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EQUIPPED TO ADAPT?

A REVIEW OF CLIMATE HAZARDS AND PASTORALISTS' RESPONSES IN THE IGAD REGION

MARCH 2022

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This publication has been produced with the assistance of the European Union and the German Federal Ministry for Economic Cooperation and Development. The opinions expressed are those of the authors only and should not be considered as representative of the official position of the German Federal Ministry for Economic Cooperation and Development or of the European Union.

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This publication was issued without official translation by TRS Unit.

Cover photo: © ICPALD

Required citation: Rodgers, C (2022) "Equipped to Adapt? A Review of Climate Hazards and Pastoralists' Responses in the IGAD Region" Nairobi: ***IOM & ICPALD***.

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FOREWORD

Forward by IOM Regional Director

The pastoral way of life has existed in the Horn of Africa for several millennia, with herders moving seasonally to take advantage of pasture and water. Even today, mobility remains the key aspect of pastoralists' ability to adapt amidst the challenges of climatic and environmental change, and this includes migration across international borders to not only access seasonally available pasture and water, but also markets and social support networks. This millennial-old livelihood is, however very much under threat in our modern world, from the adverse impacts of climate change and other socio-economic and political challenges.

This report comes at an opportune time, because we must take stock of both the vulnerabilities as well as adaptive capacities of pastoralists in our region, if we hope to effectively support them to adapt to the unprecedented challenges brought on by global climate change. Pastoralism benefits the region tremendously, as it represents a significant percentage of the Agricultural Domestic Product (AGDP), supports a large pastoral population in terms of livelihood and employment, and continues to be a large source of food for the regional population. This report tells us that pastoralism continues to not only be "*a productive and profitable form of food production*", but that, notwithstanding the projections of adverse climate change effects in this region, "*pastoralism will remain crucial to realizing regional food security, sustainable livelihoods and economic development in the 21st Century*."

IOM, the Intergovernmental Authority on Development (IGAD) and its Member States have recognised and appreciated the value of pastoralism. Not simply its economic value, but importantly, its cultural and historical value, as well as its important role in climate change mitigation. We must therefore, come together with our Member States and partners to support the IGAD Protocol on Transhumance, which seeks to protect agro/pastoralists and promote their livelihoods. Hence, the IOM Regional Office for the East and Horn of Africa is very pleased to partner with the IGAD Centre For Pastoral Areas and Livestock Development (ICPALD) in the production of this report, which synthesises a large body of existing, recent literature and data on the challenges faced by agro/pastoralists in the IGAD region in the context of growing climate change-related and environmental hazards. This report and its recommendations, form a strong foundation for evidence-based policy and programming that takes forward the Implementation Road Map for the IGAD Protocol on Transhumance.

Mohammed Abdiker, Regional Director
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FOREWORD

Forward by ICPALD

Pastoralism is characterised by mobility as transhumance communities move their livestock in search of water and pasture. This has been a long-standing and widely recognised adaptive response to the ever-present existential threat of drought and famine that continually looms over the IGAD region. The movement of pastoralists and their livestock is therefore principally dictated by the availability of water and pasture and as a consequence, the movement patterns are usually not fixed to a pre-set and predictable route. The prevailing rule is that flexibility is the key to survival and therefore the tendency to adapt to patterns that correspond to local conditions. Tactical mobility that is guided by a strategic response to the availability of natural resources is what allows livestock-keeping pastoral communities to adjust to the effects of climate change and weather variability in order to continue living in the resource-constrained ecosystems of the Arid and Semi-Arid Lands.

Historically, transhumant pastoralists adopted seasonal mobility as an adaptation mechanism to climate variability. Additionally. majority of pastoralist communities in IGAD are residents of the borderline regions between Member States. Whereas seasonal mobility has been a core-adaptation mechanism in pastoral livelihood system and a crucial aspect of risk management in the harsh and unpredictable environments, restriction on pastoral mobility, conflicts and stricter cross-border control and defective tenure policies pose threats to sustainability of pastoral livelihoods. In the 21st century, the pastoral communities are not only living in a 'shrinking' world characterised by the re-emergence of walls and other barriers; but also, a world where cross-border mobility is increasingly being perceived as a security threat. The mobile communities in this region are increasingly finding themselves in the cross-hairs of negative perceptions as both an environmental and a national security threat. As a result, these mobile communities have increasingly found themselves subjected to administrative and regulatory barriers to movement as central authority has progressively made its way to the once far-flung frontier areas. In order to address these challenges and protect pastoral ecosystem within its Member States, IGAD Member States have adopted regional Protocol on Transhumance that will facilitate free and orderly cross-border transhumance in the region.

Investing in adapting pastoralist and agro-pastoral systems to future climate change is essential. This requires an appreciation of the fact that we need to start taking action now in order to have the right systems in place by the time the impacts of climate change are felt. The IGAD Centre for Pastoral Areas and Livestock Development (ICPALD) partnered with the IOM Regional Office for the East and Horn of Africa in assessing the climate change impact on pastoralism and mobility in the IGAD Region, to highlight the key hazards facing pastoralists in the years ahead, and to identify the foundations of pastoralists' adaptive capacity. The report has succinct recommendations for the Member States and regional actors, which will inform future interventions to further address mobility associated with drought and other climate change effects amongst the pastoralist communities in the IGAD region.

Dr. Solomon Munyua
Director, IGAD Centre for Pastoral Areas and Livestock Development (ICPALD)

ACKNOWLEDGEMENTS

This report was developed through invaluable contributions from several experts. This study was conducted by Cory Rodgers in close collaboration with IOM's Migration, Environment and Climate Division at the Regional Office for the East and Horn of Africa, and with the IGAD Centre for Pastoral Areas and Livestock Development (ICPALD).

The author expresses his thanks to Lisa Lim Ah Ken (IOM) and Japheth Kasimbu (ICPALD) for their guidance as coordinators on this assignment. Technical support was provided by ICPALD team including Dr. Solomon Munyua, Dr. Dereje Wakjira and Dr. Ayan Mahamoud, who provided valuable feedback on an early draft of this report. Special thanks goes to the IGAD Member States including Ethiopia, Kenya, Somalia, Sudan and Uganda for their invaluable technical inputs on the report and Djibouti and South Sudan for their affirmation.

A number of independent scholars kindly provided their expert comments during the drafting of this report, including Gregory Akall, Elsa Cattani, Vincenzo Levizzani, Gebremedhin Gebremeskel Haile and Greta Semplici. Special thanks goes to Saverio Krätli for his critical review. The advice and feedback received by these experts improved the quality of the report many times over. The final editing of the report was undertaken by IOM and ICPALD.

ACRONYMS

AU	African Union
C2ES	Centre for Climate and Energy Solutions
FAO	Food & Agriculture Organization of the United Nations
GHA	Greater Horn of Africa
ICPALD	IGAD Centre for Pastoral Areas and Livestock Development
IGAD	Intergovernmental Authority on Development
ILRI	International Livestock Research Institute
IPCC	Inter-governmental Panel on Climate Change
IOM	International Organization for Migration
ITC	IGAD Transhumance Certificate
MECC	Migration, Environment and Climate Change
PoT	Protocol on Transhumance
RPLRP	Regional Pastoral Livelihoods Resilience Project
UNFCCC	United Nations Framework Convention on Climate Change
WFP	World Food Programme

EXECUTIVE SUMMARY

Pastoralism offers a productive and profitable—but also sustainable—form of food production in many settings across the region covered by the Intergovernmental Authority on Development (IGAD). While climate change is exacerbating many of the existing environmental challenges facing livestock producers—especially drought—pastoralism nonetheless offers an extraordinarily resilient form of primary production that is well-suited to adapt to these changes. In fact, given future projections for the volume and variability of precipitation across much of the IGAD region, pastoralism may become an even more crucial contributor to regional food security, sustainable livelihoods and economic development in the 21st Century.

Policies and programmes to support pastoral resilience often focus on promoting specific adaptations. While this may be beneficial in the short-term, trends change and old adaptation strategies may become less suitable or even maladaptive. Rather than following pre-selected adaptation pathways, pastoralists must be equipped to adjust their adaptive strategies in response to ever-shifting climatic and environmental changes. Accordingly, climate resilience policies should focus not only on promoting specific adaptations, but on providing long-term support for adaptive capacity.

Adaptive capacity refers to the ability of pastoralists to successfully respond and adapt to evolving challenges as well as emerging opportunities. It relies heavily on optionality, which encompasses the range of strategies that people have at their disposal to respond to challenges or take advantage of opportunities. One important example of optionality is the ability to move herds quickly and flexibly to access water and pasture as they become available at different places and times. If movement is restricted, optionality is diminished, thereby reducing the capacity of pastoralists to respond and adapt to shifting pasture and water availability.

This report brings together the most recent literature on pastoralism, mobility and climate change in the IGAD region in order to highlight the regional climate hazards facing pastoralists in the years ahead, and to identify evidence-based strategies for promoting their resilience in the face of adverse and often unpredictable environmental changes. The report is structured as follows:

Chapter 1 begins with an overview of key concepts and an outline of the regional and thematic scope of this study.

Chapter 2 reviews the key climate change trends and projections in the IGAD region. These include less reliable rainy seasons and more frequent drought events. The short rains may experience increased precipitation in some areas, but this rainfall would probably occur with high intensity, thus resulting in flooding and high levels of run-off wherein much water does not permeate the soil. Changes in temperature profile include higher average temperatures and longer periods of extreme heat.

Chapter 3 describes the hazards that these climate trends present to pastoralists. Most climate hazards are amplifications of existing challenges to which pastoralists are already responding with varying levels of adaptive success. Key hazards include increased frequency, intensity and duration of droughts, floods and other extreme precipitation events, changes to rangeland ecology that may reduce seasonal reliability of fodder, increased exposure to heat stress, changes in the geographical distribution of livestock disease and additional risks associated with changing conflict scenarios.

