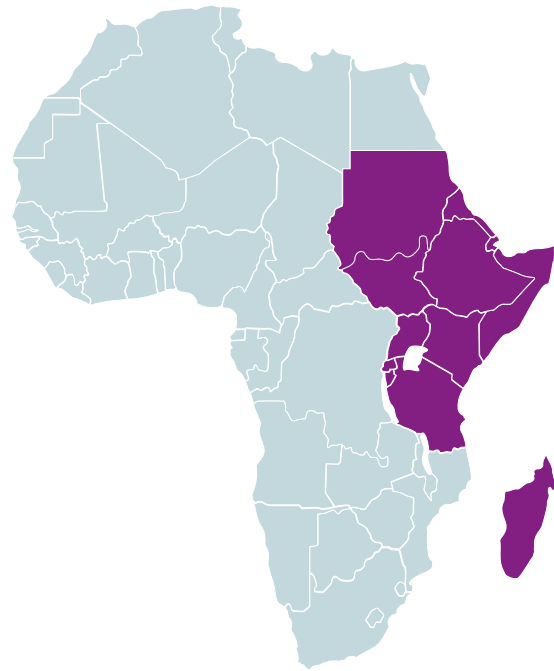


WEATHERING RISK

Africa
Climate
Security Risk
Assessment

Eastern Africa

Eastern Africa



Summary

KEY CLIMATE IMPACTS



Temperature: Air temperatures across Eastern Africa are likely to rise by 1.7–3.9°C by 2080 relative to the pre-industrial period. The largest temperature rise is expected to occur in northern Sudan and northern Kenya, with a comparatively lower temperature rise across large areas of Uganda, southern Kenya, and along the coasts of Kenya, Somalia and Tanzania.



Precipitation*: Precipitation projections are much less certain than those for temperature and vary across Eastern Africa depending on the emissions scenario. Overall, projections indicate an increase in amounts across northern and central Eastern Africa, and a decrease towards the south. In terms of heavy precipitation events, the number of days with such events is projected to increase, particularly in Uganda and southern South Sudan.



Sea level rise: By 2080, sea levels are projected to rise by around 35 cm (RCP2.6) and 43 cm (RCP6.0) on average across the entire Eastern Africa coastline, compared to the year 2000. The coastlines of southern Somalia in particular, although also Kenya and Tanzania are at high risk of rising sea levels.



Flooding*: Projections of flooding are subject to high levels of modelling uncertainty, owing to the uncertainty of future precipitation projections. Nevertheless, projections for Eastern Africa under RCP6.0 indicate an increase in the share of urban areas and roads at the national level that are exposed to river flooding.



Droughts*: Drought projections for Eastern Africa are subject to large uncertainties, but indicate a general increase in drought conditions. Soil moisture and potential evapotranspiration are two important indicators that are used to measure drought conditions. Under RCP2.6 and RCP6.0, annual mean soil moisture for a soil depth up to 1 m show a decrease of 0.6 per cent and 0.3 per cent by 2080 compared to the year 2000, respectively, albeit with large year-to-year variability and modelling uncertainty.



Cyclones: More intense tropical storms and cyclones are projected for the southern region of Eastern Africa in general and Madagascar in particular. This increase in cyclone intensity is projected to come with increased heavy precipitation events.

* Climate projections with high uncertainty need to be interpreted with great caution. Please refer to the Annex for an explanation of uncertainty in climate projections.

CLIMATE SECURITY PATHWAYS IN EASTERN AFRICA

Pathway 1: Competition over natural resources



Across Eastern Africa, competition over natural resources has been one of the major drivers behind the region's conflicts. This competition, particularly over water, land and forests, stems from changes in the availability of and access

to resources. Competition can arise from both resource scarcity and abundance, and is driven by various socioeconomic and governance-related factors, along with climate-related impacts and other environmental challenges..

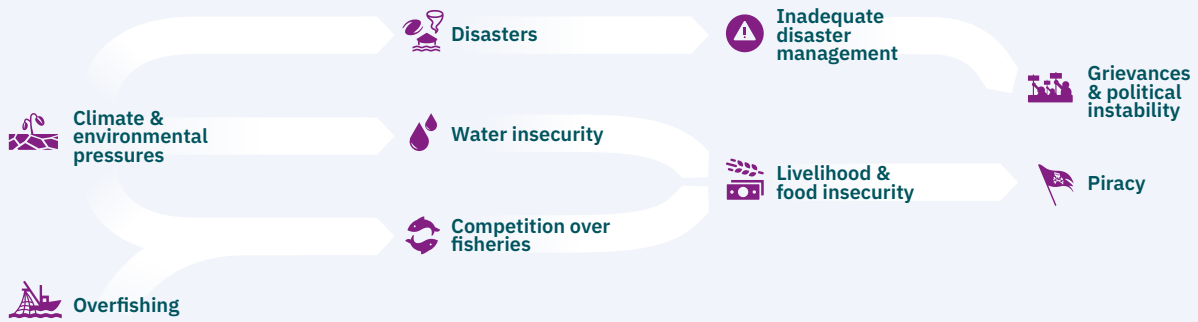
Pathway 2: Livelihood and food insecurity



The livelihood and food security of many communities in Eastern Africa are highly dependent on climate-sensitive sectors. Disruptions to these sectors can deepen economic hardships, particularly youth unemployment, and contribute to broader public discontent and more organised crime.

Efforts to address livelihood insecurities, if not done in a climate- and conflict-sensitive manner, can weaken livelihood strategies further and lock communities in a vicious cycle of vulnerability and insecurity.

Pathway 3: Coastal and maritime security



Coastal and island communities across Eastern Africa are particularly vulnerable to the impacts of climate change. Slow and rapid onset events, such as rising sea levels and storm surges, directly threaten their very safety and integrity. They also

face challenges to their economic and food security due to the compounding impacts of human-made and environmental factors that affect marine ecosystems, including the intrusion of industrial fishing fleets.

