia consider developing strategies to overcome shortages of feed at the national and regional levels. In addition to conventional feed resources, agro-industrial byproducts (AIBPs), novel and little-used feed resources would broaden the feed resource base and help meet the feed deficiency in the region. Innovations and strategies for efficient use of feed resources must be out-scaled and up-scaled depending on the context, including the study of the social and behavioral culture of the end users with respect to the innovations and strategies in reference.

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

There is a need to identify good practices that could be up- or out-scaled and important to understand reasons for their success and failure [18]. These 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 feeds; preparing urea molasses



multinutrient blocks; formulating total mixed ration; providing urea and molasses, and concentrate during dry periods; and 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, led by the government local extension system. Other opportunities include promotion of supplementary feeding of livestock with concentrate feed to diversify from dry season feeding strategies that largely depend on grazing pastures and browses.

Other recommended actions are: (1) support agricultural mechanization in the country and at local levels through local production of hydraulic presses, forage harvesters, high-throughput balers, and forage choppers; (2) develop low cost feeding troughs and promote their use to decrease feed wastage; (3) during extreme drought when pasture is unavailable, use browse enhancers to enhance the use of in-situ browses; (4) develop public-private partnerships with the feed industry and assist the industry in using good manufacturing and good hygiene practices; (5) promote strategic establishment of animal feed manufacturing plants in feed-deficient regions; (6) harvest and crush *Prosopis* pods for use in total mixed ration; (7) plant spineless cactus species in rehabilitating degraded rangelands, including in the areas where mostly invasive *Prosopis* species has been uprooted; (8) encourage private sectors in forage seeds production and distribution (include drought- and salinertolerant varieties); and (9) promote agroforestry, focusing on multipurpose trees that are useful as animal feeds.

The establishment of commercial units for multinutrient block production, forage chopping, forage densification, and premix production need stimulation. There is a need to develop strategies to efficiently use AIBPs, for example, use of dryers for increasing shelf-life of brewer's grains and molasses tanks for storing molasses for use as animal feed, among others. Promotion of the use of urea molasses multinutrient blocks in the rangelands, near water points, especially when the quality of grazing pasture decreases in dry periods, would increase productivity of livestock in the grazing system.

#### *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 Action Plan proposes countries to map areas that could potentially be used for irrigated fodder production. The main constraints to small-scale irrigation [19] include institutional, technical, financial, socioeconomic, 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. There is a need to overcome these constraints.

The development of spate irrigation for fodder-producing enterprises in river banks and major flood plains may be considered. Besides fodder reserves, spate-irrigated forage once released at the most critical periods could reduce the need for expensive trucking of feed from other areas. The organized systems 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, should be developed and promoted. Start could be made by conducting feasibility and feed market studies of target excess biomass regions and developing business model that ensures profitability and sustainability. The 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, and silo compressors should be promoted.

#### *Strengthen linkages between fodder producers and markets*

To reinforce market linkages, countries and region should facilitate linkages between fodder producers and input markets; link fodder producers to output markets through creating linkages directly to livestock export traders or traders' agents; link fodder producers with financial services; support fodder producers' groups with other training focusing on good agricultural practices; and connect fodder producers' groups and cooperatives to market information through information and communications technology (ICT) providers. 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 centers identified and operationalized**

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.

#### *Select, analyze, develop, monitor, evaluate, and scale up feed value chains*

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.

The selected value chain should be characterized and mapped, based on the predefined objectives and scope of

intervention. 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. Project design should also be flexible enough to adapt to changing circumstances.

Identification of business opportunities for the animal feed value chain is important steps in developing sustainable feed supply chains. This should address 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. 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 nongovernmental organizations (NGOs), resource partners, international and national professional associations, governments and regional bodies (e.g., IGAD and AU), and so on, with a particular emphasis on small-scale producers to ensure a more inclusive and equitable approach to sustainable development of the feed sector.

