

Effectiveness of Drought Risk Reduction Policies: Case Study of Hay Production in Kajiado County, Kenya

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Abstract

Kenya has integrated several international, continental, and regional strategies and policies into its national and county programs to address climate-related disasters in livestock systems in pastoralism. This study reviews how these policy instruments have been integrated into local laws and the viability of hay production, a drought risk reduction strategy. The methodology used was a desktop review of policies, a KAP survey using a quantitative and qualitative questionnaire on 354 pastoralists and key informants selected using stratified random sampling, and a cost-benefit analysis of 23 hay farms in Kajiado-Central sub-county. The findings established that Kenya had adopted adequate legal instruments to support disasters in general and droughts specifically. However, the strategies are not elaborated into practical guidance resulting in poor implementation. For instance, the flagship hay production project in Kajiado focuses on building infrastructure on the government farms, with little support going to the actual hay farmers. In addition, staffing levels of technical officers are too low to adequately translate the strategies into activities that address the hay farmer's pain points, namely the lack of a stable hay market, expensive capital assets and machinery, lack of quality forage seeds, and extension education. This paper recommends reviewing the implementation of the ongoing hay flagship projects to address the hay enterprise's profitability and elaborating the strategies down to guidance that can be easily rolled out cognizant of the low staffing levels. Public-private partnerships can also address some challenges by stabilizing the hay markets, providing storage, and maintaining good-quality hay. In addition, the strategic feed reserve should include hay for pastoral livestock systems under drought risk reduction programs. Thus, targeted, relevant projects are critical if private hay enterprises are a sustainable drought risk reduction strategy.

Keywords

Hay, Drought, Disaster Risk Reduction, Climate Change Adaptation, Livestock, Pastoralism

1. Introduction

The pastoralism livestock systems are crucial to the livelihoods and the economy of Africa's drylands. They cover 43% of Africa's landmass in 36 countries, stretching from Southern Africa, the Sahelian West, the Horn of Africa, and Eastern Africa and are practiced by around 268 million pastoralists (FAO, 2018). Although the nomadic nature of pastoralism is well suited to drylands, in recent decades, it has faced several challenges ranging from land-use change, conflicts, and institutional neglect, all leading to the curtailing of pastoralists' mobility over vast land areas.

Rangeland management is a necessary adaptation and mitigation strategy for addressing climate change and variability, increasing productivity and food security, and reducing the risk of drought and flooding. Commercial hay production is an example of good rangeland management because it helps vigorous grass growth through manuring practices, resting the hay, weeding out invasive species. In addition, hay cropping provides for good soil health alongside feed for livestock. In Africa, rangeland productivity in traditional pastoralism is dependent on livestock moving enabling over vast grasslands for optimal regeneration, productivity, and carbon sequestration. However, pressure from socio-political and economic challenges of land tenure, land-use change from agriculture to extractive industries to real estate has led to this traditional livestock mobility limitation. Nevertheless, hay production is a rangeland management practice, vital for climate change adaptation for pastoralism, as it supports livestock keepers' livelihoods, conserves ecosystem services, promotes wildlife conservation, and promotes indigenous cultural practices, reversing environmental degradation (FAO, 2009).

The livestock sector in Africa also has to contend with disasters from a wide range of natural and human-made hazards, such as drought, floods, landslides, storms, animal diseases, pests, locusts, earthquakes, urban and forest fires, poisoning, and power outages in animal production units. Drought is the most harmful disaster for livestock, causing 86% of total damage and loss in the sector (FAO, 2017). The link between droughts and livestock production presents evidence that drought can affect livestock both directly and indirectly. Direct effects impinge on animal growth, animal products, and reproduction. Indirect effects influence the quantity and quality of feedstuffs such as pasture, forage, grain, livestock diseases, and parasites (FAO, 2015).

To achieve meaningful resilience, poor households must grow economically by at least 3% annually to withstand the negative impact of cyclic droughts every

five years (Capacity & African Risk, 2021). Animal feeds are the foundation of building resilience within livestock production systems to protect the welfare and health of animals before, during, and after a disaster event. During droughts, providing animal feeds and water is central to disaster response. Growing hay is critical in building resilience against droughts in the animal sector. However, the slow progress in developing feed sources in Kenya has increased livestock migration and losses during droughts (FAO, 2019).

Kenya's landmass is 83% semi-arid land (ASALs) and is home to about 600,000 pastoralists. The ASAL receives low rainfall between 150 mm to 850 mm per year, making it ideal for extensive livestock keeping and hay production (GOK, 2021). The ASALs experience frequent droughts in 2005, 2009, 2011, 2012, and 2017, which decimate livestock numbers and does not allow for enough time to rebuild livestock herds leading to the erosion of livelihoods and resilience of pastoralists communities (FAO, 2018). Droughts impacted 16.3 million Kenyans between 1964 and 2004 and caused about USD 12.1 billion in economic damages between 2008 and 2011 (GoK, 2017) and more than US\$1.08 billion between 2009 and 2017 (Africa Risk Capacity, 2018).

Kajiado County is undergoing rapid land transformation due to population growth, urbanization, land privatization, fragmentation, and land sales. Land tenure and land use have significant implications on how communities can respond to climate change. These changes, plus the land tenure system, dictate the choices around the pastoral community's climate-resilient strategies. The transformation of land tenure systems from communal ranches to private parcels has increasingly shifted livestock investment patterns from extensive resource investments to resource-intensive systems. The high cost locks out many poor pastoralists whose knowledge and capabilities are aligned with extensive mobile pastoral systems. Both land tenure systems plus private and community conservancies act as dry season grazing areas for wildlife, especially during droughts. These systems also protect wildlife habitats and have the potential for tourism (Moiko, 2019).

In Kenya, studies show that smallholder farmers' exposure and awareness of different fodder crops in Kenya is high, but only 55% grow at least one fodder type on their farms (Joseph Auma, 2018). More recently, frequent droughts caused by climate change and variability, and poor land-use practices have significantly contributed to degradations and loss of natural pastures, further complicating the situation, particularly in ASAL. A 2018 study by international livestock research institutions (ILRI) suggests that Kenya suffers large deficits of livestock feeds, mainly forage for dairy cattle. The deficit is over 3.6 billion bales of hay annually, worth USD nine billion (Joseph Auma, 2018). Furthermore, the demand is expected to increase, given the emerging fodder demand by neighboring counties. Production of these quantities of fodder would require an additional 15 million acres of land under fodder crops and pasture which could be achieved by shifting to the utilization of the arid and semi-arid areas. Inadequate animal feed

and growing demand for fodder have birthed government initiatives to support fodder establishment, production, and marketing. One such initiative was introducing several natural fodder improvement technologies in the drylands to increase feed availability during the dry periods and diversify income through the sale of hay and grass seed among communities living in the ASALs. These initiatives, coupled with a demand for fodder and the inability of many farmers to establish and preserve enough fodder on-farm, created the emergence of a commercial fodder sector in Kenya (Joseph Auma, 2018).