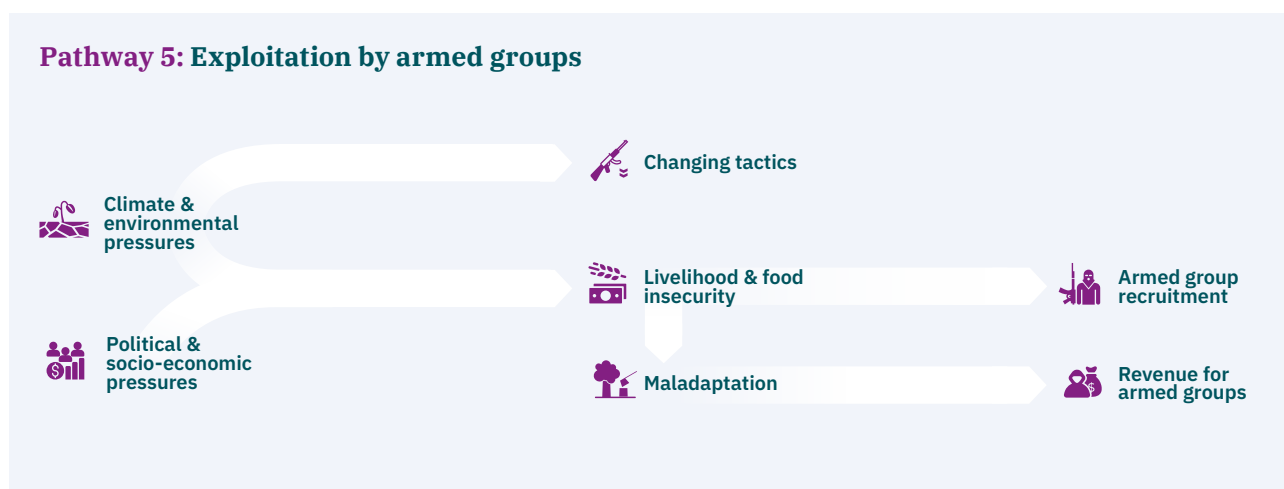
Pathway 4: Changing mobility patterns



Populations in Eastern Africa move for various reasons. For many, including pastoralists, it is an adaptation strategy to cope with periods of shocks and stresses. Climate change increasingly influences where, when and for how long people move. In general, climate change is amplifying and

altering existing migration trends, particularly rural-urban migration and cross-border migration. In some cases, migration can increase the pressure on resources and services in receiving areas, heighten competition, and stir tensions between host and migrant communities.

Pathway 5: Exploitation by armed groups



Climate impacts are increasingly shaping the operational environment of armed groups in Eastern Africa. Armed groups in the region actively exploit conditions of food insecurity, loss of livelihoods, and political and inter-community grievances for recruitment and support. The extent of their

activities depends on prevailing climatic and environmental conditions that can either hinder or ease their operations, as well as on the existence and profitability of economic activities that provide them with financial support.

Context

GEOGRAPHY

The Eastern Africa region³⁵ consists of 14 countries: Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Rwanda, Seychelles, Somalia, South Sudan, Sudan, Tanzania and Uganda. It comprises several agroecological zones with specific temperature and moisture regimes. The region's climate ranges from warm arid in the northwestern and eastern plains to humid warm tropics in the plateau and on island states to cool arid-humid conditions in high altitude areas (see Figure 20) (Binder et al. 2023). In some countries, arid and semi-arid lands make up a large share of total land area. In Kenya, the share is over 80 per cent (Nkonya et al. 2018). The regional climate is largely shaped by the diverse topography, characterised by the East African Rift Valley³⁶ and the East African Highlands³⁷ (Binder et al. 2023). A large area of Eastern Africa, located towards the northeast of the region, and facing the Red Sea and Indian Ocean, is collectively known as the Horn of Africa.

At present, mean annual precipitation amounts range from over 2,000 mm in southwestern Ethi-

opia to less than 250 mm in the arid regions of Djibouti, Eritrea, Ethiopia, Kenya, Somalia and Sudan (Camberlin 2014). The El Niño-Southern Oscillation and Indian Ocean Dipole strongly influence precipitation levels across the region. El Niño conditions are typically associated with wetter short rains, while La Niña conditions are linked with drier short rains (Palmer et al. 2023).

The region is rich in natural resources, many of which straddle across several countries and regions. Given their transboundary nature, many of these resources have historically been the source of geopolitical tensions, although they also provide opportunities for cooperation. This includes Africa's longest river, the Nile, which consists of two major tributaries (i.e. the Blue Nile and White

35 This report uses the African Union's classification system for geographic regions (https://au.int/en/member_states/countryprofiles2).

36 The East African Rift Valley is part of the Great Rift Valley, which stretches 6,000 km from northern Syria to the south of Mozambique. Its geological activity created the highest mountains and deepest lakes in Africa (Binder et al. 2023).

37 The East African Highlands include the Ethiopian highlands to the north; the Kenyan highlands, which are fringed by Africa's highest mountains, Mount Kibo (Kilimanjaro) (5,895 m) in Tanzania and Mount Kenya (5,199 m); and the Western Rift Mountains, which stretch from western Uganda to southern Tanzania (Binder et al. 2023).

Nile) and flows towards Egypt where it enters the Mediterranean Sea. Its catchment area comprises almost 3.4 million km³ (10 per cent of Africa's total area), and provides the population in the Nile Valley with water and fertile ground for agriculture (Nashwan and Shahid 2019; Binder et al. 2023). Another important river basin is the Turkana Basin, which spans an area of around 131,000 km² across northern Kenya and southern Ethiopia. The basin is dominated by the alkaline Lake Turkana, which is primarily fed by the Omo River (Feibel 2011). The African Great Lakes comprise a series of lakes in and around the East African Rift Valley, and include some of the largest lakes and freshwater bodies on the African continent, including Lake Victoria and Lake Tanganyika (Camberlin 2014; Binder et al. 2023). Other important lakes include Lake Malawi, Lake Turkana, Lake Albert, Lake Kivu and Lake Edward.