Overcoming of challenges facing the value chain development is also an integral part of the value chain development. Design and implementation actions should be appropriately sequenced so as to build capacity and address constraints in a logical manner. This could, for example, be achieved through 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.

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.

### **Output 2.5. Emergency level and complexity specified, and feed supply chains established**

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 the country, region, and county levels.

#### *Make use of available guidelines for feed supplementation*

There are a number of useful documents available on animal feed processing, as well as guidelines on feed and

forage supplementation. Support should also be provided to local research organizations to adapt established feeding technologies to local conditions using locally available resources. Urea molasses multinutrient blocks should be prepared and stored well in advance for distribution as supplementary feed during droughts. Densified straw-based complete feed rations or compacted hay could be prepared in seasons of biomass availability.

#### *Organize stakeholders' consultations to define roles and their responsibilities in the feed supply chain establishment*

This involves identifying and building trust among all stakeholders (including government, private sector, and communities) to ensure their ownership of the initiative. The 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 quality and safety laboratories, feed manufacturers' registration, licensing, and enforcement of good manufacturing practices, among others.

#### *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, and so on to support the effective management and response to animal feed emergencies. A balanced contractual arrangement and legal framework are needed to ensure a sustained supply of feed. The Action Plan is intended to encourage countries in the region to pursue such arrangements to minimize livestock losses during drought.

#### *Procure and distribute feed aid*

This entails 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 redelegation is requested, procurement lead time could take from 45 to 50 days. Field delivery takes from 1 to 4 weeks. It is therefore recommended that procurement activities be enhanced at the regional level by bulking the purchasing necessary to increase delivery in the field. This Action Plan proposes the establishment of a regional procurement unit.

#### *Make post-distribution assessment of emergency feed supplied*

The post-distribution assessment should examine the timeliness of the feeds distributed, the regime given, the

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, and so on. Impact of these interventions on the livestock production, morbidity, and motility must also be captured. 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**

#### *Provide sustainable access to water for livestock*

Water and feed are the two critical determinants of livestock survival in dry areas and during droughts. 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 development banks 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 such development project should thus consider drought proofing of communities and prepositioning watering facilities within particularly vulnerable areas, for example, along or near livestock migration routes and near markets.

#### *Better understand animal health-livestock feeding nexus and provide animal health services at appropriate times*

In emergency context, 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. If such assistance is combined with animal identification and recording systems, 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 [2].

#### *Inject cash injections in the target area provide cash-for-work and livestock feeding interventions*

Various humanitarian and development actors, including FAO, have cash and voucher programs. They can be used to distribute animal feed, as well as to promote labor-intensive activities, such as spate irrigation for pastures and forages, clearing invasive species from irrigation canals and rangelands, and rehabilitating water points.

#### *Introduce slaughter and commercial destocking at appropriate times*

Destocking programs should be implemented as soon as an 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. 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 feed, thereby 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.

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

In order to enhance productivity and resilience of the pastoral system, it is vital to assess the status of the rangelands and identify and implement the best practices to improve biomass production on, and reduce degradation of, the rangelands.

#### **Output 3.1. Status of rangeland and grazing areas determined**

##### *Collect information on current range condition in rangeland and grazing areas*

Due to the lack of monitoring, estimation of the level of degradation of rangelands and grasslands is difficult. Loss of plant cover, undesirable change in herbaceous species composition, 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.

Several methodologies and tools are available for assessing the level of rangeland degradation. It is important to assess the rangeland situation, using indicators that have been well identified in the literature.

##### *Identify agro-ecological zones for 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 rangeland rehabilitation and sustainability of the system.

The Action Plan suggests some interventions to *manage*, *restore*, or *rehabilitate* degraded rangelands by targeting the underlying causes of degradation.

### **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 reseeded, overseeding, irrigation, fertilization, rotational grazing, grass, and legume enrichment. Guidelines and best practices on how to manage grasslands and rangelands are available. The Action Plan recommends some of them based on previous consultations and experiences in the region.