The study aims to review how international, continental, and regional policies and strategies are integrated into Kenya's national and county legal instruments. The study took one project under the KSCAP and ASTGS strategies called *The Hay Production Flagship Project* to investigate if the implementation is helping the hay production be financially viable and sustainable to translate to drought resilience in livestock pastoralism systems. The study took a case study approach, looking at the Kajiado-Central sub-county in Kajiado County, Kenya. The study's specific objectives were: first, to review how the international, continental, and regional disaster risk reduction (DRR) policies and strategies have been domesticated in Kenya and how they are rolled out at the county level, with Kajiado County being a case study. Second, to establish if the implementation of one of the existing drought risk reduction strategies under KCSAP and ASTGS are being implemented in a manner that adequately supports hay growing to be financially viable for commercial enterprises and encourages pastoralists to grow their hay. Third, to understand the challenges facing hay growers and the buying practices of pastoralists as it relates to the viability of the hay enterprise. The study will contribute to effective implementation of drought risk reduction strategies towards livestock resilience in pastoralism systems.

2. Materials and Methods

Kajiado County is about 19,600 km² with over 1.8 million animals (Kenya Bureau of Statistics, 2009). The County has five sub-counties with a population of 1,117,840, and the study was limited to two sub-counties with a population of 372,335 (Kenya Bureau of Statistics, 2019). The annual rainfall average is between 300 and 800 mm. Most of Kajiado County is semi-arid and arid. The highest temperatures are about 34°C around Lake Magadi, the lowest being 22°C around Ngong Hills (Kenya Bureau of Statistics, 2019). The survey was carried out in the sub-counties of Isinya, Loitokitok, and Kajiado Central, see **Figure 1** below.

A knowledge, attitude, and practice (KAP) survey interviewed 385 (354 in Isinya and Kajiado Central; 31 in Loitokitok) pastoralists, hay farmers, and key informant. The KAP survey covered (23/26) 88% of hay farms in Isinya sub-county and Kajiado Central (Olikejuado, Ibissil, and Namanga) sub-county. A questionnaire with qualitative and quantitative questions was administered with two methods—manually on paper and using Kobocollect, a mobile data collection

application. The respondents were selected using random stratified sampling of livestock keepers and hay farmers. The survey was augmented by observation during farm visits and focused discussions with hay buyers at the local market. The data was analyzed using the SPSS and Microsoft Excel Data analysis Toolpak.

Table 1 shows the list of policies that were reviewed in the desktop analysis.

3. Findings

The findings are described in three sections, the first section reviewed how DRR global, continental, and regional policies are being translated into national DRR policies. The second section looks at how national DRR policies are translated into County DRR policies, taking the case of Kajiado County. Finally, the third section looks at the findings of the KAP survey from hay producers and pastoralists consumers as related to Kajiado County DRR program implementation.

3.1. Disaster Risk Reduction (DRR) Policies and Strategies

3.1.1. Global

Kenya has adequately domesticated international policies that strengthen disaster

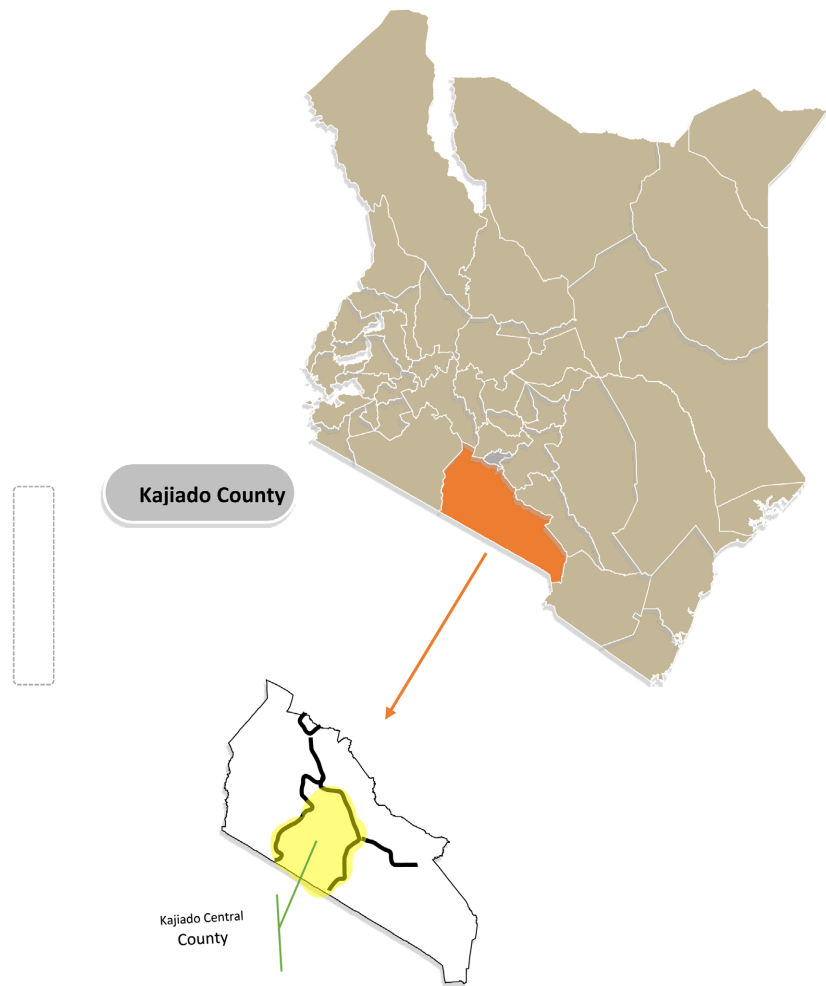


Figure 1. Map of Kajiado County in Kenya.