SOCIOECONOMIC CONTEXT

Eastern Africa's level of economic development varies between countries, with Kenya being one of the region's largest economies. The COVID-19 pandemic severely affected economic growth and exacerbated income inequality and poverty rates across

the region, although some countries have recorded strong recovery, most notably Kenya, Seychelles, Rwanda and Uganda (UNECA 2022). However, for some countries, namely Somalia, South Sudan and Sudan, recovery rates are hampered by ongoing political instability (AfDB 2022b).

Agriculture and pastoralism are the dominant activities for many communities across Eastern Africa, employing as much as 80 per cent of the population in some countries (e.g. Eritrea, Ethiopia and Rwanda) (Hunt et al. 2019). In South Sudan, approximately 95 per cent of the population depend on rainfed agriculture, pastoralism and animal husbandry for their livelihoods (NUPI and SIPRI 2021). Across the region, agriculture's contribution to GDP is also substantial. In Somalia, for example, live-stock production is estimated to account for around 61 per cent of GDP in 2018 (Hunt et al. 2019).

Moreover, coastal and inland lake communities throughout Eastern Africa are highly reliant on fisheries for food security and employment (Thoya et al. 2022). Estimates for the Great Lakes region indicate that the fisheries and aquaculture sectors account for four per cent of GDP in the region. In

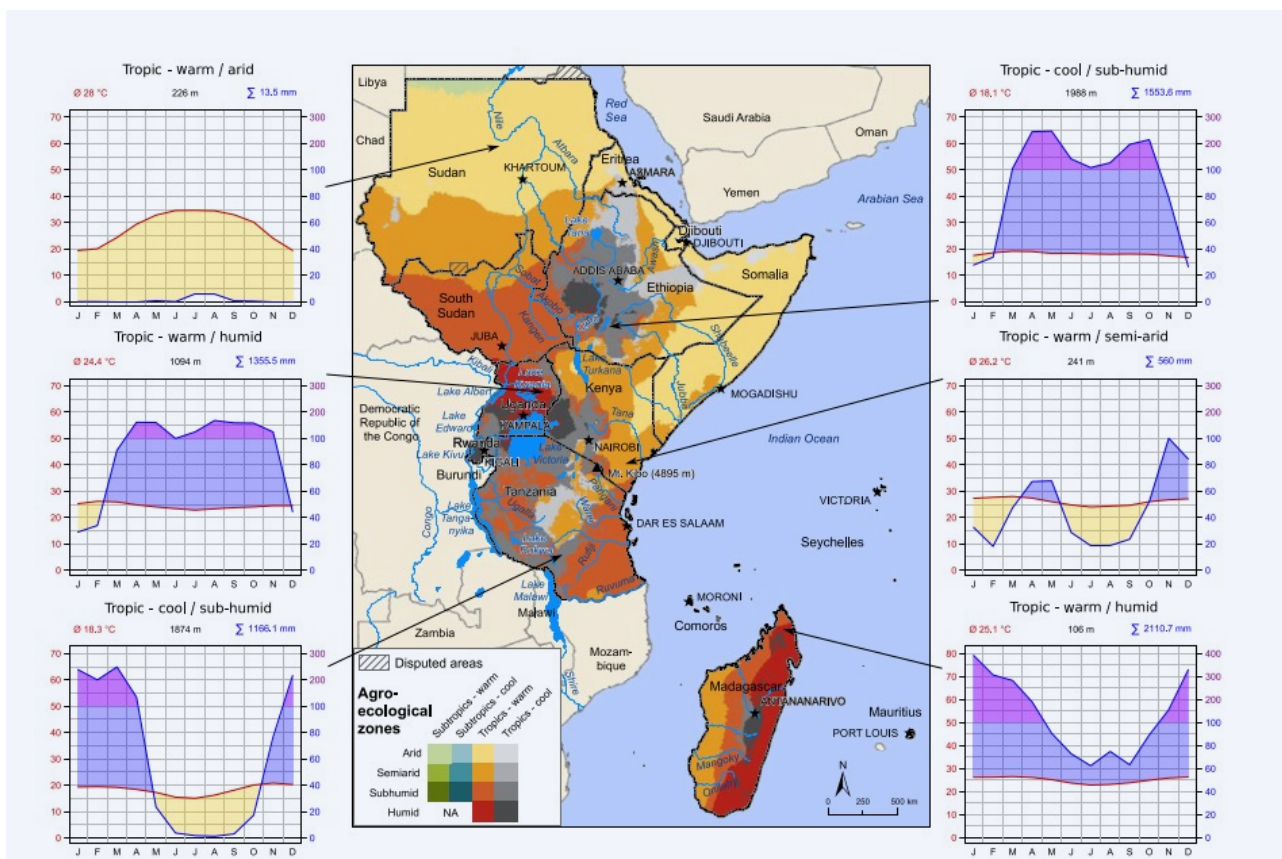


Figure 20: Map of Eastern Africa showing agroecological zones, and location-specific examples of annual temperature (red lines) and precipitation regimes (blue lines) (Binder et al. 2023)

terms of food security, certain fish species such as the Mukene (*Rastrineobola argentea*) are important sources of minerals for populations living in the region, whose grain-based diets largely lack these minerals (Chimatiro et al. 2021). In Mauritius, the fisheries sector contributes around one per cent of GDP, with fish products contributing around 19 per cent of national exports (Ministry of Blue Economy, Marine Resources, Fisheries and Shipping, Mauritius n.d.). Small-scale artisanal fisheries are particularly important. In the Comoros and Mauritius, they account for 80 per cent and 30 per cent of the total catch, respectively (Belhabib et al. 2019).

Imports dominate Eastern Africa's overall trade balance, particularly food and agricultural products, as the region is not self-sufficient in producing most of its basic food commodities. In fact, food imports have been increasing in recent decades. In Ethiopia, Kenya and Tanzania, food imports rose by 1,000 per cent, 300 per cent and 122 per cent, respectively, between 1998 and 2018 – a trend that is likely to increase in the future (AU and OECD 2022).