#### *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 and can be used to improve the productivity of rangelands and fodder production. Harvesting of local knowledge of pastoralists is important in this context. There are a number of efforts by governments, partners, and communities to improve rangelands and fodder production. Successful initiatives must be identified and scaled up into a sustainable and business model.

### **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, have prevented evidence-based technical, institutional, and policy support to the pastoral system. Good governance is needed not only to prevent degradation of rangelands but also to reverse the degradation and ensure the sustainability of the ecosystem. For this, systematic mapping of existing governance structures is needed, identifying bottlenecks and gaps to be addressed.

#### *Incorporate lessons learned into good governance*

Lessons learned and best practices, when contextualized and shared, can support a significant change in rangeland

governance. Regional feed and rangeland platforms have a central role in achieving this.

#### *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. A number of such committees exist in the region. Strengthening their capacity and linking to a national support structure are key to reinforce and spread their mandate at the 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 are crucial to ensure they meet international standards. Knowledge of the infrastructure and human skills available in-country, including at the subnational levels, is needed to guide improvements to enforce these quality and safety standards. FAO has published a number of guidelines on animal feed quality control to support these activities, feed certification laboratories and capacities, and feed contaminant (aflatoxin, veterinary drug residues, heavy metal, and pesticides) levels in feeds [20]. A recent assessment [14] of available skills and infrastructure for quality and safety control in Ethiopia found several gaps. These are common to countries in East Africa and must be addressed. Harmonization of feed quality and safety standards' certification procedures at the regional levels also needs attention to promote feed trade. The adherence to Codex Alimentarius Standards will be promoted, and particularly compliance in harmonization of national animal feed safety regulations, good feed manufacturing practices, handling, storage, processing, and distribution of animal feed and feed ingredients for food-producing animals [21–23].

#### *Support national institutional building and policy development*

Enabling policy and institutional arrangements are critical for a sustainable feed sector. Evidence-based animal feed policy making requires a review of the agriculture and livestock sector policies and an 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 practices and quality control, and promote and stimulate a competitive vibrant animal feed industry.

#### *Establish/strengthen pastoral unions/federation and associations/cooperatives*

Pastoral associations and unions can be key players, alongside other preexisting traditional institutions, in transforming the livestock and animal feed industry in the pastoral system. In addition, they can work to justify forms of territorial anchorage and identity claims of pastoral territories. Pastoral unions can protect their communal resources. A number of initiatives on rangelands have been fragmented. Policies and strategies to strengthen the functioning of pastoral unions and federations and adoption of innovations are limited or nonexistent.

### **Output 4.2. Capacity for feed production, processing, and marketing strengthened**

#### *Improve the extension services*

The Action Plan has identified a number of activities in the feed sector on which capacity needs to be developed in East Africa. Each country could tailor those to its requirements. It 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.

#### *Make the feed industry vibrant*

A recent study [16] from Ethiopia has identified challenges that the feed industry is facing. Most of these challenges are common to other countries in East Africa. Some actions for consideration include strengthening the Animal Feed Industry Association to spearhead the development of feed industry; monitoring the feed companies to go beyond customary feed production, to complement through promoting their products, for example, through establishing extension and outreach activities; better integrate functioning the feed industry with the agro-based industries so that byproducts could be efficiently utilized as feed ingredients; modernizing the feed industry by using state-of-the-art machineries, equipment, and tools; adopting the good feed manufacturing practices; strengthening the linkages with feed regulatory authorities; and establishing the feed analysis laboratories, among others.