Chapter 4 reviews the foundations of adaptive capacity among pastoralists in the IGAD region. Key pillars of optionality are reviewed, including the extensivity of rangeland ecosystems (which is disrupted by restrictive border regimes), the possibility for trans-border mobility, the diversity of pastoralists' economic profiles, and the ability of pastoralists and their institutions to participate effectively in political processes.

CHAPTER 1: INTRODUCTION

Pastoralism is a diverse but widespread way of life across the IGAD region. In 2014, the World Bank estimated that there were about 120 million pastoralists globally, 50 million in Africa, and 12-22 million in the Horn of Africa region (World Bank 2014). While data on pastoralists are often insufficient to generate national figures, rough estimates and tentative figures are indicative of the scale and significance of pastoralism (see Table 1). Geographically, rangeland ecosystems make up about 61% of the landmass in Africa (Galvin *et al.* 2008), and their extent has been increasing in the long-term (Goldewijk *et al.* 2017).

While some classificatory conventions distinguish between pastoralists and agro-pastoralists, the boundary between the two is based on the degree of reliance on agriculture and is often arbitrary. The most fundamental characteristic of pastoralism is the use of strategic herd mobility, which may be referred to as *nomadism* or *transhumance*, to raise livestock. While agro-pastoralism is sometimes described as a sedentary practice (Tadesse 2016), many agro-pastoralists actually maintain some degree of herd mobility, even if only part of the household leaves the permanent settlements and only for part of the year (Krätli *et al.* 2015). Pastoral seasonal mobility is therefore adopted to compensate for the shortages in pasture and water, to escape biting flies and muddy conditions and to avoid large-scale rain-fed and irrigated farming where livestock admission is prohibited (Baker *et al.* 2006). Whether or not a pastoralist household derives part of its subsistence from agriculture does not diminish the importance of strategic mobility for food security, sustainable production and climate resilience. Pastoralists have often lived side-by-side with farmers and adopted complementary livelihood strategies. For that reason, this report dispenses with the distinction between agro and supposedly "pure" pastoralists.

Pastoralists rely on herd mobility to track the shifting availability of water and vegetation. Drylands are often described as spaces of scarcity, but this belies the vast potential that drylands offer to those capable of contending with high levels of variability and uncertainty (Krätli 2015; Nori and Scoones 2019). *Variability* refers to the uneven distribution of water and vegetation across space, as well as the ways that this distribution changes over time. While one area may be desiccated by drought, another nearby blossoms after recent rainfall. This patchwork of heterogeneous conditions is constantly shifting, often in ways that are not completely predictable. Through their mobility, pastoralists are able to access water, graze and browse as they become available at different places and times (Kaufmann, Hülsebusch, and Krätli 2019).

Table 1. Available Data on Pastoralism in IGAD Region

Country	Ethnicities Affiliated with Pastoralism†	Pastoral Lands‡	Estimates of Pastoralist Population
Djibouti	Afar, Somali	Pasture: 73% Other: 26% Combined: 99%	Data not available
Eritrea	Tigre, Saho, Kunama, Rashaida, Bilen, Afar, Beni Amer, Hidareb, Nera	Pasture: 68% Other: 9% Combined: 77%	Data not available
Ethiopia	Afar, Bodi, Borana, Dasanech, Hamer, Murle, Mursi, Nyangatom, Nuer, Oromo, Somali, Suri	Pasture: 20% Other: 51% Combined: 71%	12-15% of National Population [~10 - 12 million people] (Desta 2006)

Kenya	Borana, Dasanech, Gabra, Maasai, Pokot, Rendille, Sakuye, Samburu, Somali, Turkana	Pasture: 37% Other: 45% Combined: 82%	~10% of National Population [~4 million people] [~800,000 households] (Krätli and Swift 2014; Wanyama 2020)
Somalia	Somali	Pasture: 68% Other: 19% Combined: 87%	~60% of National Population †† [~9-10 million people] (2013 National Adaptation Programme of Action)
South Sudan	Dinka, Jie, Mandari, Murle, Nyangatom, Nuer, Toposa	Pasture: 40% Other: 43% Combined: 83%	Data not available *54% report owning livestock (WFP 2018) ††
Sudan	Ahamda, Baggara, Bega, Kababish, Lahaween, Missiriya, Rufaa, Shukria	Pasture: 84% Other: 0%* Combined: 84%	~20% of National Population [~8.5 million] (Casciarri and Ahmed 2009)
Uganda	Bahima, Banyarwanda, Baruli, Basongoro, Dodos, Itesot, Jie, Karimojong, Langi	Pasture: 25% Other: 14% Combined: 39%	~12% of National Population [~5 million people] * estimates vary widely, 1 – 10 mil. [1.1 million households] (Krätli and Swift 2014; Wanyama 2020)

* Data on some countries adapted from table 3.1 by Gaiballah and Abdalla (2018)
* Pastoral land area is calculated by combining two categories ("permanent pasture" and "other") from the 2018 estimates listed in the CIA World Factbook. The category ***other land-use*** is described as land including "built-up areas, roads and other transportation features, barren land, or wasteland", which is often how drylands are classified in this region.
* Estimates based on unspecified data source.

Box 1: Pastoralism and Cultural Identity

As listed in Table 1, some ethnic groups in the IGAD region have a marked cultural affinity to pastoralism. Long histories of livestock-based ways of life have shaped the linguistic and cultural features of many societies: their lexicons are full of important concepts crucial to animal care and ecological awareness; families are organised in ways that meet the unique labour requirements of herd management; environmental and climatic threats become core motifs in ritual. In many parts of the IGAD region, large polygynous families provide the most efficient household structure to manage large family herds. Bridewealth exchange produces broad inter-familial bonds that are important sources of support during times of stress.

Nonetheless, a cultural affinity to pastoralism does not always correspond to the contemporary practice of pastoralism as a livelihood. For example, many of the ethnic groups that make up the Kalenjin group in Kenya's Rift Valley identify with pastoralism as their heritage, but most today practice settled agriculture and ranching. Inversely, while the Tigrinia people in Eritrea are traditionally known as sedentary farmers, a sizeable minority have taken up mobile herding in arid areas over the past few decades. Moreover, the boundaries between ethnic groups are highly fluid, and people often occupy multiple and shifting forms of belonging throughout the course of their lives. As such, policies should recognise the role of culture and customary institutions in the practice of pastoralism, without making access to pastoralist rights dependent on rigid categories of ethnic identity.

Pastoralism is a productive and profitable form of food production. The strategic mobility by which pastoralists move their herds in pursuit of ephemeral vegetation is key to deriving profit from rangeland ecosystems (Kaufmann, Hülsebusch, and Krätli 2019). In Kenya, the average total economic value of pastoralism, which accounts for livestock-based products like meat and milk as well as other goods produced by pastoralist households such as honey, fish and tourism opportunities, was estimated at almost 1.13 billion USD per year between 2011 and 2015 (Nyariki and Amwata 2019). This excludes various "uncomputed values", such as the use of livestock as draught animals, the production of manure fertiliser and the creation of informal employment for herders. While conventional development thinking has long focused on crop production as the lynchpin of the "Green Revolution", research has increasingly shown that pastoralism can be just as productive and profitable as agriculture in many ecosystems, if not more. A comparison between pastoral livestock keeping and cotton and sugar plantations in the Awash Valley of Ethiopia found that pastoralism was consistently the most profitable form of production in terms of revenue per hectare, and with far fewer long-term ecological effects on the soil and hydrology (Behnke and Kerven 2013).

Pastoralism is an efficient yet sustainable method of food production in many ecological settings. For each calorie of input energy, meat production systems in the US produce only 0.4 calories of food energy, whereas pastoralist systems produce approximately 10 calories of food energy. The difference is not only in efficiency, but in carbon emissions: most of the input energy for pastoralism is human labour, while the inputs for industrial production are largely fossil fuels (Kaufmann, Hülsebusch, and Krätli 2019, 357–58). Moreover, pastoralists and their herds provide environmental services such as transportation and dispersal of seeds and nutrients via livestock manure, control of shrub growth and bush encroachment, and trampling of the soil to stimulate grass growth and root development (FAO 2021).

Box 2: Pastoralism and Greenhouse Gas Emissions

One of the major debates in climate research has been the contribution of livestock production to global greenhouse gas emissions. Two prominent reports published by the Food and Agriculture Organization (FAO) identified livestock as the source of between 18% (Steinfeld et al. 2006) and 14.3% (Gerber et al. 2013) of global greenhouse emissions. This raised widespread concern, especially given the projected increases in meat consumption globally (Rojas-Downing et al. 2017), but the studies were also criticised for a number of methodological errors (Glatzle 2014).

The problem with these studies is that the average carbon emissions for global livestock production are not representative of the carbon footprint attributable to African pastoralism (Pelster et al. 2016). Measured in greenhouse gas emissions per unit of meat produced, pastoralism is "greener" than industrial and intensive methods such as ranching. A study from the Qinghai-Tibet Plateau of China showed that pastoralism had an emission intensity (i.e. greenhouse gas emissions per area and per carcass-weight) that was 45.21% and 40.08% lower, respectively, than an intensified livestock production system (Zhuang, Gongbuzeren, and Li 2017). Moreover, not all greenhouse gases are equal; pastoral systems mainly produce methane, which has higher climate forcing but breaks down in a matter of decades. But intensive ranching relies on fossil fuels that emit carbon dioxide, which has an atmospheric lifespan of millennia (Pierrehumbert and Eshel 2015). Moreover, measurements of the "impact" of pastoralism in rangelands require an appropriate baseline; if livestock are hypothetically removed from the ecosystem, they would likely be replaced by wild ruminants or other animals that also produce methane (Manzano and White 2019).