DEMOGRAPHICS AND MOBILITY

As of 2021, the population of Eastern Africa stood at over 405 million (UNDESA 2022b) and is growing at an annual rate of 2.3 per cent since 2010 (IGAD 2021). The region has a long history of mobility, driven by various factors including economic opportunities, conflict and natural hazard-induced disasters (IOM 2020b). Eastern Africa is home to a large number of IDPs. In 2021, there were approximately 12.4 million IDPs in the Horn of Africa and Great Lakes regions (UNECA 2022).

International migration, including intra- and inter-regional, as well as inter-continental migration, is an important trend in Eastern Africa, as the region is simultaneously an origin, transit and destination for migrants and refugees. In many areas of Eastern Africa, the number of recorded regular international migrants more than doubled between 2010 and 2019 (IGAD 2021). Irregular migration (i.e. the unauthorised movement of people across borders) is a widely recorded phenomenon, as is the case with the southern route between Eastern Africa and Southern Africa (IOM 2022b). Moreover, rural-urban migration trends are prevalent across the region, particularly in Kenya and Tanzania (Clement et al. 2021)

Mobility, particularly circular migration, is an essential adaptation strategy to cope with shocks and stresses for communities across Eastern Africa

(IOM et al. 2022). For many countries of origin in Eastern Africa, remittances from international emigrants play a vital role in their economies, although official statistics on remittance inflows are usually low, likely because migrants use informal channels to send money home (IGAD 2021). For Tanzania, internal migration has been linked to poverty reduction and improved welfare through remittances and in-kind transfers (Clement et al. 2021). In border areas, cross-border mobility is essential for cross-border trade, and in maintaining transboundary socioeconomic and cultural ties (IGAD 2018). Pastoralists are especially dependent on mobility to cope with environmental hardship and growing climate variability (Idris 2018).

PEACE AND SECURITY

At the time of writing, Eastern Africa is experiencing a number of devastating conflicts that are presenting major security challenges to the region. To a large extent, these have been triggered by ethnic and resource-driven communal conflicts, and have been exploited by armed groups and political elites. In addition, conflicts have been intertwined with organised criminal activities, including the sale of weapons and piracy.

Three major conflicts illustrate many of the historical security challenges facing the region. The armed conflict between the Sudanese Armed Forces (SAF) and Rapid Support Forces (RSF) in Sudan, which broke out in April 2023, can be traced back to the regime of former president Omar al-Bashir, which contributed to inter-communal frictions and the creation of a network of patronage in the country's security sector. Reports also indicate that both rival forces are recruiting young people based on ethnic and tribal affiliations (Foong et al. 2020b; Ali et al. 2023).

In Somalia, a lack of effective central governance following the collapse of the Siad Barre regime in the early 1990s, coupled with periods of severe droughts that devastated pastoralist livelihoods, led to a civil war that is still ongoing, most recently between Al-Shabaab and counter-insurgency operations led by the Somali federal government (Maystadt and Ecker 2014; ACLED 2023).³⁸

38 For an overview of the multiple environmental, socioeconomic and political factors that led to these armed conflicts, see <https://climate-diplomacy.org/case-studies/civil-war-darfur-sudan> (for Sudan) and <https://climate-diplomacy.org/case-studies/droughts-livestock-prices-and-armed-conflict-somalia> (for Somalia).

In the Tigray region of Ethiopia, violent armed conflict between the federal government and the Tigray People’s Liberation Front between 2020 and 2022 resulted in around 600,000 casualties. In 2021 alone, the conflict internally displaced an estimated 5.1 million people, with millions more fleeing to neighbouring Sudan. The conflict can be traced back to historical inter-ethnic and political divisions, and has seen the involvement of troops from Eritrea and other regional militias. While an agreement to cease hostilities was signed in November 2022, concerns remain over the long-term effectiveness of the peace deal to end violence in the region (Center for Preventive Action 2023; Pilling and Schipani 2023).

Areas of Eastern Africa are facing major humanitarian crises, related to conflicts, droughts, and external shocks. Recent global shocks such as the COVID-19 pandemic and the war in Ukraine have disrupted the region’s food supply, driven up food prices, and worsened food insecurity (Ayanlade and Radeny 2020; WFP 2022). While externally and internally driven conflicts and humanitarian crises continue to challenge Eastern Africa’s peace prospects, the region has some of the strongest strategies, policies and mechanisms to address climate-related security risks. These are covered in greater depth in the Eastern African response and good practices section.

Climate change and impacts^{39,40}

AIR TEMPERATURES

Temperatures across Eastern Africa have been on the rise in recent decades. Depending on the season, mean annual temperatures rose by 0.7–1.0°C during the period 1973–2013. At present, average annual temperatures range from 11.6°C to 30.7°C, with lower temperatures recorded in the region’s high altitudes, and higher temperatures in the Sahel and Saharan deserts, as well as in southern Somalia and northern Kenya (Binder et al. 2023). In areas of the Horn of Africa, this has led to a sharp increase in the number of heatwaves and a higher transmission rate of pathogens, such as malaria (IGAD 2022d).

Air temperatures across Eastern Africa are likely to rise by 1.7–3.9°C by 2080 relative to the pre-industrial period. The largest temperature rise is expected to occur in northern Sudan and northern Kenya, with a comparatively lower temperature rise across large areas of Uganda, southern Kenya, and along the coasts of Kenya, Somalia and Tanzania (see Figure 21) (Binder et al. 2023).