### **How this Action Plan will help East Africa**

Understanding livestock data disaggregated by production system and type of animals, feed requirements, and the

inventory of the different feed resources including seasonal availability particularly in rangelands and where they are located was recognized by countries as one of the key steps in designing and informing sustainable livestock production systems in the region (covered through Priority area 1). Improving data and information on the animal feed supply chains was highlighted as critical for countries to study and map strategic points to which feed investments can be targeted. This Action Plan will help countries in the region to generate reliable information about their feed and forage resource availability and estimate different animal production requirements. It will also assist countries' profile and put into use nontraditional animal feed sources especially from crop production and industrial byproducts. This information once generated will be critical for informing livestock feed emergency response, policy, and investment decision in the livestock sector and in guiding continued evolution of climate-smart best feeding practices. It will enable countries to harmonize and apply the same standards especially when trading or responding to cross-border livestock feed emergency support. In addition, the information provided through the implementation of the Action Plan will be crucial for sourcing feed for an emergency response, as well as for feed resource management and utilization, developing business models on feed value chains, sustainable intensification, market-oriented fattening, and dairy and poultry production. These efforts would help develop more sustainable feed supply chain (as outlined in Priority area 2), including development of climate-smart feeding strategies and thereby increasing resource use efficiency.

Most pastoralists and agro-pastoralists manage their rangelands communally irrespective of the international borders, benefiting from greater flexibility and seasonal access to grazing resources [1]. However, there is still inadequate knowledge and understanding of local governance structures and their role in the management and use of rangeland resources. This has limited evidence-based technical, institutional, and policy support to the systems. Good governance at the community, state, and international levels is needed not only to prevent degradation of rangelands but also to reverse the degradation and ensure the sustainability of the ecosystem [24]. The strong need for a systematic mapping of existing governance structures identifying bottlenecks and gaps to be addressed is critical for targeting rehabilitation and sustainable use of range resources. This mapping must take into account the unique features of rangelands, issue of scale, ecological disequilibrium, and seasonality (Priority area 3). FAO in collaboration with Texas A&M University piloted the use of predictive Livestock Early Warning System in Kenya, which helps to monitor the edible vegetation conditions and inform the current status and the 3–6 months' forecast to inform decision by communities and partners [10]. IGAD is finalizing the transhumance protocol to further guide its member states on how to facilitate peaceful and sustainable pastoral mobility in the region [25].

The common analysis by FAO and IGAD that livestock production and related value chains, when effectively harnessed, can be the foundations of resilience and sustainable development for pastoral and agro-pastoral populations across the region, was key in bringing member states of IGAD to address these challenges. The persistent drought in the region and the feed response by governments and humanitarian partners in the past years necessitated that a mechanism be put in place to ensure dialog among countries on how to develop a lasting and sustainable animal feed supply system including making the feed manufacturing sector vibrant. The Action Plan supports countries to jointly address these issues and strengthen an enabling environment that build a vibrant animal feed sector at the national level (Priority area 4).

The Action Plan is a mean 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 Action Plan is to provide guidance 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 byproducts and to maximize the economic and social benefits of the livestock subsector.

### **How the Action Plan is intended to be used**

The Action Plan will be used largely as a framework for countries to adapt to their own specific animal feed context and needs. It will provide a solid base upon which sustainable animal feed sector development can be designed, to meet the challenges of both mixed crop-livestock and grazing systems at the national and regional levels. Its implementation requires a concerted effort on the part of the governments in the East Africa, international and national organizations and NGOs, research institutions, academia, private sector, civil society organizations, pastoralists, farmers, and so on.

### **Partnership and stakeholders**

This Action Plan requires that all stakeholders are engaged throughout its implementation, including public and private sector entities and communities alike. The first step is to identify and document stakeholders, including their roles and responsibilities, and build trust around the Action Plan to ensure ownership of the process. Within the countries, there is a need for high-level intersectoral and interministerial collaboration. An intersectoral/ interministerial joint platform on animal feeds and feeding, led by a designated government authority, may also be

needed to discuss the feed-related issues, as outlined in the Action Plan.

### **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 the regional level, implementation of the Action 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 Action Plan, while IGAD and EAC will ensure coordination and policy support provided to their Member States in the adaptation and implementation of the framework in their own contexts.