Given current projections for climate change in the IGAD region, pastoralism will remain crucial to realising regional food security, sustainable livelihoods and economic development throughout the 21st Century. Historically, the extent of grazing lands (the total of intensively grazed pasture lands and extensive rangelands) across sub-Saharan Africa has increased from 697 million hectares in 1950 to 805 million hectares in 2000 (Goldewijk *et al.* 2017, 941). Many models have predicted global expansions of dryland areas due to climate change (Huang *et al.* 2016; Feng and Fu 2013), although others have questioned this conclusion because atmospheric aridity – on which many models rely – is a poor proxy for terrestrial aridity (Berg and McColl 2021). Regardless of the extent of drylands, precipitation trends associated with climate change may make crop production increasingly unreliable in many areas that are currently productive, thereby increasing the *relative* importance of pastoralism (Godfray *et al.* 2010, 2772). While intensification of food production has often focused on irrigation and agricultural inputs, the most promising and sustainable means of increasing production in many of the IGAD region's drylands may involve inputs to livestock production (Jones and Thornton 2009; Robinson *et al.* 2015).

Pastoralists are uniquely positioned to adapt to the hazards presented by climate change in the IGAD region. In many parts of the world, increasingly unpredictable weather is experienced as a disruption of long-standing climate patterns. But in many of the drylands where pastoralism is practiced, uncertainty has long been part of the day-to-day experience (Scoones 2004). It is not just that pastoralists are able to *cope* with the unpredictability of droughts and heatwaves and floods; pastoralism as a production system *embraces* uncertainty and strategically exploits the high spatial and temporal variability of resources as the norm (Krätli and Schareika 2010; Roe, Huntsinger, and Labnow 1998; Nori and Scoones 2019).

However, pastoralists' ability to adapt to new and unprecedented conditions (i.e. their "adaptability" or "adaptive capacity") depends on sustaining and strengthening the foundations of this capacity. This includes the freedom to exercise herd mobility, which has been threatened by an array of trends including changes in land use, resource privatisation, and international border controls. While the extent of lands that are ecologically suitable to grazing has long been increasing in much of Africa, the actual use of this land by pastoralists is restricted by lack of legal rights and encroachment by commercial agriculture, the extractives industry and other interests. In recognition of this, the African Union's (AU) *Policy Framework for Pastoralism* (2010) provides a continent-wide basis for protecting and improving the lives, livelihoods and rights of African pastoralists. Section 3.3.3i of the AU framework specifically acknowledges both the contribution of pastoralism to climate change adaptation and the importance of protecting pastoral mobility:

> *Pastoralist production systems evolved over generations as a response to marked rainfall variability, and used the main strategy of mobility to access limited water and grazing resources in large ecosystems. Additional strategies included the rearing of different livestock species, utilizing different types of vegetation and because each species has different watering requirements. Decades before climate change was recognised as a global phenomenon, pastoralists selectively bred their livestock to emphasise traits such as drought resistance and milk production. They also altered the species composition of their herds in the face of rainfall and other trends, such as market opportunities. Pastoralism adapted to drier periods and wetter periods, to changes in disease risks, and to conflict… At policy level, it is important to recognise the considerable adaptability of pastoralism if pastoralists are enabled to practice mobile livestock production, which in turn, means security of access to sufficient rangelands. (p. 129)*

The AU framework provides an important commitment in principle, but its efficacy depends on regional and national level implementation. National policies affecting pastoralism differ from country to country (Tadesse 2016), but IGAD has made its own regional institutional and policy framework for pastoralism. The establishment in 2012 of a specialised Centre for Pastoral Areas and Livestock Development (ICPALD) mandated to articulate, facilitate and support policies and programmes in cross border areas to promote the resilience of pastoralists and agro-pastoralists is a solid commitment to these communities on the part of

IGAD Member States. Other initiatives include the Regional Pastoral Livelihoods Resilience Project (RPLRP), a major five-year World Bank funded project implemented by Ethiopia, Kenya, and Uganda which includes a range of activities to support livelihoods, natural resource management, improve early disaster warning systems, and provide livestock health services. IGAD has facilitated bilateral and multilateral MOUs between its Member States for joint border surveillance and disease control, in particular at the following nexuses: Ethiopia-Kenya, Kenya-Somalia, Ethiopia-Djibouti, Ethiopia-Somalia, Djibouti-Somalia, Kenya-Uganda and Ethiopia-Kenya-South Sudan-Uganda. More recently, the adoption of the Protocol on Transhumance by 7 of the IGAD Member States has created a regional framework for facilitating cross-border movements by pastoralists and their herds.

Conceptual Framework and Report Outline

The ways that we understand and discuss the interface between climate and communities is shaped by the terms that we use. Working Group II of the Intergovernmental Panel on Climate Change (IPCC) is an especially important influence on this lexicon. They focus their reports around three core concepts - Impact, Adaptation, and Vulnerability - which have become central to the climate discourse. These terms are defined as follows:

Impacts: "Effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes."

Adaptation: "The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change."

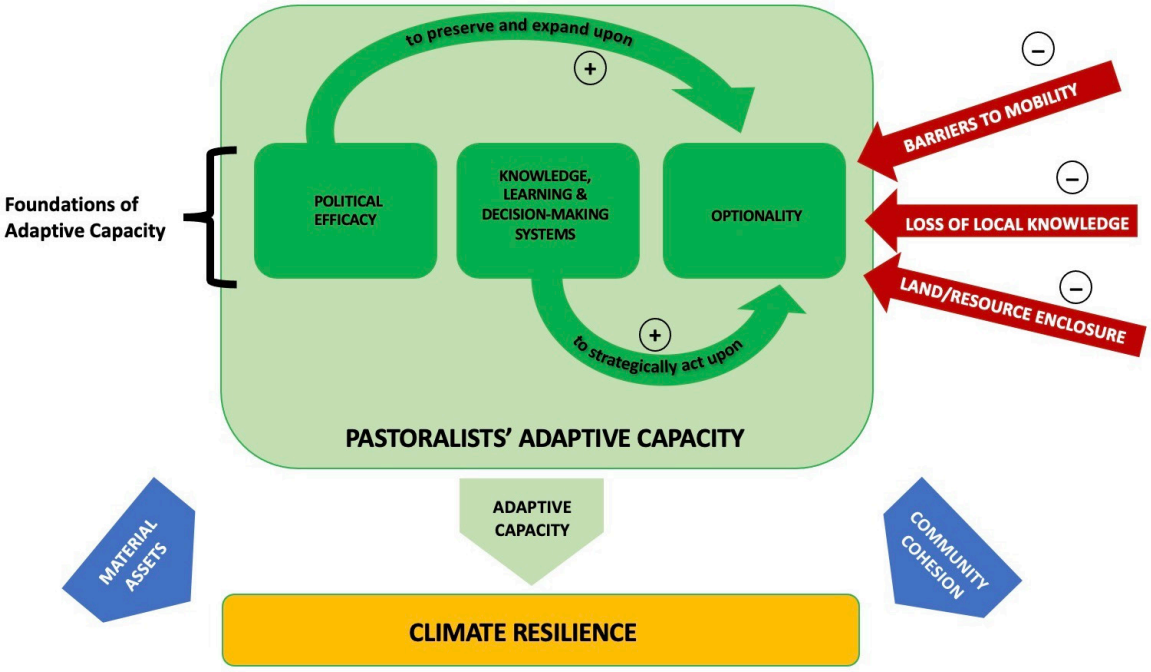
Vulnerability: "The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt."

These concepts are widely recognised and appear frequently in the discourse of policy-makers, service providers, community-based organisations and others working to support pastoralism. In the terms of many mainstream policy documents, pastoralists are "vulnerable" to the "impacts" of climate change, and programmes should promote "adaptations" to these challenges.

However, there are some problems with the ways that these terms have been applied in policy discourse, which this report has attempted to take into account. For one, the everyday meaning of the word *impact* is in many ways ill-suited to describing the ways that climate change affects communities. Many studies have investigated and attempted to quantify the *impacts* of climate change on pastoralists and rangeland ecosystems (Abdalla and Gaiballah 2018; Boone *et al.* 2018; Herrero *et al.* 2016). They describe how climatic and environmental changes affect livestock ("direct impacts") as well as their influences on ecological and socio-economic systems ("indirect impacts"). However, the notion of an *impact* implies linear causal pathways and discrete causal agents or events, like a projectile impacting its target. This represents the gradual, processual and complex ways that climate change influences communities and their socio-ecological systems. Rather, climate change is often experienced as an amplification of existing challenges that pastoralists are already facing, and to which they are already responding with varying levels of success. Some research on climate change and pastoralism is shifting away from "impact" studies and toward more dynamic models of "transitions" and nexuses (King, Unks, and German 2018; Ng'ang'a and Crane 2020). Accordingly, this report dispenses with the notion of "climate impacts". Instead, ***chapter 2*** reviews the key climate change trends and projections in the IGAD region, and ***chapter 3*** describes how these trends create 'hazards' for pastoralists

A second problem is that the term *adaptation* is often used in policy discourse to refer to specific strategies, rather than an ongoing process of responsive adjustment. But, as Robinson and Berkes succinctly explain, people may be highly adapted to a particular set of circumstances and stresses, "and yet have little capacity to adapt to new kinds of changes, shocks and stresses, or surprises" (2011, 1185–86). For this reason, policies that support specific *adaptations* in the short-term do not necessarily contribute to pastoralists' *ability to adapt* – i.e. their adaptive capacity – especially as conditions change and old adaptive strategies become less suitable. Projects that promote particular adaptations may have short-term benefits, but as circumstances change, so must adaptive pathways. With this in mind, ***chapter 4*** reviews the foundations of adaptive capacity among pastoralists in the IGAD region. Rather than a list of specific adaptive strategies—which are only relevant to specific situations and problems—this chapter discusses the conditions required for pastoralists to engage responsively and successfully in adaptive processes in the decades ahead. As shown in Figure 1, a key condition for adaptive capacity is 'optionality', which entails the range of options and strategies that pastoralists have at their disposal to contend with challenges and embrace opportunities.

Figure 1. Adaptive Capacity in the Context of Pastoralism



A third problem pertains to the concept of vulnerability, which encompasses both "sensitivity or susceptibility to harm" and "lack of capacity to cope and adapt". Policymakers often call for interventions to reduce vulnerability to climate change. While this seems like a commonsense objective, the discourse around vulnerability sometimes frames pastoralists as inherently vulnerable, which in turn perpetuates a perception that pastoralism is out-dated, unable to change, and an obstacle to adaptation. In fact, pastoralism can be both highly vulnerable and highly adaptive in the face of adverse climate change. In other words, pastoralists can be negatively affected by climate hazards, but also well equipped to cope with and respond to these challenges in the long run.