In line with these temperature projections, the annual number of very hot days⁴¹ is projected to rise with high certainty. Under RCP6.0, large areas of Somalia, eastern Ethiopia and northeast Kenya

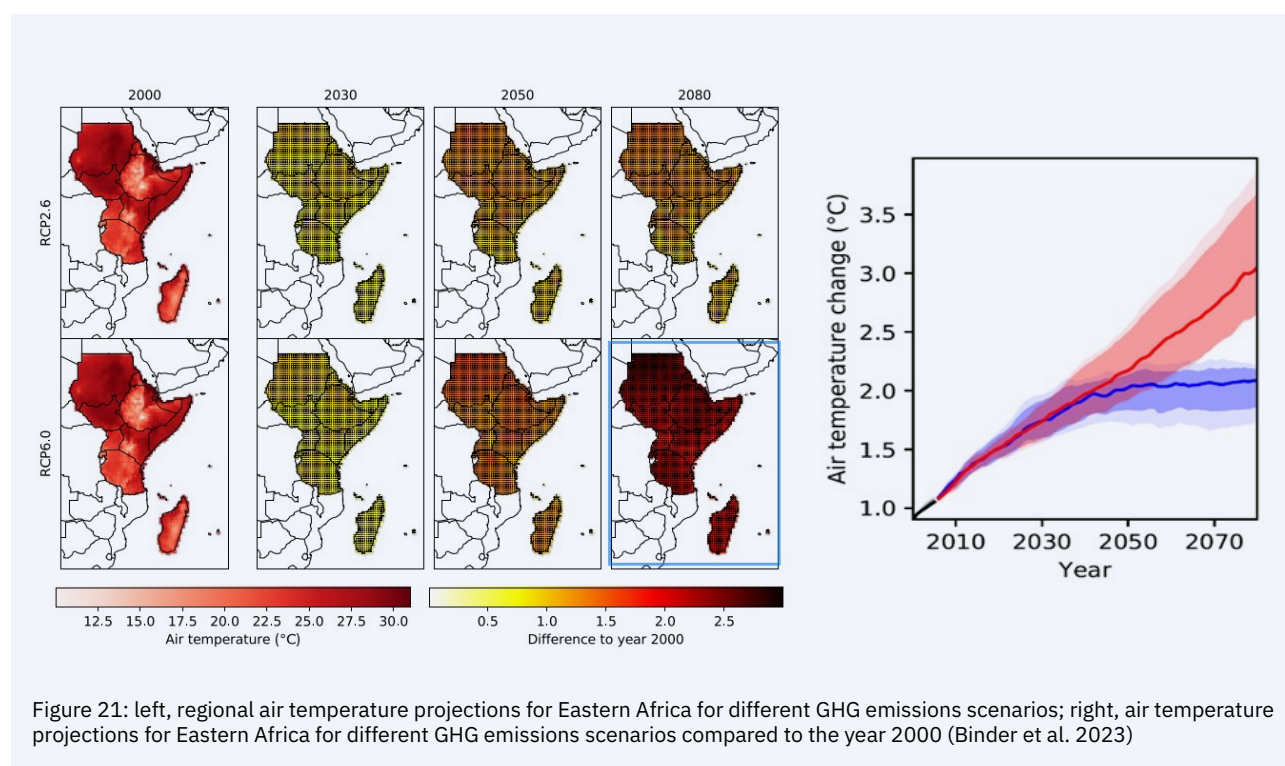


Figure 21: left, regional air temperature projections for Eastern Africa for different GHG emissions scenarios; right, air temperature projections for Eastern Africa for different GHG emissions scenarios compared to the year 2000 (Binder et al. 2023)

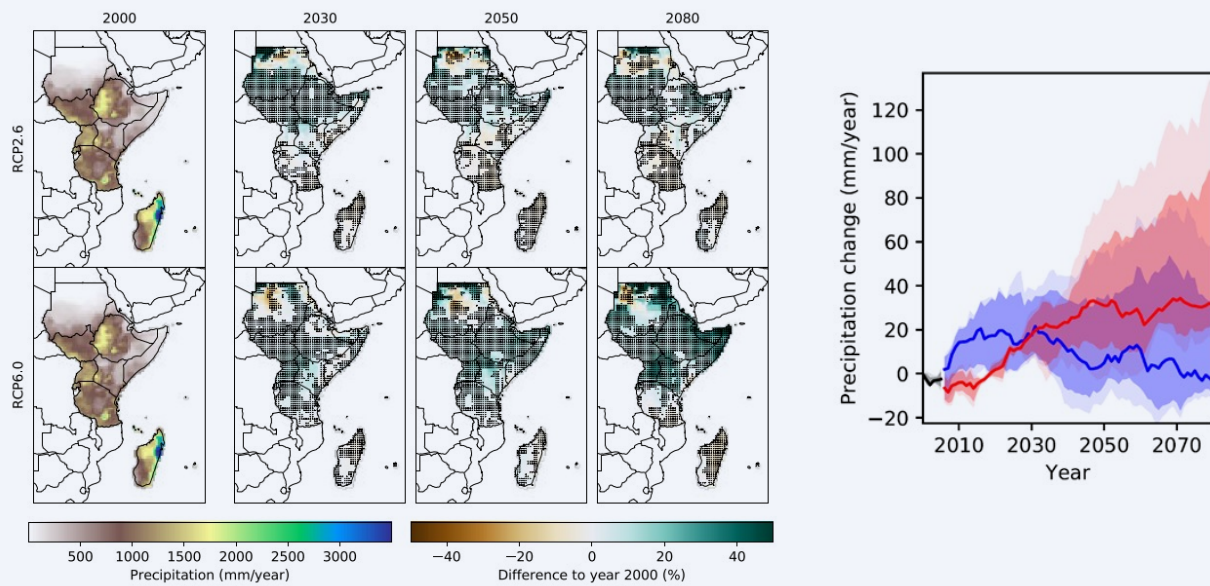


Figure 22: left, regional projections of annual mean precipitation for Eastern Africa for different GHG emissions scenarios, compared to the year 2000; right, mean precipitation projections for Eastern Africa for different GHG emissions scenarios compared to the year 2000 (Binder et al. 2023)

are projected to experience up to 66 more very hot days annually by 2030 and 165 days by 2080 (Binder et al. 2023). In some Eastern African cities, including Kampala (Uganda), projections estimate a 2,000-fold increase in exposure to dangerous heat (i.e. over 40.6°C) by 2090, compared to 1985–2005, assuming high population growth and high future GHG emissions (RCP8.5) (Rohat et al. 2019).

PRECIPITATION

Precipitation trends vary across Eastern Africa, depending on the season. Since the 1980s, precipitation has been decreasing during the “long rains” (March–May) over the Horn of Africa, although this decrease has recovered more recently. Meanwhile, during the “short rains” (October–December), precipitation has increased since the 1960s (Binder et al. 2023). In northern areas of the region, where there is one rainy season (June–September), precipitation has decreased since the 1960s and remained relatively low since then (Masson-Delmotte et al. 2021).