### **Monitoring and evaluation**

Depending on local capacity and resources, a phased approach could be used for implementation. As stated above, the Action Plan is a guiding document for countries and provides a framework to identify activities based on their priorities and chalk out their time frames. The indicators with associated time frames, and roles and responsibilities need to be identified by the participating countries for measuring success. It is envisaged that all countries in East Africa share their plans with time frames among themselves and with FAO and IGAD. As a start, all countries have agreed that there is a need to strengthen animal feed-related data; Ethiopia, Kenya, Somaliland, and Sudan are expected to establish feed inventory and feed balance in the next 3 years. Other activities in the listed priority areas in the Action Plan could also run in parallel. The implementation of the Plan will be monitored and evaluated by regional animal feed platform set up by IGAD and its Member States.

### **Challenges and possible solutions**

Implementation of this Action Plan may face some challenges notably financial especially in South Sudan, Somalia, and Eritrea where budgets are constrained due to ongoing political instability. In addition, human resource constraints with the required level of expertise to implement the Action Plan are acknowledged across member states. IGAD and FAO plan to organize a series of joint resource mobilization efforts involving all countries and to ensure that the national capacity is built to successfully implement the Action Plan.

In addition, IGAD and FAO are committed to the realization of this Action Plan through promoting technically feasible actions and advocating for countries,

harmonizing relevant policies and legislative frameworks to stimulate livestock sector growth in East Africa. Ethiopia and Kenya have initiated the process to generate sound animal feed data for informed decision making. For Ethiopia, feed inventory and feed balance have been created for all 10 regions of Ethiopia [14], and feeding systems have been characterized and feeding strategies for the dry area prioritized [26, 27], and availability and utilization of agro-industrial byproducts have been assessed [15]. Also through various training workshops, capacity of feed manufacturers on good feed manufacturing practices and of the regulatory authorities on feed quality as safety assessment has been improved [14]. Through the government of the Netherland data on animal feeds will be collected for Somaliland/Somalia and Sudan, additional efforts are underway to mobilize resources with IGAD to out-scale this work to all its member states.

It is hoped that the Action Plan will guide improvements in feed resources and livestock feeding through increased availability of safe and quality feed year-round, a critical step in building the resilience of livestock-dependent communities and improving the economy from the subsector. In addition, on implementation, it will enhance efficiency of utilization of natural resources, opening new avenues for development of sustainable bioeconomy in East Africa and decreasing environment footprint of the livestock. Climate change/variability is an important issue in the Horn of Africa, especially in (agro-) pastoralist's food and nutrition security and livelihood outcomes, and the Action Plan, on its implementation, will allow beneficiaries and stakeholders at the local, national, and regional levels to better mitigate climate risks in East Africa.

## Acknowledgments

The authors are grateful to numerous contributors in the drafting of the Animal Feed Action Plan for East Africa, from FAO, IGAD, ILRI, GiZ, USAID, EU, ministries, national research institutions, and academia. The authors would like to thank in particular, the technical staff of FAO and IGAD: Badi Besbes, Patrick Jacqueson, Anne Mottet, Fallou Gueye, Paul Mutungi, Wamalwa Kinyanjui, David Balikowa, Gregoire Leroy, and Saskia Reppin for their valuable comments and encouragement. In addition, this work would have not been possible without the support from East Africa Community, Member States, pastoralist organizations, development partners, and the private sector whose varied support and stimulating discussions helped to domesticate this regional initiative.

## Disclaimer

The views expressed in this publication are those of the authors and do not necessarily reflect the views or policies of FAO or IGAD.