To avoid the pitfall of the vulnerability discourse, this report focuses less on the objective of reducing vulnerability, and more on promoting climate resilience. Resilience refers to "the capacity of an individual, household, population group or system to absorb, adapt, and transform from shocks and stresses without compromising – and potentially enhancing – long-term prospects" (Wekesa 2016, 19). As shown in Figure 1, adaptive capacity is a key pillar of climate resilience for many pastoralists. Accordingly, Chapter 5 of this report identifies ways to support climate resilience, and to avoid eroding the optionality upon which their adaptive capacity is founded.

CHAPTER 2:

CLIMATE TRENDS IN THE EAST AND HORN OF AFRICA

Climate Trends in the East and Horn of Africa. ©ICPAC

This chapter succinctly reviews the key climate change trends and projections in the Greater Horn of Africa (GHA), which encompasses the IGAD Member States of Djibouti, Ethiopia, Eritrea, Kenya, Somalia, South Sudan, Sudan and Uganda. Many definitions of the GHA region also include the non-IGAD countries of Tanzania, Rwanda and Burundi. Selecting an appropriate scope for this chapter is complicated by the fact that research findings are presented for various geographic ranges, none of which perfectly aligns with trade blocs and political designations such as IGAD. GHA is therefore taken as an imperfect but acceptable approximation of the IGAD region.

Many of the trends reviewed here are derived from the reports of the Intergovernmental Panel on Climate Change (IPCC), especially the African regional sections of the ***Physical Science Basis*** (Christensen ***et al.*** 2013) and the ***Impacts, Adaptation and Vulnerability*** (Niang ***et al.*** 2014) components of the Fifth Assessment Report, and several special reports (IPCC 2019b; 2019a). However, climate science is always improving, with greater data availability, increased granularity, and better understanding of the links between local terrestrial weather patterns and distant atmospheric and oceanic systems. This chapter includes some updates from recent academic publications, and also highlights a few areas of ongoing debate. Only the Working Group I (Physical Science Basis) component of the Sixth Assessment Report (Ranasinghe ***et al.*** 2021) had been published at the time of writing.

Anthropogenic climate change is already observable. It is estimated that human activities have already caused a 1°C rise in global temperatures above pre-industrial levels, with associated changes in ecosystems (IPCC 2019b). In sub-Saharan Africa, annual temperatures have increased by about 0.03°C since at least 1975, with increased incidence of extreme weather events and longer heat waves (Girvetz ***et al.*** 2019; Seneviratne ***et al.*** 2012). For instance, Somalia is one of the most vulnurable and climate-sensitive countries in IGAD region, as its livelihoods are directly dependent on productive sectors such as livestock, forestry, crop production and fisheries, all of which are very subject to climate change and climate variability.

Global and regional climate models suggest that average temperatures across Africa will continue to increase under all of the likely global warming scenarios (Niang *et al.* 2014)**.** These scenarios are based on different future rates of carbon emission, which in turn affect the resulting changes in global warming trends. For the scenario in which global temperatures increase by 2°C, tropical Africa is expected to see regional temperature increases that are higher than the global average (Déqué *et al.* 2017). Within the GHA region, warming is projected to be greater in the northern parts of the region (Osima *et al.* 2018). In regions with permanent glaciers, such as Mount Kenya, the changing temperature regimes may reduce or eliminate snow cover, with consequences for the seasonal availability of riverine water (Ranasinghe *et al.* 2021).

Projections for the GHA region also show more frequent occurrence of intense heat waves (Perkins-Kirkpatrick and Gibson 2017). Some climate change scenarios project that by 2050, there will be 50 to 100 more days per year with extreme maximum temperatures (exceeding 35°C) in the GHA region (Ranasinghe *et al.* 2021; Coppola *et al.* 2021), which roughly corresponds to the North Eastern Africa Region (NEAF) used in the IPCC's geographical category system.

While temperature projections are relatively robust, projections for precipitation are much more uncertain (Ericksen *et al.* 2013). The Sixth Assessment Report acknowledges "spatial extensions in seasonal agricultural droughts in recent decades" across East Africa, but points out that "it is difficult to disentangle these trends from climate variability" (Ranasinghe *et al.* 2021). Interdecadal variability, in particular, creates complications for future climate projections: rather than a linear trend, some decades may be characterised by drying while others experience increased precipitation (Déqué *et al.* 2017). Beyond average precipitation projections, estimates of future aridity in East Africa are also complicated by the uncertain balance between precipitation and evaporation (Kew *et al.* 2019; Ranasinghe *et al.* 2021).

Another important source of uncertainty is the incomplete understanding of cross-regional atmospheric teleconnections. Weather patterns across the GHA region are influenced by dynamics elsewhere. The El Niño Southern Oscillation (ENSO), a pattern of warming and cooling across the tropical Pacific Ocean, has an important affect on drought in the GHA region. It is projected to become stronger in the years ahead, which would likely lead to more severe drought consequences in the region (Endris *et al.* 2019, Rifai *et al.* 2019). The Indian Ocean Diode (IOD) is a shifting temperature gradient in the Indian Ocean, in which the western ocean temperatures nearer to Africa become warmer and colder relative to the eastern temperatures. This in turn drives inter-annual and even inter-decadal variation in weather patterns across the GHA region, and has been shown to be an active driver of climate extremes. In particular, strong positive IOD conditions affect the short rains and can exacerbate flooding in equatorial East Africa (Douville *et al.* 2021). Climate trends in the southern part of the GHA region are also affected by the directionality of airflow, because winds from the west bring wetter air from the Congo. The occurance of such westerlies in any year is affected by a range of broader phenomena, including the Madden Julian Oscillation (Finney *et al.* 2020).

Overall annual precipitation is expected to increase across the GHA region, but this general trend glosses over important spatial and temporal variations. There is a general trend in which the western parts of the region will see decreasing rainfall while the eastern parts see increases (Ranasinghe *et al.* 2021). Temporal variations include complex effects on seasonality, frequency and duration of rainfall (Dunning, Black, and Allan 2018). The conjunction of increased annual precipitation and increased drought risk has been described as a "climate paradox" (Lyon and Vigaud 2017).

The key explanation for this is the intensification of precipitation—with a greater volume of rainfall per rain event (Ericksen *et al.* 2011)—which results in high levels of run-off that do not permeate the soil. Two related trends are also characterised by polarisation of the distribution of precipitation: temporally, it is projected that dry spells will become longer and wet spells will become shorter (Osima *et al.* 2018), and spatially, dry regions are getting drier and wet regions are getting wetter (Haile *et al.* 2020).

The seasonality of rainfall is expected to undergo a similar polarisation, although the changes are complex and locally-specific. Seasonal precipitation in the GHA region is generally described as bi-modal, with 'long rains' occurring from March to May and 'short rains' from October to December. Across the region, long rains are generally getting drier while the short rains get wetter (Liebmann ***et al.*** 2014; Brown ***et al.*** 2017; Cattani ***et al.*** 2018; Nicholson 2017). There are some exceptions to this. For example, projections for parts of western Ethiopia show increased precipitation during the long rains (Gebrechorkos, Hülsmann, and Bernhofer 2019). Conversely, parts of eastern Kenya may experience decreasing wet season precipitation (Cattani et al. 2018). Moreover, the projections are of varying quality: in the Fifth Assessment Report of the IPCC, evidence for increased short rains was relatively robust, whereas the models for long season rains are poorer (Christensen et al. 2013). Some scholars have recently called into question the adequacy of the bi-modal rainfall model in the region, suggesting that the long rains show too much intraseasonal variability to be treated as a single season; Nicholson (2017) suggests that each month in the long rains period should be treated separately.

Projections also suggest more frequent extreme weather events. The intensity of extreme events such as flooding has increased in the GHA region since the 1990s (Ongoma, Chen, and Omony 2018). Depending on the level of greenhouse emissions in the years to come, the overall drought area in the region is projected to increase by 16 to 54 percent. However, the duration, frequency and intensity of droughts will increase in some areas (Sudan, Somalia, and South Sudan) while decreasing in highland areas of Kenya, Uganda and Ethiopia (Haile ***et al.*** 2020). Projections for 30-60 years in the future in the Horn of Africa show increased frequency of short drought events (6 months to a year) but decreased frequency of long drought events (over one year) (Gizaw and Gan 2017).

The trends above have important implications for pastoralists, who predominantly live in dryland areas where average annual rainfall is expected to diminish. As long rains become less reliable, pastoralists may face increasingly frequent drought events. Increased precipitation in the short rains may provide some respite, but the intensity of rainfall in this period can diminish the usefulness of these rains. Changes in temperature profile will have additional effects on livestock, fodder and local ecology. The following chapter considers the hazards that these changes may have for pastoralism in the GHA region.

CHAPTER 3:

CLIMATE HAZARDS IN THE CONTEXT OF PASTORALISM

Climate hazards in the context of Pastoralism. ©ICPAC

Many of the *hazards* presented by climate change are amplifications of existing challenges that pastoralists have long faced, and to which they are already responding with varying levels of adaptive success. The current trajectory of climatic trends suggests that these challenges will be exacerbated in the decades ahead, with implications for the food security of pastoralists and other residents of ASAL areas (Kogo, Kumar, and Koech 2021). Key hazards include the following, as elaborated below:

- Droughts, floods and other extreme precipitation events
- Rangeland degradation
- Livestock disease and heat stress

This chapter concludes with a discussion of the ways that these hazards are affecting human security in pastoralist areas, and narratives around the climate-conflict nexus.