Table 1. List of policies reviewed.

| Global Polices |
|--|
| Sendai Framework for Disaster Risk Reduction 2015-2030 |
| United Nations Sustainable Development Goals 2030 |
| Paris Agreement on Climate Change 2030 |
| Africa—Continental Policies |
| Africa Agenda 2063 |
| The Comprehensive Africa Agriculture Development Programme Framework (2010) |
| Policy Framework for Pastoralism in Africa (2010) |
| The Livestock Development Strategy for Africa (LiDeSA) |
| Animal Welfare Strategy for Africa (AWSA) 2017 |
| Animal Health Strategy for Africa (AHSA) 2019 |
| Regional Economic Communities (RECs) Policies—Intergovernmental Authority on Development (IGAD) |
| IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI) |
| IGAD Regional Strategy (2016) |
| ICPAC Strategic Plan (2016) |
| IGAD Regional Climate Change Strategy (2018) |
| IGAD Regional Disaster Risk Management Strategy (2019) |
| Regional Economic Communities (RECs) Policies—East African Community |
| EAC Protocol on Environment and Natural Resources Management (2006) |
| EAC Climate Change Strategy (2011) |
| EAC Climate Change Masterplan (2015) |
| EAC Disaster Risk Reduction and Management Act (2016) |
| EAC Development Strategy (2020/21) |
| Kenya |
| Constitution of Kenya 2010 |
| Kenya's Vision 2030 |
| Big 4 agenda |
| National Climate Change Response Strategy (NCCRS) 2010. |
| National Climate Change Action Plan (NCCAP) 2017 |
| Kenya Climate-Smart Agriculture Strategy (KCSAS) 2016-2026 |
| Ending Drought Emergencies (EDE) 2014-2022 |
| National Drought Management Authority (NDMA) Act 2016 |
| common framework for Ending Drought Emergencies (EDE) 2014-2022, |
| National drought management authority (amendment) Bill (2019). |
| National Drought Management Authority (NDMA) Strategic Plan (2018-2022) |
| Agricultural Sector Development Strategy (ADSD) 2010-2020 |
| Agricultural Sector Transformation and Growth Strategy (ASTGS) 2019-2029 |
| Kajiado County, Kenya |
| The Kajiado county integrated development plan 2018-2022 (CIDP) |
| Kajiado County Climate Change Bill 2020 |
| Kajiado County Environmental Protection Bill 2020, |
| the Kajiado County Pastoralist Development Centers Bill 2020. |
| Kajiado County Disaster Management Bill 2015 |
| Kajiado County Emergency Fund Bill 2014 |

risk reduction (DRR) into its national laws, policies, plans, and programs. The laws that Kenya ratified in 2015 include the United Nations Sustainable Development Goals (SDGs), Sendai Framework for Disaster Risk Reduction (SFDRR), and the Paris Agreement on Climate Change. The Sendai Framework emphasizes reducing disaster risk and linking DRR to the resilience targets in the SDGs, which states that countries should prevent and mitigate any disaster impacts on their livelihoods and the economy. The Sendai Framework and SDG also link to the targets in the Paris agreement as climate change impacts natural resources, the bedrock for livestock production (FAO, 2017). Kenya is also signatory to the UN Framework Convention on Climate Change (UNFCCC), the Conservation of Biological Diversity (UNCBD), and the United Nations Conventions on Combating Desertification (UNCCD). Kenya estimates the cost of US\$40 billion would be required to finance the adaptation and mitigation interventions across six critical sectors until 2030 (NEMA-KENYA, 2015).

3.1.2. Continental and Regional

At the continental level, Kenya is implementing policies under the Africa Agenda 2063, namely, the Comprehensive Africa Agriculture Development Programme Framework (2010); the East African Community Climate Change Policy, which emphasizes on sustainable management of land and water for improved agricultural productivity through research and dissemination of technologies, and reductions in agricultural greenhouse gas emissions; the Policy Framework for Pastoralism in Africa (2010), which addresses optimal use and conservation of drylands and rangelands inhabited by pastoralists. The policy promotes climate adaptation practices within pastoral systems; the Livestock Development Strategy for Africa (LiDeSA) (2015). Disaster management is further elaborated in the Animal Welfare Strategy for Africa (AWSA) (2017) and the Animal Health Strategy (AHS) (2019). Taking care of animals in disasters is at the heart of good animal welfare and health, and both these strategies seek to reflect this animal resource sector (AU-IBAR, 2017).

IGAD institutions that support Kenya in climate related policies, digital products and training include the IGAD Centre for Pastoral Areas and Livestock Development (ICPALD) and the IGAD Climate Prediction and Applications Centre (ICPAC). Kenya also implements other regional policies developed by Intergovernmental Authority on Development (IGAD). These are: the IGAD Regional Strategy (2016); ICPAC Strategic plan (2016), IGAD Regional Climate Change Strategy (2018), IGAD Drought Disaster Resilience and Sustainability Initiative—IDDRSI (2019), and the IGAD Regional Disaster Risk Management Strategy (DRM) (2019). The IGAD Regional DRM Strategy aims to drastically reduce disaster risk and losses incurred by people, animals, and the environment in line with the SFDRR.

The East Africa Community (EAC) strategies and legislation relevant to DRR include the two years EAC Development Strategy 2016/17 later updated to 2020/21, Disaster Risk Reduction and Management Act (2016), EAC Climate Change Masterplan (2015), Climate Change Strategy (2011), and the EAC Pro-

toocol on Environment and Natural Resources Management (2006). The East Africa Feed Production Action Plan (2019) addresses poor livestock nutrition by encouraging good quality feed production in pastoral systems, recognizing that the lack of feeds and water is the key driver of poverty in pastoralism livelihoods. The plan notes that livestock feed and feeding systems are constrained by recurrent droughts, livestock mobility, overgrazing, rangeland degradation, land tenure policies, land-use changes, resource-based conflicts, invasive plant species, soil infertility, and limited seeds and input (FAO, 2019).

3.1.3. Kenya: National DRR Policies and Strategies

Support for DRR and food security is enshrined in the Constitution of Kenya; article 43 states that everyone has the right to be free from hunger and have adequate quality food. The environment is further protected by Articles 42 and 69 in the Constitution that emphasizes conserving and managing the environment equitably and sustainably (GoK, 2010). Kenya's Vision 2030 strategy aims to support agriculture and the productive assets that support agriculture like land, irrigation, and markets. In addition, the government's Big Four agenda offers a push and focus on food security and nutrition, universal healthcare, affordable housing, and manufacturing (GoK, 2020).