## References

- Herrero M, Havlik P, McIntire J, Palazzo A, Valin H. African livestock futures: realizing the potential of livestock for food security, poverty reduction and the environment in sub-Saharan Africa. Geneva, Switzerland: Office of the Special Representative of the UN Secretary General for Food Security and Nutrition and the United Nations System Influenza Coordination (UNSIC); 2014. p. 118. Available from: URL: [https://cgspace.cgiar.org/bitstream/handle/10568/41908/Livestock\\_Report\\_en.pdf?sequence=3&isAllowed=y](https://cgspace.cgiar.org/bitstream/handle/10568/41908/Livestock_Report_en.pdf?sequence=3&isAllowed=y) [accessed: 26 June 2020].
- Makkar HPS. Animal nutrition in a 360-degree view and a framework for future R&D work: towards sustainable livestock production. *Animal Production Science* 2016;56(10):1561–8. doi: 10.1071/AN152653
- Lopez J, Munyua S. Rapid cross-border drought assessment (technical report). Nairobi, Kenya: Food and Agriculture Organization of the United Nations and Intergovernmental Authority on Development; 2017. Available from: URL: [http://www.fao.org/fileadmin/user\\_upload/emergencies/docs/FAO-IGAD%20Rapid%20cross-border%20assessment%20results%20summary.pdf](http://www.fao.org/fileadmin/user_upload/emergencies/docs/FAO-IGAD%20Rapid%20cross-border%20assessment%20results%20summary.pdf) [accessed: 26 June 2020].
- FAO Report. FAO's preparedness and response to the horn of Africa drought. 2011. Available from: URL: [http://www.fao.org/fileadmin/user\\_upload/emergencies/docs/FAO\\_ongoing\\_response\\_to\\_the\\_drought\\_in\\_the\\_Horn\\_of\\_Africa.pdf](http://www.fao.org/fileadmin/user_upload/emergencies/docs/FAO_ongoing_response_to_the_drought_in_the_Horn_of_Africa.pdf) [accessed: 26 June 2020].
- Patz JA, Campbell-Lendrum D, Holloway T, Foley JA. Impact of regional climate change on human health. *Nature* 2005;438:310–7.
- Ministry of Livestock Forestry and Range. Somalia drought impact and needs assessment presented at IGAD feed and range platform. Nairobi: Global Facility for Disaster Reduction and Recovery, Somalia; 2018. Available from: URL: [https://www.recoveryplatform.org/assets/publication/PDNA/CountryPDNAs/Somalia\\_DINA%20Report\\_2018\\_Volume%20II.pdf](https://www.recoveryplatform.org/assets/publication/PDNA/CountryPDNAs/Somalia_DINA%20Report_2018_Volume%20II.pdf) [accessed: 26 June 2020].
- Jama A, Kaitho R, Wu J, Macopiyo, L. A new toolkit for monitoring and forecasting forage supply in the grazing lands of eastern Africa. In: Lee C, Schaaf T, editors. *The future of drylands*. Dordrecht: Springer; 2008. p. 349–58.
- Balehegn M, Mekuriaw Z, Miller L, Mckune S, Adesogan AT. Animal-sourced foods for improved cognitive development. *Animal Frontiers* 2019;9(4):50–7. doi: 10.1093/af/vfz039
- Bruinsma J. World agriculture: towards 2015/2030, an FAO perspective. London: FAO Earthscan Publication; 2003. Available from: URL: <http://www.fao.org/3/a-y4252e.pdf> [accessed: 26 June 2020].
- Matere J, Simpkin P, Angerer J, Olesambu E, Ramasamy S, Fasina F. Predictive livestock early warning system (PLEWS): monitoring forage condition and implications for animal production in Kenya. *Weather and Climate Extremes* 2019;27:1–8. doi: 10.1016/j.wace.2019.100209
- FAO, IGAD. East Africa Animal Feed Action Plan. Rome: Food and Agriculture Organization of the United Nations (FAO) and Intergovernmental Authority on Development (IGAD); 2019. p. 50. Available from: URL: <http://www.fao.org/3/ca5965en/ca5965en.pdf> [accessed: 26 June 2020].
- Upton M. The role of livestock in economic development and poverty reduction. Pro-poor livestock policy initiative, PPLPI working papers 10. Rome, Italy: Food and Agriculture Organization of the United Nations; 2004.