Precipitation projections are much less certain than those for temperature and vary across Eastern Africa depending on the emissions scenario. By 2030, compared to the year 2000, precipitation will likely increase by 7–38 mm per year under RCP2.6 and by 7–29 mm per year under RCP6.0, although projections for the latter scenario come with high uncertainties (Binder et al. 2023).

Overall, projections indicate an increase in the amount of precipitation across northern and central Eastern Africa, and a decrease towards the south. A wetting trend is expected particularly in the medium-to-long term under RCP6.0, with the highest increases across large regions of the Horn of Africa, but also in Kenya and Uganda. Meanwhile, the south of Tanzania and most areas of Madagascar will see a decrease in precipitation under all scenarios. An exception to this pattern is the north of Sudan, where both sharp increases and sharp decreases are projected, depending on the area and scenario used (see Figure 22) (Binder et al. 2023).

In terms of heavy precipitation events, the number of days with such events is projected to increase, particularly in Uganda and southern South Sudan (Binder et al. 2023). Projections of the impacts of global warming on the El Niño–Southern Oscillation and Indian Ocean Dipole remain uncertain. However, regardless of the trend, the associated rainfall extremes that come with the El Niño–Southern Oscillation and Indian Ocean Dipole are likely to become more severe due to an intensification of hydrological cycles (Palmer et al. 2023).

39 Please refer to the Annex for guidance on how to read the plots and for an explanation of the concept of uncertainty in climate projections.

40 The summary of the key climate impacts in this section is based on: Binder L. 2022. Climate Change in East Africa. Berlin: Potsdam Institute for Climate Impact Research.

41 Very hot days are defined as days with a daily maximum temperature above 35°C.

SEA LEVEL RISE

Coastal and ocean systems are important for the economies and livelihoods of Eastern African countries located off the coasts of the Red Sea, the Gulf of Aden and the Indian Ocean. Thus, sea level rise poses an immediate challenge, as rising sea levels can cause saline intrusion in coastal waterways and groundwater reservoirs, rendering water unusable for domestic use and harming biodiversity (Binder et al. 2023). Moreover, rising sea levels are generally associated with an increased risk of coastal flooding, especially in low-lying coastal areas (Richardson et al. 2022). Assessments show that Djibouti, the Seychelles and Comoros have an especially high risk of coastal flooding (GFDRR 2022).

By 2080, sea levels are projected to rise by around 35 cm (RCP2.6) and 43 cm (RCP6.0) on average over the entire Eastern Africa coastline, compared to the year 2000 (see Figure 23). The coastlines of Southern Somalia in particular, although also Kenya and Tanzania are at high risk of rising sea levels and associated impacts (El-Shahat et al. 2021). In terms of costs, by 2050, sea level rise-induced damages in Dar es Salaam (Tanzania) are estimated to amount to USD 880 million under RCP2.6 and USD 1.36 billion under RCP8.5 (IPCC 2022).

FLOODING

Many areas of Eastern Africa are considered prone to flooding. An analysis of flooding between 1990 and 2014 showed that Ethiopia, Kenya, Somalia and

Tanzania were among the most flood-prone and flood-affected countries across the continent (Li C et al. 2016). In Kenya, heavy rains and subsequent flash flooding and landslides in late 2019 affected over 160,000 people, displacing over 30,000 people, and killing 132 people and 26,000 livestock (ECHO 2019). More recently, in 2020, heavy precipitation and severe flooding in the north of the region, particularly Ethiopia, Sudan and South Sudan, affected more than 3.6 million people (UN OCHA 2020).

Projections of flooding are subject to high levels of modelling uncertainty, owing to the uncertainty of future precipitation projections. Nevertheless, projections for Eastern Africa under RCP6.0 indicate an increase in the proportion of urban areas and roads at the national level exposed to river flooding (Binder et al. 2023).

In the Great Lakes region, more intense precipitation events are likely to increase the risk of pluvial (rainfall-induced) flooding (Ranasinghe et al. 2021; Richardson et al. 2022). Meanwhile, increased precipitation and interannual variability could lead to increased streamflow variabilities across the Blue Nile Basin, with an associated rise in flooding. Certainty over these changes is, however, low due to the uncertainty of future projections of precipitation amounts and their spatial distribution (Ranasinghe et al. 2021; IPCC 2022).

DROUGHTS

Eastern Africa has witnessed some of the most devastating drought events that have led to severe food insecurity, water shortages, agricultural and livestock losses, and acute humanitarian crises (IGAD 2022d). In September 2022, five consecutive poor rainy seasons left over seven million people in Somalia in urgent need of assistance to prevent acute malnutrition and hunger-related death (FEWS NET 2022). In southern Madagascar, prolonged droughts devastated the country's food and water security between 2018 and 2022 (De Berry 2023).

Drought projections for Eastern Africa are subject to large uncertainties, but indicate a general increase in drought conditions. Soil moisture and potential evapotranspiration are two important indicators that are used to measure drought conditions. Under RCP2.6 and RCP6.0, annual mean soil moisture for a soil depth up to 1 m show a decrease of 0.6 per cent and 0.3 per cent by 2080, respectively, compared to the year 2000, albeit with large year-to-year variability and modelling uncertainty (Binder et al. 2023).