3.1 Droughts and Floods

The most widely recognised climate hazard facing pastoralists is the amplification of drought risk. Drought risk is not simply a matter of meteorological conditions; rather, it is a function of the probability that precipitation will be insufficient (***hazard***), the degree to which people and their assets are affected by this insufficiency (***exposure***), and the susceptibility of those who are exposed to this hazard (***vulnerability***) (Ahmadalipour ***et al.*** 2019). The most acute aspect of droughts in pastoralist areas is the reduction in the availability of fodder for livestock (Thornton 2010; Brown ***et al.*** 2017). Droughts emerge gradually when rainfall is insufficient, especially across multiple seasons. The 2017 drought across much of the GHA region followed lower-than-average precipitation across the 2016 rainy seasons, with devastating results the following year (Anyadike 2017). In Kenya, this event put at least 20% of the country's pastoralists

in need of humanitarian assistance (UNOCHA 2017). And even in regions where the climate has long been characterised by aridity, including much of Sudan, the heavy reliance on imports makes the population vulnerable to climate-induced price volatility in other regions.

The effects of drought are not limited to diminished livestock productivity. Regardless of whether they are labeled as pastoralists or agro-pastoralists, all mobile livestock producers rely on trade in agricultural goods and are thus affected by changes in regional or local crop production and food prices. In the Somali and Afar regions of Ethiopia, reductions in rainfall have resulted in crop shortages, which drive up the price of grains and force pastoralists to sell off even more livestock to meet their nutritional needs (Brown *et al.* 2017). Moreover, many livestock \feeds on the leftover byproducts (stover) of harvested crops, a shortage of which can be a major constrain on ruminant production (Herrero *et al.* 2012). Droughts can also have a direct effect on human health because lack of freshwater forces pastoralists to turn to less preferable water sources, which may be polluted or highly saline. A study among Dassanech pastoralists living on the shores of Lake Turkana found that consumption of highly saline water is associated with both hypertension and hyperdilute urine, the latter suggesting progressive kidney failure (Rosinger *et al.* 2021).

The primary response among pastoralists in the face of a mounting risk of drought is to move. In non-drought conditions, many pastoralists move seasonally between drier areas that flourish temporarily after the rains and less arid areas that can sustain some vegetation throughout the year. However, during drought, even the dry season pastures may become bare. For example, many pastoralists in northern Kenya and southern Ethiopia rely on montane forests in the dry season; but these small refuges within the wider dryland plains are expected to experience some of the most extreme precipitation decreases in the coming decades (Cuni-Sanchez *et al.* 2019). When the usual dry season pastures are depleted, the ability to move further abroad is crucial to sustaining the herds during drought, but it also brings dangers, such as conflict with other pastoralist groups or disputes with conservancies and agricultural schemes (Tilahun *et al.* 2016; Bartels 2016). For some groups, the pattern is reversed; in northern Kenya, for example, the dry season pastures of Gabra and Borana herders are located close to areas where they are the predominant ethnic group, while travel to wet season pastures takes them into surrounding lowland plains where they interact with other groups (Ember *et al.* 2014). Aside from mobility, the availability of graze can also be adjusted with some infrastructural interventions. Sand dams have been shown to increase the availability of vegetation during periods of extended droughts, and also allows vegetation to recover more quickly when the rains arrive (Ryan and Elsner 2016).

Another widespread and ongoing response to increasing drought risk in the IGAD region is to adjust herd composition. Many in the region are replacing cattle with more drought-resilient species such as camels and shoats (Ericksen *et al.* 2013). This general trend varies from place to place: in Ethiopia, Afar and Borana herders are mostly shifting from cattle to camels and goats, while Somali herders are shifting from camels to goats and sheep (Gebremichael and Kifle 2009; Gebresenbet and Kefale 2012). Climate is not the only driver of changing herd composition. Many Beja herders in Sudan have changed camel species to produce more milk, in response to market demand (Gaiballah and Abdalla 2015). These species may be less climate-resilient, creating a trade-off between drought resilience and profitability. Aside from species, pastoralists also manage the sex ratios of their herds, keeping more reproductive females to make herd recovery faster after drought and increase milk production (Gaiballah and Abdalla 2018).

Even where they shift the overall ratio of the herd toward less climate-sensitive species, herders often attempt to retain a diversity of livestock. This allows them to spread risk, in case one species is lost to disease or depletion of its food base (Gebresenbet and Kefale 2012). Retaining multiple breeds sometimes requires splitting the herd in order to pursue the different grazing or browsing needs of different species. Other mechanisms for spreading risk include investments in less drought-sensitive assets (e.g. savings accounts) as well as customary stock associations that serve as a form of insurance in case of losses during drought (Amare *et al.* 2019).

More extreme precipitation events are also likely to result in more frequent and more severe flooding. This topic has received very limited attention in pastoralism research; flood risks are usually mentioned by researchers only in passing. One exception is Little, Mahmoud and Coppock's (2001) study on the El Niño rains of 1997/98 in northern Kenya and southern Somalia. Floods destroyed roads and increased the spread of mosquito-borne Rift Valley Disease. In her research from Turkana, Omolo (2010) also describes how flash floods can result in massive losses of livestock and property. During the author's research in Turkana in 2015-2016, many herders reported losses as livestock were swept away by the brief but rapid flooding of seasonal rivers. This risk is common to the various river valleys inhabited by pastoralists, such as the Omo in southern Ethiopia, the Awash Valley in the Afar region, and the Shabelle and Juba rivers in Somalia. In most of these areas, flooding is an important seasonal event that replenishes soil nutrients and groundwater reserves. But floods are dangerous when they occur suddenly and are not anticipated, or when people are not able to prepare themselves; improved early warning systems can significantly reduce this risk.

While some responses to flooding are the same as those deployed during drought (e.g. moving the herd), there are important differences. Herders exposed to the 1997/98 El Niño rains in southern Somalia were unaccustomed to such prolonged flooding, thus limiting their ability to respond. This stood in contrast to the more "normal" risk of drought, for which they are ready to respond effectively. In a drought, herders can offload animals at markets, where they often receive poor prices but can nonetheless purchase food. Floods, on the other hand, can destroy transport infrastructure, making markets inaccessible or reducing activity by potential buyers, thus removing the option of emergency livestock sales. Nonetheless, herd mobility – and the ability to move away from the disaster or less toward affected areas – remains an important response strategy (Little, Mahmoud, and Coppock 2001).

3.2 Rangeland Degradation

Climate change may diminish the productive potential of many rangelands. The aridity of African drylands has been increasing since at least 1950 (Huang *et al.* 2017), and this trend is expected to continue in many places, with reductions in mean herbaceous biomass (Godde *et al.* 2020). Some of the decrease in biomass due to water stress may be offset by increases in growth due to higher carbon dioxide levels (Abdalla and Gaiballah 2018). Existing land degradation in the Horn of Africa is only partially explained by rainfall decreases and may also be attributable to population increases and changing land use regimes, all of which can interact to deplete rangeland resources (Pricope *et al.* 2013). The projected expansion of agricultural activities into savanna ecosystems in East Africa has and will continue to contribute to drier conditions (Olson *et al.* 2008).

Climate change will likely alter the species composition of rangeland flora, which can cause bush encroachment or diminish the nutritional value of forage. The forage upon which pastoralists rely is highly sensitive to changes in climate (Boone *et al.* 2018). With higher temperatures and greater water stress, plant tissues become more lignified and therefore less digestible (Sangeda and Malole 2014). Rising carbon dioxide concentrations may reduce the transpiration rates for shrubby species, thus giving them a greater competitive advantage over grasses and other graze species (Magita and Sangeda 2017). Similarly, higher temperatures and drought conditions may increase the risk of fires; while occasional fires are a normal and necessary part of many rangeland ecosystems, higher fire frequency may further shift the species composition (Sangeda and Malole 2014).

Arid and semi-arid regions in Ethiopia and northern Kenya have already seen invasions by tree and shrub species like *prosopis*, as well as some succulents (Witt, Beale, and van Wilgen 2018), which are less suitable as food for livestock. There are still large uninvaded areas where climate change is likely to increase the ecological favourability for *prosopis* to spread (Eckert *et al.* 2020; Sintayehu *et al.* 2020).

Various customary governance practices and herding techniques are involved in maintaining rangeland ecosystems. Where pastures have been depleted, reducing livestock (i.e. moving them elsewhere) or enforcing a resting period can give vegetation a chance to regenerate. Reseeding of desirable

species is also an option, although this strategy is usually only possible with external intervention and assistance due to the high capital requirements (Mussa, Hashim, and Teha 2016). Fire has played an important role in preventing or even reversing bush encroachment, although planned fires have been banned in some places (see Solomon, Snyman, and Smit 2007 for an example from the Borana region of Ethiopia). Manual clearance of shrubs is an option as well, although it is highly labour-intensive (Mussa, Hashim, and Teha 2016).

3.3 Livestock Health Risks

As climate regimes shift, there is concern about the increased geographic range of some disease pathogens and their vectors, such as mosquito-borne Rift Valley Fever and tick-borne East Coast Fever (ICPALD 2018). Warming is likely to have a positive effect on their proliferation in places that are now cool or temperate, although the warming of places that are already hot may inhibit their growth. Rising temperatures may generally favour greater growth of mycotoxin-producing fungi in pastures and fodder, with risks for both livestock and people (Gbashi *et al.* 2018). Aside from increases in the geographic range of some disease vectors, more migrations in response to climate change may put pastoralists and their livestock into increased contact with some disease vectors (Bett *et al.* 2017).

Heat stress can also make animals more susceptible to disease. Most animals have an optimal temperature range within which they thrive; exposure to temperatures above this range can reduce animal growth, milk yield and reproductive performance, and it can also hamper the immune and endocrine systems, making animals more susceptible to infection (Das *et al.* 2016). Aside from the rise in average annual temperature, climate change is also projected to increase the frequency of extreme temperatures across the GHA region. Because heat stress can reduce an animal's ability to mount an immune response to infection, it can amplify the detrimental risk of exposure to endemic pathogens (Bett *et al.* 2017). A recent assessment of projections for eastern and southern Africa suggests that increases in the frequency of heat-stress periods in the coming decades may have an adverse effect on livestock, especially in South Sudan (Rahimi *et al.* 2021). However, pastoralists raising indigenous breeds will likely be less affected than those relying on exotic and crossbreeds that are less drought-tolerant.