## 16 CAB Reviews

13. Makkar HPS, Ankers P. Towards sustainable animal diets: a survey based study. *Animal Feed Science and Technology* 2014;198:309–22. Available from: URL: <http://www.fao.org/3/a-au681e.pdf> [accessed: 26 June 2020].
14. FAO. Ethiopia: report on feed inventory and feed balance. Rome, Italy: FAO; 2018. p. 160. Available from: URL: <http://www.fao.org/3/ca1718en/CA1718EN.pdf> [accessed: 26 June 2020].
15. FAO. Ethiopia. Availability and utilization of agroindustrial by-products as animal feed 2018. Rome: FAO; 2019c. p. 64. Available from: URL: <http://www.fao.org/3/CA3600EN/ca3600en.pdf> [accessed: 26 June 2020].
16. Bediye S, Nemi G, Makkar HPS. Ethiopian feed industry: current status, challenges and opportunities. *Broadening Horizons* 2018;50:1–7. Available from: URL: [https://www.feedipedia.org/sites/default/files/public/BH\\_050\\_feed\\_industry\\_ethiopia.pdf](https://www.feedipedia.org/sites/default/files/public/BH_050_feed_industry_ethiopia.pdf) [accessed: 26 June 2020].
17. Makkar HPS. Support to institutionalization of livestock feed security system in Ethiopia. A report by Vétérinaires Sans Frontières International submitted to FAO. Addis Ababa, Ethiopia: FAO; 2018.
18. FAO. Successes and failures with animal nutrition practices and technologies in developing countries. Rome: FAO; 2011. Available from: URL: <http://www.fao.org/docrep/014/i2270e/i2270e00.pdf> [accessed: 26 June 2020].
19. Sisay B, Abebe B. A critical review of small scale irrigation in Ethiopia: prospects and challenges. *International Journal of Current Research* 2017;9:60916–20.
20. Sharma V, Sharma S. Feeding safe feed to livestock safeguards human health. *Broadening Horizons* 2017;37. Available from: URL: <https://www.feedipedia.org/content/feeding-safe-feed-livestock-safeguards-human-health> [accessed: 26 June 2020].
21. Codex. Code of practice on good animal feeding, CAC/RCP 54–2004, Section 6. Original 2004. Amendment (2008).
22. Codex. Guidelines on the Application of Risk Assessment for Feed, CXG 80–2013 (2013a).
23. Codex. Guidance for Governments on Prioritizing Hazards in Feed; CXG 81–2013 (2013b).
24. Oba G. Harnessing pastoralists' indigenous knowledge for rangeland management: three African case studies. *Pastoralism: Research, Policy and Practice* 2012;2:1. doi: 10.1186/2041-7136-2-1
25. FAO, IGAD. Promoting effective resilience investments – delivering peace, agriculture-led growth and socio-economic transformation in the Horn of Africa. Rome: Food and Agriculture Organization of the United Nations (FAO) and Intergovernmental Authority on Development (IGAD); 2019. p. 72. Available from: URL: <http://www.fao.org/3/ca3703en/ca3703en.pdf> [accessed: 26 June 2020].
26. Makkar HPS, Addonizio E, Gizachew L. Characterization of feeding systems in Ethiopia with a focus on dry areas. *Broadening Horizons* 2018;51. Available from: URL: <https://www.feedipedia.org/content/characterization-feeding-systems-ethiopia-focus-dry-areas> [accessed: 26 June 2020].
27. Makkar HPS, Addonizio E, Gizachew L, Giani A, Bah AK. Emergency animal feed and feeding strategies for dry areas. *Broadening Horizons* 2018;49. Available from: URL: <https://www.feedipedia.org/content/emergency-animal-feed-and-feeding-strategies-dry-areas> [accessed: 26 June 2020].