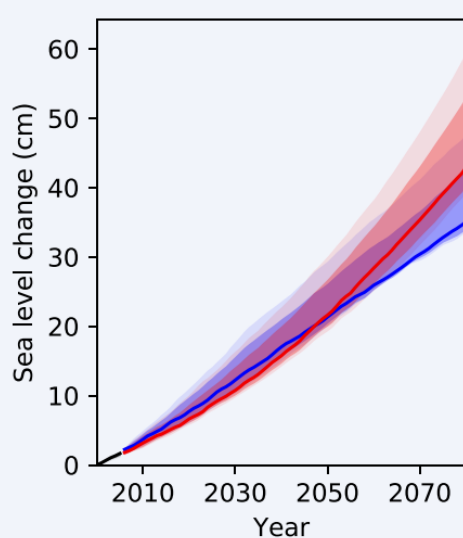


Figure 23: Projections for sea level rise, averaged over Eastern Africa's coastline for different GHG emission scenarios (blue line for RCP2.6 and red line for RCP6.0), compared to the year 2000 (Binder et al. 2023)

In terms of potential evapotranspiration, under RCP2.6 and RCP6.0, projections indicate an increase of 3.3 per cent and 5.7 per cent, respectively, across Eastern Africa by 2080, compared to the year 2000. These projections come with a high level of certainty, with the highest percentage increase likely to occur in Madagascar and southern Tanzania (Binder et al. 2023). In general, higher evapotranspiration rates affect groundwater levels and the amount of surface water that is available for agriculture, thereby potentially affecting agriculturally dependent livelihoods over the long term.

CYCLONES

In Eastern Africa, coastal areas and island states in the southwestern Indian Ocean (including Madagascar and Mauritius) are particularly vulnerable to tropical cyclones. In the southern Indian Ocean, the destruction potential of cyclones doubled during the period 1999–2016 compared to 1980–1998 (Vidya et al. 2021). The resulting socioeconomic damages caused by their landfall are particularly devastating. In March 2023, tropical Cyclone Freddy, one of the longest-lasting tropical cyclones of all times, affected more than 250,000 people in Madagascar in terms of food insecurity and humanitarian assistance, as the country was still reeling from the effects of previous cyclones (UN 2022a; WFP 2023).

More intense tropical storms and cyclones are projected for southern areas of Eastern Africa in general and Madagascar in particular. This increase in cyclone intensity is projected to come with increased heavy precipitation events (Seneviratne et al. 2021).

Climate security risk pathways

COMPETITION OVER NATURAL RESOURCES

Across Eastern Africa, competition over natural resources has been one of the major drivers behind the region's conflicts. This competition, particularly over water, land and forests, stems from changes in the availability of and access to resources. Competition can arise from both resource scarcity and abundance, and is driven by various socioeconomic and governance-related factors, along with climate-related impacts and other environmental challenges.

Pastoralism and cattle raiding

Pastoralism has become a major factor behind many communal resource-related conflicts in Eastern Africa. In part, this is due to the enduring legacy of

colonial imposition of borders which disrupted traditional transhumance routes, and thereby fostered political competition and resource conflicts within newly formed states (IGAD CEWARN 2022b). Counter to prevailing narratives around natural resource conflicts and the role of pastoralists, the most widespread form of these conflicts in areas of Eastern Africa are not conflicts between farmers and pastoralists but cattle raiding. Historically, it has been a traditional coping mechanism used by pastoralists to make up for livestock losses due to droughts, as well as a cultural practice associated with marriages and social relations (IGAD CEWARN 2022b).

The practice was historically kept under control by shared norms and the conflict-mediating roles of elders and traditional authorities. However, it has increasingly turned violent due to the proliferation of small arms and weapons, as well as politicisation and exploitation by political elites (Idris 2018; IGAD CEWARN 2022b). One example can be seen in South Sudan, where traditional disputes, such as those between the Dinka and Nuer pastoralist groups, have been exacerbated by a large proliferation of heavy weapons and the exploitation of intergroup hostilities by state authorities for political interests (Climate Diplomacy n.d.c). More recently, in some areas, cattle raiding has become a highly commercialised process with a large youth involvement. In some cases, it is tied to transnational organised criminal networks, particularly in border areas, which facilitate the trafficking of livestock across borders to escape tracking and legal action (IGAD CEWARN 2022b; Sax et al. 2022).

Climate change impacts – especially droughts, and their increasing intensity and variability – contribute to the level of violence in cattle raiding. In particular, extreme weather events reduce the reliability and predictability of available water and grazing resources, forcing pastoralists to change grazing routes (van Baalen and Mobjörk 2018; Binder et al. 2023). In turn, changes in grazing routes, coupled with growing human and livestock populations, can increase the likelihood of pastoralists coming into contact with other pastoralist groups, making access to resources highly contested, and exacerbating the frequency and intensity of clashes (Richardson 2011; Yoshida 2013; IGAD CEWARN 2022b). The combined impacts of resource pressures, structural inequality and economic marginalisation have also led to a shift in the purpose of raiding from an adaptation strategy to replenish stocks to an increasingly violent and commercialised enterprise (IGAD CEWARN 2007).

Shifts in pastoralist grazing patterns and routes can also result in clashes with sedentary farmers. This can happen when pastoralists cross farmlands more irregularly or too early during the growing season, thereby increasing the risk of crop damage and clashes with farmers. Conversely, droughts and unfavourable climate conditions can result in crop yields shrinking, forcing farmers to expand cultivation, which may encroach grazing routes. Furthermore, farmer-pastoralist conflicts are often intertwined with tribal and ethnic affiliations, as is the case in areas of Ethiopia and Sudan (Yishak 2019; Foong et al. 2020b).

The role of socioeconomic and governance-related factors in land, water and forest conflicts

In addition to pastoral-related conflicts, there are a number of other conflicts around land, water and forests between different user groups across the region. The conflict risks arising from competition over resources in Eastern Africa is further exacerbated by other interacting socioeconomic factors, including poverty and marginalisation of certain social groups (Dutta Gupta et al. 2021). Eastern Africa's growing population, and the resulting increase in demand for food and agricultural products have been key factors driving cropland expansion, which increased pressures on forests and natural land areas across the region (Berkhout et al. 2021). Such trends can already be seen in several areas of Eastern Africa, such as in the vegetated areas of Mount Kilimanjaro (Misana et al. 2012) and in Madagascar, where deforestation is associated with the expansion of rainfed agriculture to cope with droughts (Desbureaux and Damania 2018). The impacts on forest disproportionately affect forest-dependent livelihoods, particularly those of women who often manage natural resources, and whose livelihoods heavily rely on forest products for fuel, food and medicine (Binder et al. 2023).