Kenya has a broad spectrum of climate-smart agriculture (CSA) policies, strategies, and plans domesticated from global, continental, and regional strategies. For instance, all the climate change commitments are integrated into the National Climate Change Response Strategy (NCCRS) 2010. Kenya further developed the 2016 Kenya Climate Change Act 2016. The National Climate Change Action Plan (NCCAP) 2017 operationalizes the NCCRS and emphasizes a low-carbon, climate-resilient development critical for achieving the Sustainable Development Goal (SDG13) of combating climate change and its impacts. The NCCAP details Kenya's Nationally Appropriate Mitigation Actions (NAMAs) for six sectors: waste management, energy, transport, industry, agriculture, forestry, emissions from the forestry and agriculture sectors (GoK, 2017). In addition, disaster risk management is one of the seven priority areas in the NCCAP 2018-2022 to improve the community's ability to cope with droughts and floods by properly managing rangelands to benefit livestock and wildlife (GoK, 2018).

The climate and disaster national plans are synthesized into two- or five-year strategies to give a focused push on targeted actions. One such strategy is the Kenya Climate-Smart Agriculture Strategy (KCSAS) 2016-2026 that will contribute to the Nationally Determined Contributions towards Kenya's UNFCCC commitments. In addition, KCSAS seeks to bridge the gap in other climate-smart strategies by enhancing adaptive capacity and resilience for farmers, pastoralists, and fisherfolk to climate change while creating an enabling regulatory and institutional environment (GoK, 2016). To further support this, the Kenya Climate-Smart Agriculture Program (KCSAP 2015-2030) envisions increased productivity in the livestock sector and disaster proofing infrastructure associated with livestock production, especially in arid and semi-arid lands, home to pas-

toral livestock systems, where better range management and water conservation is needed for both livestock and wildlife (GoK, 2018). The Kenya Climate-Smart Agriculture Project (KCSAP) aims to help Kenya meet rising food demand and attain the SDG 1 of ending poverty, SDG 2 ending hunger, SDG 13 combating climate change and its impacts, and contributes to the Government of Kenya's Vision 2030 development agenda of transforming smallholder subsistence agriculture into an innovative, modern, and commercial sector. The 2010-2020 Agricultural Sector Development Strategy (ASDS) aimed for an annual 7% agricultural sector growth for the first five years while transforming smallholder agriculture. For livestock, ASDS prioritized improved livestock diversification and grazing systems, improved breeding, and biogas utilization. In addition, KCSAP aligned with the World Bank's Strategy of eliminating extreme poverty and boosting shared prosperity by 2030 and the Africa Climate Business Plan of Accelerating Climate Resilience and Low-Carbon Development (World Bank, 2016).

The 2019-2029 Agricultural Sector Transformation and Growth Strategy (ASTGS) targets the 600,000 pastoralists categorized as small-scale and whose ability to expand pastoral practices is limited by high prices, low-quality inputs, low mechanization, and low adaptation to new technologies such as improved fodder seed, irrigation, and artificial insemination. Hay production suffers from erratic market demand, high post-harvest losses due to poor storage and technologies to keep hay nutritious and free from pest infestation. The ASTGS already has a framework in place and what is needed are targeted programs to address hay producers' pain points. The ASTGS has six flagship projects, out of which four are relevant to hay production in pastoral areas (GoK, 2019). However, under these flagship projects, better support from the private sector in increasing hay production can be given. For example, flagship one can include supporting hay producers through subsidies for machinery, modern hay store construction, tilling land, harvesting, or providing stable markets by government formulating buy-back programs. In addition, flagship four can consider hay producers farms below 2500 acres, while flagship six has omitted the views from hay farmers in community programs, a critical component of building resilience in the ASAL.

All Counties are required to develop five-year County Integrated Development Plans (CIDP) as provided for by the Kenya's Public Finance Management Act. To monitor effective implementation, it's important to "follow the money". The CIDP is a very good indicator as to which activities are receiving financial support within the County. The CIDP also audits annual development plans, the annual county fiscal strategy papers, and the annual budget estimates. Counties will also highlight the strategies and policies they are focusing on within the given five-year.

3.2. Kenya: National Disaster Management Structures

The 2016 National Drought Management Authority (NDMA) Act established

the National Drought Management Authority. NDMA's mandate is to coordinate and manage drought and climate risks, plus implement drought resilience, preparedness, and response initiatives to end drought emergencies in Kenya. Kenya has developed the common framework for Ending Drought Emergencies (EDE) 2014-2022, which guides and coordinates all planning and investment in drought risk reduction and resilience. To operationalize the EDE, County Preparedness & Response Plans should set aside 5% - 10% of total revenue for drought/disaster response. The NDMA Bill 2016 operationalizes the National Drought Emergency Fund (NDEF) plus enhancing the status and powers of the NDMA in line with the Sessional Paper No. 8 of 2012 on the Policy for the Sustainable Development of Northern Kenya (NDMA, 2017). To align with the Public Finance Management Act 2012, the NDEF was moved to sit under National Treasury through the national drought management authority (amendment) Bill 2019. NDMA Strategic Plan (2018-2022) aims to enhance drought resilience and climate change adaptation (GoK, 2020).

Disaster response is spread over several agencies in Kenya, namely, the National Disaster Operations Centre (NDOC), the National Disaster Management Unit, the National Drought Management Authority (NDMA), and the State Department of Special Programmes. Non-state actors are also brought into this process under the National Platform for Disaster Risk Management (NPDRM). The NDOC, through an Act of parliament, is mandated to coordinate all fast onset emergencies. Other government actors dealing with drought and food security emergencies are the State Department for Livestock, the Kenya Food security meetings (KFSM), the Kenya Food security steering group, and the Inter-Governmental Technical Committees. In addition, the Director of Veterinary Services (DVS) has a Disaster and Risk Management Unit that deals with animal disease emergencies coordinating closely with the NDOC and the County Disaster Management committee (CDMC), County Disaster Operation Center (CDOC), and the various County Steering Groups (CSGs).