There are a number of ways to reduce the risk of heat stress in livestock. This includes adjusting feed intake and thereby reducing metabolic heat production (although this is often impracticable where herds are grazing freely), enhancing heat loss and dissipation (e.g. directing animals to shade during the midday heat), and genetic selection for heat tolerance (Renaudeau *et al.* 2012; Jack *et al.* 2021). Pastoralists have long been selective about species and breed selection, and claims that zebu cattle (*B indicus*) are more tolerant of heat stress have been confirmed by genomic analysis (Kim *et al.* 2017). When selecting sheep for breeding, pastoralists in the Jijiga, Shinile and Hararghe zones of eastern Ethiopia place greater emphasis on heat tolerance than do people who rely to a greater extent on agriculture (Nigussie *et al.* 2013).

However, an "adaptive" change in herd composition can have both pros and cons. For example, while many pastoralists are turning to camels due to their resilience in the face of drought and heat stress, this also puts their herds at greater risk of losses from diseases to which camels are particularly susceptible, as well as the risk of zoonotic diseases like Q Fever and MERS. Knowledge of camel diseases and associated veterinary care and biosecurity controls for camels are generally lower in the IGAD region than for cattle, goats and sheep (Browne *et al.* 2017).

3.4 The Climate-Conflict Nexus

In addition to the climate hazards listed above, there is also concern about the ways that climate hazards interface with another source of destitution among pastoralists: violent conflict. Among pastoralists, it is widely recognised that climatic hazards—especially drought—can exacerbate inter-personal as well as inter-communal competition for scarce pasture resources, especially amidst growing population density. This climate-conflict nexus suggests that increases in the duration, intensity and frequency of drought will, in turn, drive greater conflict.

While climatic change can certainly affect conflict, its role should not be overstated. Globally, it is estimated that one standard deviation change from normal temperature or rainfall levels results in a 14% rise in the frequency of intergroup conflict (Hsiang, Burke, and Miguel 2013). But correlation does not always reflect causation: a systematic review of conflict in the GHA region shows that climatic variables have far less explanatory value than other variables, such as historical marginalisation and long-standing political disputes (van Weezel 2019). Simplistic 'climate conflict' narratives can overwrite longer-standing historical factors involving oppression, dispossession and marginalisation (Verhoeven 2011).

Rather than determining whether climate change is statistically correlated with conflict, it is more practically useful to understand the specific mechanisms that underlie the climate-conflict nexus in any given context (Lind, Ibrahim, and Harris 2010, Salehyan 2014). These mechansims work across different scales. Whereas climatic factors may influence inter-group relations locally by increasing resource competition or pushing different communities into the same territories, such tensions can also be exploited by higher-level actors like militias, elites, or state actors (van Baalen and Mobjörk 2018). In Darfur, for example, worsening droughts in the 1970s and 80s reduced the crop output among agriculturalists, reducing their ability to continue trade with Rezaigat camel nomads. While this did not spark conflict directly, it provided an opportunity for the government to recruit Rezaigat herders into their militias.

One well documented mechanism of climate-induced conflict is the "spill-over effect" during drought. This refers to the scenario in which drought-affected pastoral areas remain calm, while neighbouring agrarian areas see an uptick in conflict. This occurs because pastoralists leave the drylands and travel further abroad to less arid areas in search of graze (Mcguirk and Nunn 2020). The resulting conflicts have often been described as farmer-herder conflicts. However, in many contexts, cultivators and pastoralists are normally at peace, and may even enjoy collaborative arrangements through which herders can graze their animals on the vegetative matter leftover in the fields after harvest, leaving behind manure as fertiliser (Krätli 2015). Conflicts emerge when pastoralists move into new areas where such arrangements have not been made, and at times that are not conducive to cooperation (e.g. immediately pre-harvest). In Sudan, worsening drought conditions during the last quarter of the end of the Twentieth Century forced Baggara and Kababish herders to move further south than was usual, putting them into conflict with farmers in Southern Kordofan (Chavunduka and Bromley 2011). More recently, in South Sudan, the destruction of farms during the seasonal migration of cattle between wet and dry season pastures has incited conflicts between Jurbel agriculturalists and Dinka pastoralists, and between Bari agriculturalists and Mundari pastoralists (World Food Programme 2012).

The role of institutions is a key mediating factor in the conflict-climate nexus (Buhaug 2015). While institutions can be responsible for both the eruption and the prevention or resolution of conflict, climate-induced violence is more likely to occur in places with less effective mediating institutions (Detges 2017). Across three counties in the Rift Valley and Western Kenya, inter-group dialogue by community-level institutions was found to be effective in reducing the resort to violence during drought, while formal rules imposed by states had no effect (Linke *et al.* 2015). The influence of institutions may vary seasonally. Several studies from Kenya have shown that pastoral conflict is higher in the wet season than the dry season, because dry season scarcity forces people to look to collective institutions and inter-communal dialogue to manage the widespread scarcity of water and graze (Witsenburg and Adano 2007; Adano *et al.* 2012; Linke *et al.* 2015).

While the effect of climate on insecurity is complex, the effect of insecurity on environmental change in the drylands is clearer. The risk of insecurity limits pastoralists' options for pasture and often requires them to stay within secure zones or close to urban areas, and the intensified grazing of these areas results in degradation. Access to pasture within this area may be highly unequal, varying according to each household's social networks, herd size and wealth level (Letai and Lind 2013). Moreover, the long-term abandonment of grazing in insecure areas results in bush encroachment accompanied by the arrival of pests and predators (Schlee 2010b, 12).

CHAPTER 4:

SUPPORTING PASTORALISTS' ADAPTIVE CAPACITY

In dryland areas there are no permanent 'best' solutions: by definition the variability means that there can't be a standard response. The 'solution' for drylands is to increase levels of optionality. (Krätli et al. 2015)

Adaptation is a moving target. It unfolds in response to shifting climate change trends, which are characterised by inter-annual and even interdecadal variability, as described in chapter 2. Due to this dynamism, strategies that provide adaptive advantages over the next decade may become maladaptive later. Policies that lock people into a particular adaptive pathway may prove short-sighted in the long-term (Herrero *et al.* 2016).

Moreover, pastoralists don't adapt as a monolithic group; they pursue heterogeneous adaptation pathways according to differences and disparities in material, social and cultural capital. There are many possible "adaptive avenues" for pastoralists to pursue, which may involve changes in herd composition, livestock insurance schemes, investments in alternative or supplementary livelihood activities, and increased seasonal sale of livestock. But because each avenue comes with its own material and social costs, pastoralists endowed with different levels of wealth face different prospects for successfully pursuing a particular adaptive strategy. A case study of Maasai pastoralists living near the Il Ngwesi Group Ranch in Laikipia County, Kenya, shows how social differentiation can, in turn, result in differentiated adaptation pathways (Ng'ang'a and Crane 2020). Many of the wealthier herders have been able to diversify into agricultural activities by purchasing land for irrigated and rain-fed cultivation; their wealth allows them to invest in less climate-sensitive economic activities beyond pastoralism. But herders who cannot afford land have pursued adaptation pathways that continue to focus on customary livestock production, as well as supplementary activities with low entry requirements like artisanal and tourism-based activities. Similarly, while many Afar and Somali herders in Ethiopia have opposed irrigation-based schemes that reduce available pasturelands, other individuals from the community have grasped the opportunity to purchase private land for cultivation (Eriksen & Marin 2011). These examples demonstrate how wealth variability in a community that once shared a collective development can lead toward a divergence of adaptation trajectories.

Rather than promoting particular 'adaptations', policy-makers should focus on supporting pastoralists' adaptive capacity. Simply put, adaptive capacity refers to the ability of pastoralists to successfully respond and adapt to ever-shifting challenges and opportunities. This notion is captured in most academic definitions of *resilience* (Mekuyie, Jordaan, and Melka 2018). However, in policy and practice, resilience has often been framed in terms of long-term stability and uniformity, which are ill-suited to dryland contexts and pastoralism (Semplici 2020). Adaptive capacity requires access to the assets required to successfully pursue a new strategy, which may include physical, economic, and social capital. These are often distributed unequally and may not be available for everyone (King, Unks, and German 2018). If people lack the assets required to pursue a particular adaptive strategy, they may abandon it. This is also the reason that different wealth groups pursue different adaptive pathways (Ng'ang'a and Crane 2020).

A fundamental basis of pastoralists' adaptive capacity is *optionality*. Optionality entails the range of strategies that people have at their disposal to respond to challenges or take advantage of opportunities. For pastoralists, "this means keeping options open and maximising the capacity to undertake real-time choices from among a variety of potential strategies" (Krätli *et al.* 2015). Some strategies may seem irrelevant to adaptation under certain conditions, but their preservation in local knowledge is important because they may become useful later, when conditions change. These are sometimes called "latent strategies".

Policymakers and practitioners responding to climate change must continue to address the various drivers of pastoral impoverishment and the factors that constrain their adaptive capacity. As described in chapter 3, climate change hazards affect pastoralists by amplifying existing threats, such as drought, rangeland degradation and resource-related, inter-communal tensions. Climate change is not a challenge that can be addressed in isolation. Moreover, climate hazards can also constrain pastoralists' ability to adapt to future threats, by undermining their adaptive capacity. Therefore, policies should aim to improve adaptive capacity, so that pastoralists can contend with current challenges as well as the unforeseeable challenges that they will face in the years ahead—climatic or otherwise.

This chapter highlights several of the most important dimensions of adaptive capacity among pastoralists in the IGAD region and suggests operational goals toward which policies should aim, including extensifying pastoral rangelands, supporting cross-border transhumance, supporting livelihood diversification, and empowering pastoralists to participate in the political and technical processes required for successful adaptation.

4.1 Rangeland Extensification

Rangeland fragmentation covers an array of different processes; what they have in common is that they reduce the options for pastoral movement. Herd movement can be prevented by physical obstructions, such as large-scale infrastructural interventions or commercial projects, as well as various kinds of territorial regimes, including private property lines and fences, exclusionary conservation zones, and international borders. Although these impediments to movement are governed by different institutional bodies and legal frameworks, they are similar in that they limit optionality and impose "exclusivity of use" on previously communal resources (Galvin *et al.* 2008). Privatisation by external entities is often described as "land grabbing", in that previously communal resources governed by local residents (including pastoralists) are transferred to external owners, who may be individuals, small and medium enterprises, or large corporations. But in other situations, wealthy pastoralists may sell some of their stock and invest in land for agriculture, business or simply as a less climate-sensitive investment. Even if the new private landowners are pastoralists, the removal of the land from communal governance results in fragmentation, as the use of pasture may be restricted to those who can pay an access fee (Goldman and Riosmena 2013; Lind et al. 2020).

Even where communal land rights are legally recognised, their implementation is often guided by fundamental misconceptions about communal governance and tenure. In Ethiopia, the Land Administration to Nurture Development (LAND) project was established to certify communal lands used by pastoralists. During the pilot in Oromia regional state, pastoralists identified the *dheeda* (a traditional grazing unit) as the unit of landholding, but regional officials were reluctant to certify such large land-holdings, which often traverse administrative boundaries. In the view of government officials, customary structures were only deemed acceptable for local governance of small territories. Fortunately, in this case, the project was able to provide evidence that convinced officails to pass legislation which allowed community institutions to register as Community Land Governance Entities (CLGEs) and hold title to communal land (Woldegiorgis 2018). In an attempt at land reform in Kenya, the 2010 Constitution devolved land governance to the local level, and the Community Land Act of 2016 provided an alternative to private land tenure that was intended to be used by pastoralists to register communal lands. However, even with these reforms, security of tenure is still understood as the erection of fixed boundaries and formal titling to a designated group (Gargule and Lengoiboni 2020). Under this model, the territory has been designated to specific groups on the basis of ethnic identity, and without any particular regard for grazing rights outside that territory. As such, the Community Land Act goes some way in preventing enclosure through privatisation, but still contributes to fragmentation by ignoring customary mechanisms through which pastoralists negotiate access to grazing according to shifting needs. It corresponds roughly to the "group ranch" model that prevails in parts of central, southern and western Kenya (Thornton *et al.* 2006).

While privatisation is often treated as an inexorable trend, re-extensification is possible. Extensification of rangelands is a way of recovering "spatial optionality", that is, a sufficient range of potential places to which a pastoralist can move in response to changes in weather, security conditions, or the availability of graze and browse (Robinson *et al.* 2015). Even where there is no clear legal framework or precedent for communalisation of private and public lands, extensification occurs in practice through informal negotiations, local political pressure, and abandonment of private land by its formal owners, as has been observed on Maasai Group Ranches in Kenya (Galaty 2016). However, where re-extensification is not possible, there should at least be protections to prevent further reductions in extensivity (Robinson *et al.* 2015, 138).

4.2 Facilitating Cross-border Movement

Because international boundaries often traverse rangeland eco-systems, they are a key cause of fragmentation and a restriction on optionality. Section 1.1.2 of the AU Policy Framework for Pastoralism recognises that "pastoralist ecosystems often transcend national borders and that movement within these systems is economically and ecologically rational". Pastoralists cross-borders for an array of reasons, including to access seasonal pasture and salt licks; to access markets or better terms of trade for animals; to escape droughts, floods and other disasters; and to allow the vegetation in wet season areas to recover (Davies *et al.* 2018). For example, Turkana pastoralists of the Ng'ikamatak territorial section regularly cross from Kenya into Uganda to seek dry season pasture on the Loteere plains. Practically speaking, there are few physical barriers to transboundary movement, as much of the border has little state presence in the form of infrastructure or border guards. However, Turkana herders in Uganda are hampered by lack of access to social services, and fear of physical insecurity from local herders or the Ugandan military. Rights to strategic mobility therefore require protections across international boundaries, not just within them (Schlee 2010a, 159). The IGAD Protocol on Transhumance is an important step in this direction.

Borderland insecurity and conflict are major risks to cross-boundary transhumance. Following the secession of South Sudan, mounting tensions between militias on either side of the border, as well as nationalist sentiment among citizens of the new state of South Sudan, prevented Missiriya pastoralists in Sudan from pursuing their usual migratory routes, which required crossing the new border (Craze 2013).

Insecurity is also a risk to cross-border livestock trade. When livestock are brought from Somalia to Kenya for sale, each head of cattle gains 200 USD in value when moved from southern Somalia to Garissa in Kenya, but those making the trip also suffer bribes and extortion by militants as well as border officials, and the threat of injury and death due to military activity and insecurity (Ng'asike, Stepputat, and Njoka 2020, 6).

Even where states have legalised cross-boundary transhumance, strict regulatory regimes can hinder the flexibility required for pastoral mobility. Pastoral optionality often requires rapid responses to changing environmental conditions, such that pre-meditated movement may not be possible. Pastoralists often make migration decisions just a day or even hours before departing, drawing on incoming information as well as observations of ever-changing weather conditions. Rather than planning out their movements ahead of time and following a pre-designated course, they may practice highly tactical movement, responding to changing conditions and new information en route. In this regard, the notion of "transhumance corridors" used in migration mapping exercises is somewhat misleading because it suggests that pastoralists follow regularised routes, like pathways through the rangelands. But in many contexts, annual migrations only follow highly generalised patterns of directionality, and the actual course of a herds movements is highly variable from year to year. Authorities should avoid forms of regulation that inhibit flexibility, such as restrictions of border crossings to designated points or prolonged permitting processes: "Realistic management support should refrain from the temptation to exert control and instead focus on strengthening capacity for real-time adaptation" (Krätli *et al.* 2015).

Box: What is "Orderly" Movement for Pastoralists?

The idea of "orderly" migration is attractive to governments and is inherent to IOM's mandate. However, it must be interpreted carefully in regard to pastoral transhumance, which relies heavily on flexibility, responsiveness to sudden changes, and negotiation across complex networks of herding households. To outsiders and governments, pastoralist migration often seems messy and haphazard. But this is because successful herd management in dryland environments requires decentralised decision-making and bottom-up coordination. In governing pastoral movement, states and their partners must dispense with the "airport model" of linear processing procedures and queues, instead recognizing and supporting the self-ordering that takes place among pastoralists. Regulation should take a minimalist approach and remain flexible, without infringing on basic liberties (Schlee 2010b). States should clearly define what minimum of documentation and surveillance is absolutely necessary, and devolve many of the other functions to local administrations and customary authorities.

4.3 Supporting Livelihood Diversification

Livelihood diversification is fundamental to adaptive capacity. The term *diversification* encompasses a range of strategies, such as diversifying the herd to include an array of species and breeds, or investing in children's education in order to diversify potential sources of future income (Herrero *et al.* 2016). It includes *portfolio diversification*, in which a household invests in multiple productive activities that are ongoing simultaneously and which spread risk across a range of activities with different sensitivities to weather events. It also includes *temporal diversification*, in which herders move between different activities at different times. Maintaining a range of potential economic options give poorer pastoralists and dryland inhabitants a back-up plan in case their herds perish or new needs arise.

Temporal diversification is sometimes mistaken as "dropping out" and "sedentarisation", which imply a permanent cessation of pastoral practice. But people are not necessarily locked into such trends, and may change course in response to new opportunities (Rodgers 2020; Lind *et al.* 2020). In Turkana, for example, fishing and irrigated agriculture provide "fallback" options for destitute pastoralists, who retain connections to the pastoral economy and invest in livestock (Akall 2020).

Even where so-called "drop-outs" cease their direct involvement in livestock production, they often remain connected to the pastoral economy through relatives. An example is formally educated children who seek urban employment; rather than dropping out, they may support their families by sending cash remittances during drought, thereby diversifying the household-level economic portfolio.

Livelihood diversification is inherent to pastoralism, not an alternative to it. Diversification of food production methods has sometimes been described as an alternative to pastoralism, as if crop cultivation, fishing, or trade are somehow antithetical to "pure pastoralism". In the face of climate change and other challenges, it is sometimes stated that herders must "choose to remain in pastoralism, or to diversify their livelihoods" (Nassef, Anderson, and Hesse 2009: 18). But this is a false dichotomy; the idea of pure pastoralism is largely a myth, and most pastoralists have long practiced supplementary forms of food production, resource exploitation and trade in order to sustain or rebuild their herds. The modes of diversification are changing; for example, whereas many Maasai pastoralists previously traded for agricultural goods from subordinated Datoga cultivators within a stratified social system in Tanzania, many have more recently undertaken portfolio diversification by cultivating their own gardens or small farms (McCabe, Leslie, and DeLuca 2010). Other pastoralist adaptations and modernizing trends (in Sudan), include the use of water tankers or bladders to facilitate access to pastures in dry areas, diversified investment strategies and expansion in sheep, the development of a new sheep cross-breed in East Darfur, and the privatisation of support services. Recent trends are potentially less advantageous to pastoralists; for example, the commodification of crop residues, which are now often sold by the farmers. Modernizing trends need to be better understood to enable a more informed discussion of the merits and wider implications of adaptations in relation to enabling local livelihoods. (Helen Young *et al* 2013). As such, livelihood diversification should be offered as an option to support pastoralism, not simply as an option for those who are transitioning out of pastoralism.

Some forms of livelihood diversification make an important contribution to pastoralists' adaptive capacity. Dryland agriculture is an option for some pastoralists, although this depends on local soil quality and access to water, as well as the necessary capital to make initial investments in land or irrigation infrastructure. Migration to seek paid employment is an option for households, especially where the family size exceeds the requirements for herding labour, and investments in education can improve future earnings. However, some formal school curricula are laden with anti-pastoralist sentiment, creating rifts between children and their families and creating public distrust in the education system (Krätli 2006; Lesorogol 2008). The gathering, processing and selling of locally available resources and goods has lower entry requirements and can provide a supplementary income without disrupting the household structures around which pastoralism is organised. In the IGAD region, this includes bee-keeping and honey production, collection and sale of forest products like aloe vera, charcoal production and— near lakes—fishing. While these activities can provide supplemental income in the short-term, local regulatory mechanisms are required to ensure that they are practiced sustainably.