3.3. Case Study: Kajiado County

3.3.1. DRR Policies and Strategies

As part of its commitment to policy rollout, county governments in Kenya have gone a step further and developed sub-national level strategies and legislation to implement the national policies. This paper will focus on Kajiado County to illustrate progress on implementing policies at the local level. The Kajiado county integrated development plan 2018-2022 (CIDP) is aligned to the national "Big Four" agenda in its ambition to increase agricultural production by investing in hay production, reducing post-harvest losses, expanding irrigation, encouraging modern technologies, and reducing climate change impacts. Kajiado County is rolling out the Agricultural Sector Transformation and Growth Strategy (ASTGS) and the Kenya Climate-Smart Agriculture Project (KCSAP) through the CIDP (Kajiado, 2018). The CIDP also aligns with the UN Sustainable Development Goals (SDGs). Namely, goal 1 is to increase livestock production and to address

climate change challenges; goal 2 is to end hunger and achieve food security by promoting hay production to improve livestock productivity and build mega-dams for irrigation. The CIDP will also contribute to goal 15 of protecting and promoting sustainable land ecosystems and stopping biodiversity loss. Another focus of CIDP is wildlife conservation and management by reducing human-wildlife conflict, ending poaching, and stopping the trade of illegal wildlife products. The CIDP will also have projects to combat desertification, restore degraded land and soil, address the impact of drought and floods. The CIDP also supports the Sendai Framework by improving how disasters are managed. The CIDP 2018-2022 economic pillar theme will mainly focus on agriculture and livestock production and productivity. The CIDP identifies six flagship projects, namely the upgrade of the urban road network, building mega-dams for water supply and irrigation, and encouraging hay production, constructing the Kajiado Technical and referral hospital, improving solid waste management, and establishing the Olkejuado University Applied Technology.

The Kajiado County has several bills to address disasters training, emergency animal health and welfare, and feeding tailored to pastoralism. The completed bills include Kajiado County Climate Change Bill 2020, Kajiado County Disaster Management Bill 2015, Kajiado County Emergency Fund Bill 2014, Kajiado County Environmental Protection Bill 2020, the Kajiado County Pastoralist Development Centres Bill 2020. The bills still under development include Agricultural Training Centre services Bill, Kajiado County Cooperative Bill, Kajiado County Sale Yard Bill, and Kajiado County Animal Welfare Bill (Kajiado County Assembly, 2020).

3.3.2. Hay Production Flagship Project

Under the CIDP, hay production is a flagship project to encourage hay growing and storage to build resilience for the pastoral livestock systems during droughts. According to CIDP progress reports 2019/2020, the plan is to develop strategic feed reserve in training centers of Emali, Kajiado Demonstration Farm, and Olkiramatian; construct a pit silo on the Kajiado Demonstration farm; reseed rangelands with 1600 kgs of pasture seeds; train 70 community-based hay production groups; fence Tardafarm and Kajiado demonstration farm; construct hay stores at all the demonstration sites; and increase the acreage under hay. From key informant interviews, the study found the activities being undertaken under the hay flagship project were building structures in the government demonstration farms, namely stores, fence off farms with barbed wire and electric fences, construct storage. The only direct engagement was with pastoralists farmer groups around training.

1) Hay production and deficit

The KAP survey covered (23/26) 88% hay farmers in Isinya and Namanga division in the Kajiado Central sub-county. Of these 23 hay producers, (2/23) 9% had between 350 - 400 acres of hay, (6/23) 26% had between 135 - 200 acres of hay, (7/23) 30% had between 20 - 50 acres of hay, and (8/23) 35% had 3 - 15

acres under hay. These farms represent 88% of the hay producers in Kajiado Central County. Farms growing over 350 acres of hay, account for 73% of total hay production, see **Figure 2**.

The findings found a hay deficit of over 95% during the drought years of 2005, 2007, and 2009. However, between the drought years of 2015 to 2018, hay production increased by over 60%. By 2017, the hay harvested was 49,138 bales accounted for 24% of the total bales needed that drought year. However, in 2019, there was a drop in hay production because the large farms did not harvest their hay grass, instead opting to leave the hay standing on the farm as there is no demand for hay due to the excellent rainfall experienced, making free grazing resources available to pastoralists. This trend is depicted in **Figure 3**.

The KAP survey also interviewed 354 pastoralists and found that only 6% grew hay commercially or for their use. Most pastoralists preferred buying hay rather than growing hay. In 2015, the quantity (in kgs) of hay feed was 23% of total feeds, while commercial feed accounted for 76% of total feeds. This reversed in 2017, with hay accounting for 62% of total feed and commercial feeds

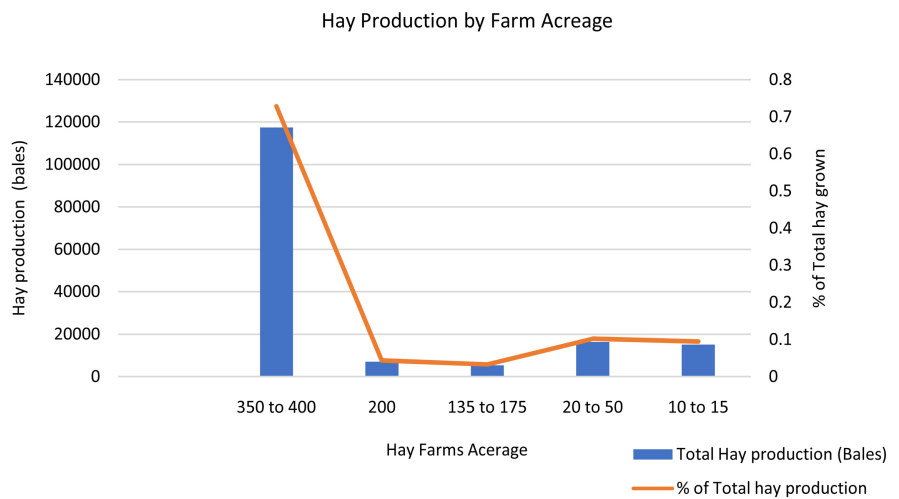


Figure 2. Hay production by farm acreage.

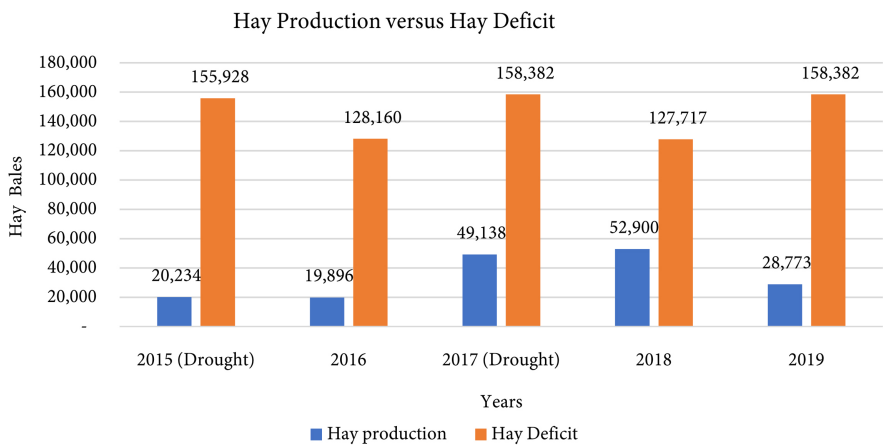


Figure 3. Hay Production versus hay deficit.

dropping to 38% of total feeds. This shows a growing preference for feeding with hay and an increase in availability of hay in the market. During the same period, feeding livestock using own-grown hay only increased from 1% to 22% of total feeds. These low percentages show that pastoralists are still not growing enough hay for their own needs. This trend is shown in **Figure 4**.

2) Hay growing challenges

All the hay farmers cited the lack of demand for hay in years when rainfall was average or good. On the other hand, hay sales are excellent in drought years which occur every 2 - 3 years. However, the years in-between droughts can see little to no hay sales as pastoralists have plenty of free grazing resources. No sales mean that hay is stored for between 1 to 3 years before selling, making hay growing unprofitable. For the period under study, hay was sold in 2015, 2016, 2017 with low sales in 2018 and no sales in 2019 and 2020. These later years had good rains, and grazing grass was available to pastoral herds.

The highest capital cost incurred by farms was the building hay stores. The large farmers constructed permanent stores made of iron sheets and stone. Smaller farmers build wood-frame structures with iron sheet roofs with exposed walls. In all the cases, especially for large producers, when the harvest exceeds the stores' holding capacity, the hay is stored in the open, using the pyramid stacking method, then covering with a tapeline. However, it was observed that none of the storage methods preserved the hay's quality, with the open pyramid method and open-wall stores having the fastest deterioration of quality. Indeed, hay stored for over two years had turned black and, in some cases, was moldy.

All the farms (100%) experienced illegal grazing on their hay farms by neighboring pastoralists creating farmer-herder conflicts. For those farms that owned their machinery, they all cited the high capital costs and running of tractors, balers, and irrigation equipment. In fact, farms that bought capital expenditure like tractors and balers and used irrigation were not profitable.

Half (50%) of the respondents cited the lack of government support. Although some farmers had used the government tractors and baler services, they later opted for private providers who were more reliable and efficient. In addition, the

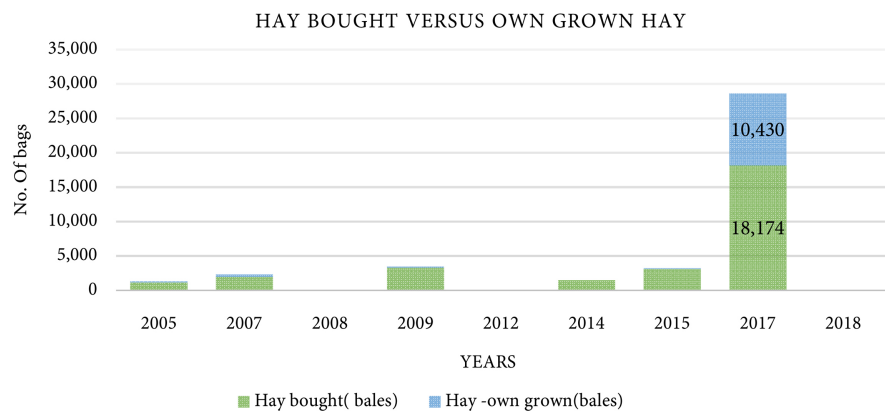


Figure 4. Hay bought versus Own grown hay.

farmers reported receiving little tangible government support for the hay value chain. The farmers were left to figure things out on their own. All farms reported that they had never attended a direct meeting between hay producers and the County government despite hay being a priority flagship crop. The lack of dialogue means that the hay farmers' challenges and possible solutions are not reflected in the CIDP rollout. Farmers also cited the lack of hay production extension services. On further deep-diving into the issue of government support, the 400-acre farmers strongly noted that programs being rolled out were mismatched to farmers' needs. For instance, one farmer mentioned he had heard of the technical discussions around quality standards for hay. However, he noted that discussions did not reflect the reality of the production system and that introducing quality standards would have an overall negative impact on hay profitability. Any further additional input costs without addressing markets realities will collapse the already fragile hay production enterprise.

The study found that the low profitability of hay farms was making hay growers seek alternative ways of exploiting land like selling off part of their land. On further probing, the profitability of hay growing seems to be the heart of this land-use change. Farmers expressed no interest in hay cooperatives to address market concerns. The study specifically inquired about setting up a hay cooperative as this is an activity in the flagship priority plan of Kajiado and the Agricultural Sector Growth and Transformation Strategy (ASTGS). However, the idea of setting up hay cooperatives was firmly rejected by all farmers who cited corruption as the reason they would not join a hay cooperative.

Farmers felt that they received no recognition for the hay farms' contribution to social and ecological services—the large hay farms support pastoralists' livestock and wildlife. The wildlife (antelopes, zebras, elephants, elands) trek from Amboseli National Park and graze on the hay farms for up to four months every year. At the time of the interview's antelopes was observed on two of the large farms. The herbivores are attracted to the farms by the abundance of grasses compared to the overgrazed lands outside the farms. The wildlife sector benefits from this at the expense of the hay farms that lose hay production from this grazing. While most hay farm owners appreciate wildlife and allow them to graze to protect them from illegal killings, neither Kenya Wildlife Services (KWS) nor the County government has engaged the farm owners in their role in wildlife conservation. Observation and discussion noted that herbivores on the farm thrive and even reproduce while on the farm. Farmers reported that the number of herbivores coming to the farms has also increased every year, showing that wildlife migration patterns have been modified to include hay farms. Although not the scope of this study, the role of hay farms in wildlife drought risk reduction is an area that needs further study. Another ecological service provided by hay farms is weeding out invasive species like (*ipomoeacairica*) which is destroying grazing lands. Farms are forced to invest heavily in weeding out the invasive species to stem the spread of these plants. It was observed that the hay

farms were free of *ipomea* while the weeds had overrun the surrounding areas.

3) Differences in DRR programs provided versus Pastoralist’s preferences

The survey sought to understand the level of awareness, satisfaction and preferences of the disaster risk reduction (DRR) programs and activities undertaken by government, NGOs, and other actors. A total of 31 pastoralists and key informants from Loitokitok sub-county were interviewed.