Equity is an important consideration here, as economic diversification by a wealthy minority can increase overall community vulnerability. While social differentiation and class formation has received relatively less attention among pastoralists than agrarian communities, pastoralism has nonetheless been influenced by similar processes, with consequences for wealth stratification and political inequality (Scoones 2021). For example, the livelihoods of the Turkana people of northwestern Kenya were historically reliant predominantly on pastoralism, but a growing urban demographic has become largely disengaged from the practice and economy of pastoralism (Rodgers 2018). Moreover, wealthy pastoralists are the most likely than their poorer counterparts to diversify into cultivation, as they are the only ones equipped to invest in the required land and capital (Ng'ang'a and Crane 2020; Lind *et al.* 2020). Such investments may undermine communal access to pastoral resources, especially where they drive processes of privatisation and erection of property boundaries (Chavunduka and Bromley 2011; Lind *et al.* 2020).

Where possible, vulnerability should be addressed through public and community-level investments rather than just household-level interventions. A behaviour that is adaptive at the level of the household may be maladaptive at the level of the community. This can be illustrated in regard to the topic of market integration in pastoralist areas. Access to livestock markets has often been identified as an important avenue of climate change adaptation, because selling livestock allows some herders to decrease their own household vulnerability by converting some of their herd-based wealth into cash prior to the onset of drought. However, the commercialisation of livestock production may also exacerbate inequality at the broader level of the community, thereby undermining communal solidarities, and thus increasing overall community-level vulnerabilities (Robinson *et al.* 2015; Catley and Aklilu 2013).

4.3 Empowering Pastoralists and Their Institutions

Most pastoralists in the IGAD region live in historically marginalised areas. Drylands in much of eastern Africa have long been treated as unproductive peripheries, with little attention in national development plans. National policies have historically treated pastoralists as backward and even threatening to national security (Scoones 2021, Scott 2017). In both southeastern Ethiopia and northeastern Kenya, secessionist efforts to unite these territories with Greater Somalia brought local communities into conflict with the state, with marked violence against civilians—many of them nomadic pastoralists—and oppressive military occupations. Allegedly, either during disarmament exercise or when combating cattle rustling, nilotic pastoralist communities in northern Uganda and northern Kenya have been subjected to forceful security operations (Mkutu 2008, Hazama 2021). Pastoralists in Ethiopia long lacked secure legal claims to their communal lands, leaving them vulnerable to dispossession in the face of agricultural and industrial development (Fratkin 2014). Many pastoralist regions have received disproportionately low investments in infrastructure and social services development, such that local people have not enjoyed the full benefits of national citizenship (Kenya Human Rights Commission 2010). These histories of political and economic exclusion have had long-standing influences on people's sense of national belonging and trust in state institutions.

Redressing the long histories of political and economic marginalisation in dryland areas requires substantial investments in infrastructure and social services. However, borderland development in dryland areas has until now focused on economic priorities generated by central governments. Infrastructural interventions in pastoralist areas are often extractive; energy projects like the GIBE III megadam on the Omo River and the Lake Turkana Wind Power Project in northern Kenya predominantly benefit distant urban areas. The infrastructure constructed for the LAPPSET corridor in northern Kenya is physically constructed in pastoralist areas, but the objective is largely to improve national GDP and facilitate movement of goods *across* pastoral areas. Alternatively, bilateral and regional policies for borderland development can put the priorities of pastoral areas and the well-being of their populations at the centre of planning. Roads in particular can improve connectivity to regional and global markets, reduce the price of food and other goods form other regions, and improve the terms of trade for livestock (Herrero *et al.* 2016). In Ethiopia, it has been estimated that up to a quarter of the total price of each animal is attributed to the costs of transporting livestock out of the pastoral zone (Little, Behnke, and McPeak 2010; cited in Brown *et al.* 2017).

Developing and implementing policies that benefit pastoralists requires their political participation at all scales (Nassef, Anderson, and Hesse 2009). At the global level, fora like the World Initiative for Mobile Indigenous Peoples (WAMIP) provide opportunities to engage policy-makers and urge more inclusive policies by major NGOs and donor countries. Pastoralists should also be represented in regional fora such as the AU and IGAD, which are responsible for bilateral and multilateral mechanisms that support cross-border areas, such as the Protocol on Transhumance.

At the national level, pastoralist parliamentary groups provide one means of promoting representation of pastoralist interests in law-making, although they must be accompanied by better representation of pastoralist concerns in civil society and the media (Morton 2005). In Ethiopia, the implementation of the federal system in the mid-1990s created regional states that better represented pastoralist populations in the Somali, Afar, and Gambella regions, although the central government's development agenda continued to privilegeagricultural investments. More recently, Ethiopia Pastoral Development Policy was approved in 2020, signaling an attempt to pursue development policies that are more appropriate in dryland contexts and suited to pastoralists' needs. In Kenya, devolution of political power to the county level in 2013 has had a complicated influence on national politics, in some cases exacerbating conflict, but it has certainly yielded a windfall of investment in the northern ASAL countries (Lind 2018). Locally, state administration units must continue to include customary institutions and engage informal negotiation mechanisms when making decisions and implementing policies.

Engaging local institutions is also crucial to their sustained relevance as agents of adaptive governance. While many customary pastoralist institutions are well adapted to a range of conditions and challenges, the rise of unprecedented climatic conditions requires engagement with information and technologies developed by other actors, including development organisations and research institutes (Robinson and Berkes 2011). And even where local knowledge contains most of the information required for an adaptive response, institutions sustained public engagement in order to sustain and regenerate their basis of knowledge and customary practice (Spencer 2004). But top-down responses from formal institutions can weaken customary institutions by excluding them from participation, which over the long-term can undermine their persistence (Schmidt and Pearson 2016). Formal education also presents a dilemma for the persistence of local knowledge, because access to education is crucial for the political status of pastoralist groups, but young people who have attended schools are often decoupled from the systems of local knowledge reproduction in their communities.

5: CONCLUSION

In the Greater Horn of Africa region, there is more recognition now than ever before that pastoralism offers an economically productive and ecologically sustainable livelihood that is highly adaptive in the face of climatic and environmental changes. But this ability to adapt is being eroded by a growing list of challenges that constrain pastoralists' optionality, including their ability to move their herds flexibly in pursuit of transient resources. Pastoralists have long exploited optionality to "pick a path" through scarcity and uncertainty, including the extreme temperature and precipitation events that are becoming increasingly frequent and intense. But this capacity to adapt to climatic and environmental challenges is often undermined by "optionality-reducing trends" like rangeland fragmentation, asset depletion, growing poverty and inequality and the breakdown of communal land tenure systems.

Fortunately, the erosion of this capacity is not a foregone conclusion. With the appropriate policies and investments, states and their development partners can support pastoralists to retain and even recover adaptive capacity in the face of climate change and other environmental hazards. This requires a combination of both medium-term and long-term interventions.

In the medium-term, investments in veterinary outreach, livelihood diversification, and social safety nets can support pastoralists by reducing their vulnerability to extreme weather events. Where possible—and especially where the pastoralist communities of interest live in the borderlands between countries—such activities should be coordinated at the regional scale. For example, IGAD's Protocol on Transhumance (PoT) demonstrates a greater acknowledgment among states, of the economic potential of pastoralism, as well as a heightened awareness of the various challenges that threaten its future in the region. By easing cross-boundary movement for pastoralists, the PoT could re-extensify rangelands that are now fragmented by inter-state border restrictions. Moreover, social services, safety nets and infrastructural support can be planned at a regional rather than a national scale, providing more coherent planning for borderland areas.

In the longer-term, there there are also more ambitious policy options that could reconfigure the ways that borders and state regulations affect pastoralists. For example, states and regional bodies such as IGAD and the African Union could explore the possibilities for managing borders using mobile technology. At present, the most common method of border management is to operate border checkpoints at fixed locations,

which is costly for governments and inconvenient for pastoralists in more remote areas. Moreover, many herders move at night due to heat, so these check-points need to be open 24 hours to facilitate night-time crossings. An innovative alternative would be to manage border crossings via remote check-in methods (i.e. using mobile phones) and pre-crossing or post-crossing check-ins by regulatory officials. That is, pastoralists notify officials that they have crossed a border, and then arrange a time for a remote border team to arrive for an inspection. Such a model could be adapted from expedited clearance systems based on registration and pre-approval, such as the Transportation Security Administration "pre-check" system at US airports.

Another long-term goal would be to provide legal frameworks for land governance that are more amenable to pastoral land tenure. As described above, the Community Land Act in Kenya goes some way in preventing enclosure of rangelands through privatisation, but still contributes to fragmentation by ignoring customary mechanisms through which pastoralists negotiate access to grazing according to shifting needs. A process of land reform that is better attuned to the needs of pastoralism would 1) recognise the role of local customary authorities and informal negotiating mechanisms, 2) avoid communal land registration based simply on ethnicity, and 3) recognise rights to mobility and grazing for those outside the registered group. In order to attain this objective, legislative bodies across the IGAD region would need to develop their own 'Pastoral Areas Communal Land Bills', based on consultation with experts in law, ecology and the social sciences who specialise in resource governance and land use by pastoralists.

The pathway forward is laden with promising opportunities to support the capacity of pastoralists to adapt to current and future challenges. Some of these fruits are low-hanging while others remain hard-to-reach. An integrated approach will require activities at various scales—local, national, and regional—as well as investments in both ***particular adaptations*** and ***adaptive capacity***. This distinction may seem subtle, but these are two fundamentally different objectives. While support for ***particular*** adaptive pathways—such as the shift from cattle to camels in response to worsening droughts—can reduce vulnerability in the short-to-medium term, there must also be investment in the legal, educational, social and infrastructural environments that enable pastoralists to successfully identify and respond to future and potentially unforeseen challenges.

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