Of the 31 respondents who were asked to select all DRR mechanisms and projects, over 44% were not aware of any local disaster risk response mechanisms available at the county or community level. In addition, only 23% cited communicating early warning messages as the DRR mechanism used. Approximately 30% reported being aware of disaster preparedness measures advocated by either government, NGOs, or private companies, before and during droughts to reduce deaths and prevent injury and diseases in animals. The main activities carried out are destocking, hay and pasture growing training, vaccinations, and general DRR training, as shown in **Figure 5**. However, many respondents noted that very few farmers practiced these methods taught. A majority (76%) indicated that they were dissatisfied with the assistance they get for their livestock during disasters from government, NGOs, or other local organizations. In addition, only 19% reported being satisfied with disaster mitigation interventions, as shown in **Figure 6**.

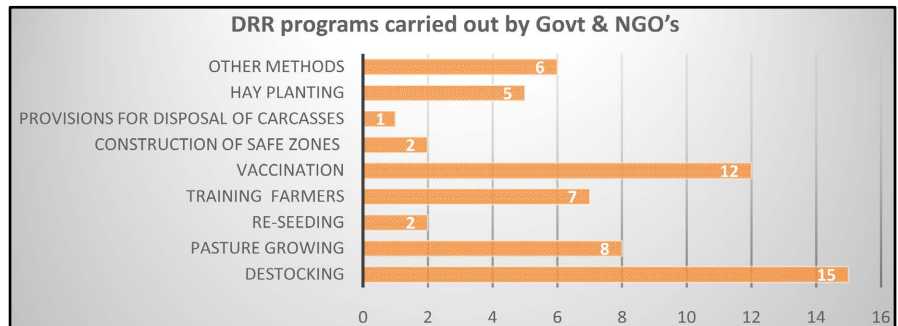


Figure 5. DRR programs carried out by Govt & NGO's.

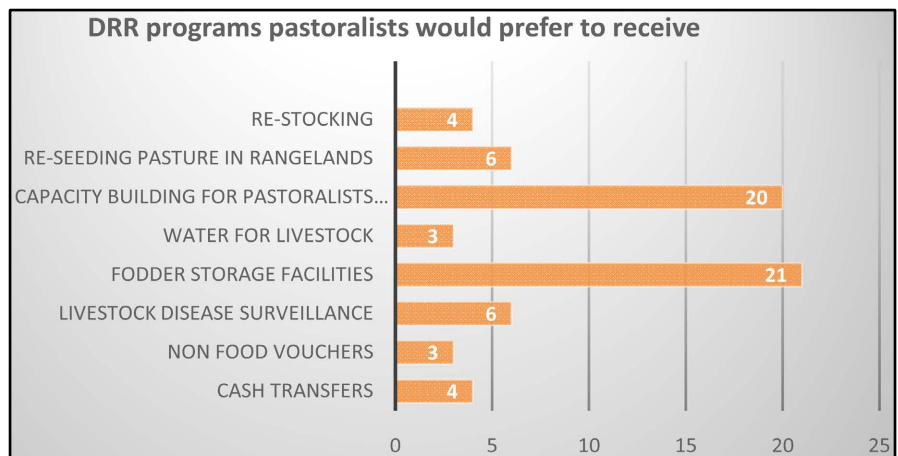


Figure 6. DRR programs pastoralists would prefer to receive.

When asked to list disaster preparedness assistance practices that were carried out correctly and which ones they prefer, most respondents cited destocking and planting of hay. About 62% prefer capacity building programs for pastoralist communities and the provision of fodder storage facilities.

3.3.3. Case Study Key Findings

- The international, continental, and regional strategies have been integrated into national strategies like the ASTGS and KCSAP, which are reflected in the Kajiado CIDP. In addition, the county disaster and climate-related bills are in place and can support a more robust drought risk reduction strategy.
- The aspirations of the ASTGS and KCSAP need to be further elaborated into guidance and frameworks before reaching the counties CIDPs. For instance, the hay production flagship project demonstrates the disconnect between the activities done under the CIDP and the strategy's aspirations. As a result, hay farmers' needs are not being met. Instead, activities focus on building infrastructure within the County's demonstration farms.
- Although the CIDP has training on hay growing, it is directed to existing pastoralist groups who, according to the study findings, have shown an increase in utilizing own-grown hay from 1% in 2015 to 23% in 2017 of total feed types utilized. In addition, their appetite to buy hay increased from 23% in 2015 to 62% of total feeds utilized during the same period. Therefore, the CIDP should refocus their training to existing hay farmers and train them on improving their enterprise and increasing their production, while pastoralists should be trained on optimally utilizing feeds like hay to build resilience and productivity through the year.
- The demand for hay by pastoralists has been increasing, albeit only in severe drought years, as reflected in a hay deficit of over 95% during the droughts of 2005, 2007, and 2009. As a result, hay production increased by over 60% from 2015 to 2018, accounting for 24% of the total bales needed in the 2017 drought. However, in 2019, there was a drop in hay production because the large farms did not harvest their hay grass due to low demand from pastoralists occasioned by above-average rainfall that provided good grazing.
- The large hay farmers, who account for 73% of all the hay production, do not receive direct support from the KCSAP or ASTGS programs. Instead, they cite their main pain points as a lack of a reliable yearlong market, as hay is only bought during drought years. Poor markets should be addressed as they are the backbone of hay supply to the pastoralists.
- The main challenges experienced by hay farmers are the lack of a stable market, the high cost of capital, no extension services, policies that do not address their pain points, and the low profitability of the hay enterprise.
- Hay farmers contribute to other ecological services like providing a dry season grazing ground for wildlife at their own cost. However, they are not recognized nor supported to continue providing this support, even though this service contributes to the County's tourism revenue.

- The activities under the DRR support that pastoralist receive from the government and NGOs do not match their preference.

4. Discussion

Kenya has commendably integrated international laws into its national law, which has been reflected in county laws. Adequate policies and Bills exist to support hay production. However, the strategies developed from these Bills need to be better conceptualized and rolled out with clear deliverables that can impact the entire hay value chain. The Kajiado County Disaster Management Bill of 2015 and the Kajiado County Emergency Fund Bill of 2014 creates a law supporting resilience building and disaster response. This review recommends an implementation framework that will directly support hay production to meet hay producers' and consumers' needs in times of drought. However, because hay production is still viewed as a short-term response option, the Bills should put longer-term resilience measures like buying hay during the average rain years and re-distributing the same hay during drought years.

There is a need to elaborate the existing policies and strategies to actionable guidance and work plans utilizing localized research evidence. The low number of technical staff means that the time needed to elaborate the strategies and develop appropriate programs and activities is not possible based on evidence from studies. As a result, the staff tends to fall back on the already existing pastoralist groups to train them on growing hay. The interest of these pastoralists in growing hay is not very high. The study showed that only 6% of pastoralists interviewed grew hay for their livestock. Ideally, a mapping of existing hay growers should be done and these selected for additional training and support. The study found that none of the existing large hay farmers had attended any training. So, from the onset, the activities under the CIDP do not reflect the farmers' needs nor the pastoralists' hay buying behavior patterns but instead assume pastoralists will take up hay farming. This study recommends that strategies be further elaborated to actionable work plans at the national level for all Counties. The technical staff at the Counties are already overstretched and cannot be expected to undertake research and elaborate strategies. They need ready-to-use information.

However, a closer look at how CIDP supports DRR practice on the ground, as illustrated by the hay production flagship project, shows that implementation has several gaps and challenges. First, there is a need to appreciate the different categories of hay farmers, those who grow commercially and those who grow for subsistence. For instance, the activities being implemented under the CIDP do not consider the seasonality of supply and demand of hay and how this impacts hay producers. Pastoralists buy hay only during severe droughts, therefore not providing a steady market for hay producers. In addition, pastoralists prefer to buy hay rather than grow it themselves, which is not reflected in training provided, which encourages pastoralist groups to grow hay themselves. A complete

review of the direction of the hay production flagship needs to be considered, with large hay farmers focusing on production and small-scale pastoralists encouraged to utilize hay throughout the year to improve livestock productivity. The current hay production flagship project does not allocate adequate funds to activities that directly support hay producers as envisaged in the Kajiado county strategic plan. As a result, the large hay farmers with over 100 acres under hay do not get appropriate extension services and training and often must learn by doing, as arid hay production knowledge is not readily available. The overall low hay production is evident in the hay deficit during the previous droughts reducing slowly from 95% in 2009 to 76% in 2017.

Furthermore, the CIDP does not address the large hay producer's pain points, like the lack of a stable market for hay and the low profitability of the enterprise. The large hay farms account for 73% of all hay production, so any challenges they face leading to their abandoning hay farming would mean the County will crash into a hay deficit in the 90% range. The CIDP does not support large hay producers. Instead, the CIDP activities focus on infrastructure development like store-building and fencing on government demonstration farms. Even the hay-growing training for pastoralist groups does not include the large hay growers in the sub-county. Thus, there is a disconnect between how the policies are implemented in the CIDP and the reality.

The pressing issues negatively impacting hay producers need to be addressed to attain the aspirations of the Kajiado Hay Flagship project. The Kajiado County can consider taking the following actions: first, review the land tenure and rights policies to facilitate hay production in private and communal land. Second, to develop public-private partnerships that support primary hay producers, especially in providing a stable market. Third, the County can buy hay in peak production and re-distribute it during droughts under one of the Kajiado County Bills on disaster preparedness and response. Fourth, allocate funds for hay under the strategic feed reserve either as a purely public function or under public-private partnership arrangements. The County needs to consult hay producers in developing these strategic feed reserves to ensure the activity is customized to meet the County's peculiarities. Fifth, to allocate investments and finance to enable private landowners to implement mitigation and adaptation actions. Sixth, to support communal, private, and conservancy systems to protect wildlife during droughts. Seventh, to provide training based on the best practices in hay farming.

These recommendations are also supported in the Land-use transformation recommendations in the Kajiado County report, which states that pastoralists need to be supported to get into hay production through enabling land policies and land-use to enable traditional access to land for pastoralists, investments, and finance to enable private landowners to put in place mitigation and adaptation actions, and support for communal, private and conservancies systems for both livestock and wildlife (Moiko, 2019). With most hay farms being small-scale

below 10 acres and limited direct government support, the future growth of hay production to the levels that it can mitigate against droughts and even be an integral part of livestock production practices will remain limited. Direct government intervention to encourage the private sector to engage in large-scale hay production and other aspects of the hay value chain to provide storage and markets is required. Hay production by the government and private sector remains far below requirements. The limited resources need to directly support hay producers along the value chain to fill this gap (Ouma, 2017).

Ethiopia faces similar challenges in providing sufficient good quality forage feed for their pastoralism sector. Hay production is not widely practiced, with free grazing accounting for 66% of feeding methods used. However, pressure from land-use change has seen arable land available for grazing drop from 30% in 1980 to 12% in 2000 and continues to shrink. With reduced land for pastoralism, forage production in the mid and lowlands of Ethiopia will need to be encouraged. In addition, the private sector and cooperatives need to partner with the government in the fodder value chain, which is currently dominated by the government (Alvarez Aranguiz, 2019). In Sudan, alfalfa hay is a vital forage crop used for grazing, hay, silage, green manure, and cover crop. Hay production has been increasing since 2012 due to foreign direct investments from Gulf countries like the United Arab Emirates, which have invested heavily in large-scale irrigated forage production. This private investment has made Sudan a leading exporter of hay to the middle east (Research and Markets, 2021).

5. Conclusion

Kenya has done a commendable job in domesticating global, continental, and regional policies down to the county levels, supporting pastoralism as seen in this review of Kajiado County. The focus on the hay production flagship at both the national and county level is evidence of this. However, there is still a considerable gap in implementing these policies and designing and rolling out the strategies. The involvement of the private sector is weak, and the stratified support that recognizes the different needs of commercial and subsistence farms to ensure a vibrant hay production enterprise is largely lacking. The budgetary allocation is focused on supporting government institutions like demonstration farms and developing policies and capacities within government. As a result, the private sector has engaged in hay production organically, focusing on low technology, resulting in low productivity.

The mismatch of resources and needs may partly be attributed to the low numbers of technical staff expected to elaborate the strategies, design and implement the programs. Therefore, the few technical offices tend to fall back on what is easier to do, retrain existing pastoralists groups to grow hay instead of creating a new group for actual hay farmers. The low 6% uptake of these pastoralist groups in growing hay indicates the mismatched training as this group prefers to buy hay.

In conclusion, revisiting the existing strategies like the ASTGS, KCSAP, and CIDP and providing the necessary financial, staffing, guidance, and frameworks to ensure that hay production flagship is rolled out properly and suitable hay farmers are supported to be commercially viable. On the other hand, pastoralist groups should be encouraged to utilize hay to improve productivity throughout the years, not just as an emergency drought response during droughts. Hay production can be an effective drought risk reduction measure and a contributor to increased livestock productivity in dry seasons that are not droughts, therefore, increasing livestock resilience.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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