The propensity for resource competition to escalate into conflicts hinges upon governance structures and government policies. In particular, property rights and natural resource management rules can reduce the effect of resource scarcity on conflicts. In Ethiopia, land tenure certification is found to significantly reduce the effects of water scarcity on land disputes among farm households (Di Falco et al. 2020). Similarly in Kenya, the presence of both governmental and traditional natural resource use and access rules has been found to reduce the number of violent events in the event of a drought (Linke et al. 2018).

Meanwhile, government policies and interventions for climate adaptation, forest protection, commercial agricultural expansion and economic development can result in large-scale land use changes that affect livelihoods. In particular, region-wide land use change, along with climate-related impacts, could become a new driver of localised conflicts and violence over resources in the region (Abrahams 2021). For example, conflict mitigation policies that seek to settle pastoralist communities and limit mobility are sometimes seen as intervening in pastoralists' way of life, thus limiting the effectiveness of policies in addressing the root causes of conflict (IGAD CEWARN 2022b). The establishment of conservation sites run the risk of inciting conflicts. One such example was the establishment of Mago National Park in South Oro, Ethiopia, in 1978, where planning for the park assumed that the area was "uninhabited" and "free of human activity," when in reality there were already six groups living in and using the area. Since its establishment, encroachments into the park by pastoralists have led to clashes with park authorities, which in some cases have been linked to episodes of drought and loss of land as a result of acquisitions by investors (Yitbarek 2020). Conservation policies can also affect other livelihood activities such as small-scale fisheries, which have in the past led to tensions between local fishing communities and conservation authorities (see Eastern African chapter section on maritime fisheries).

Many of Eastern Africa's conflicts stem from political elites exploiting competition over land. For example, in Rwanda, where 80 per cent of reported disputes at the district level are related to land, many disputes have been frequently manipulated by political elites to serve their own interests (Kanyangara 2016). Evidence suggests that land scarcity was one of the many factors, along with droughts and food shortages, that exacerbated the politically driven inter-ethnic antagonism that ultimately led to the Rwandan genocide of 1994 (Climate Diplomacy n.d.h). Competition over land is further driven by the growing privatisation of land and acquisition by external investors, which has led to tensions between investors and pastoralist communities over land access and use rights (IGAD CEWARN 2021).

Inter-state competition and hydropower development

Competition over natural resources in Eastern Africa extends to the inter-state level, particularly

over transboundary water basins and inland lakes. Tensions between upstream and downstream countries over competing water uses, especially over hydropower development, feature prominently across the region's major river basins, including the Nile and Turkana. The Grand Ethiopian Renaissance Dam (GERD) is one such example (see Transboundary Water box). Hydropower contentions have been observed at Ethiopia's Gilgel Gibe III Dam, the operation of which could jeopardise the livelihoods of downstream farming, fishing and pastoralist groups in both Ethiopia and Kenya who depend on the seasonal water flow of the Omo River. The potential for shrinking water resources could aggravate ongoing tensions between communal groups on both sides of the border (Climate Diplomacy n.d.j).

Inter-state security challenges can be seen in the Juba-Shabelle Basin, shared by upstream Ethiopia, downstream Somalia and, to some extent, Kenya. Water resources in the basin are crucial for regional agriculture, drinking water and hydropower. For Somalia, the basin is known as the country's bread basket, because of the country's reliance on the basin's alluvial plains for irrigation (Krampe et al. 2020). Historically, both Ethiopia and Somalia have unilaterally made plans to develop the basin for hydropower and irrigation purposes, which in one instance required intervention and mediation by the World Bank (Salman 2011). While the risk of inter-state conflict is low due to Ethiopia's relative hegemony in terms of its military, economy and diplomatic influence, the impacts of climate change in diminishing river flows and increasing drought frequency could stress water access and availability, disrupt local livelihoods, and trigger inter-state tensions over the basin (Krampe et al. 2020).

One aspect that can escalate unilateral use of transboundary water into an inter-state dispute is the lack of data on basin hydrology and water management, as well as the lack of associated information sharing between riparian countries. Such limitations hinder opportunities for riparian countries to sustainably and peacefully cooperate in managing water resource use. This is the case in the Juba and Shabelle river basins, where sparse data on river flow and water use – due in part to limited monitoring capacities, a lack of governance and security concerns in the region – hinder opportunities for joint water resource development and management (FAO SWALIM n.d.).

LIVELIHOOD AND FOOD INSECURITY

The livelihood and food security of many communities in Eastern Africa are highly dependent on climate-sensitive sectors. Disruptions to the productivity and economic viability of these sectors can deepen economic hardships, particularly youth unemployment, and contribute to broader public discontent and more organised crime. Efforts to address livelihood insecurities, if not done in a climate- and conflict-sensitive manner, can weaken livelihood strategies further and lock communities in a vicious cycle of vulnerability and insecurity. These dynamics are strongly linked to global trade dependencies and price shocks, as well as to the other climate security pathways outlined in this chapter.

Pressure on climate-sensitive livelihoods

Agriculture, pastoralism and fisheries play an important part in the livelihoods and food security of many Eastern African communities (see Eastern Africa chapter section on socioeconomic context). At the same time, these sectors are sensitive to extreme weather events and increasingly erratic climatic conditions due to their dependence on climate-sensitive resources, such as water.

Agriculture and livestock productivity are highly vulnerable to changing temperature regimes. High temperatures are one of the leading factors contributing to the growing rate and intensity of land degradation across the region, which has reduced agricultural productivity and income, and worsened food insecurity. Some regions are likely to face a decline in yields due to the higher frequency and intensity of extreme weather events, while other regions could potentially see productivity gains due to higher water availability and more favourable temperatures, particularly in highland areas. Southeastern Sudan, for example, is likely to face a decline in maize yields of up to 32 per cent by 2080 under RCP6.0 (Binder et al. 2023) due to droughts, shorter growing seasons and flooding damaging agricultural land and related infrastructure (Siddig et al. 2018). Meanwhile, eastern Ethiopia is likely to see an increase in maize yields of up to 77 per cent by 2080 under the same scenario (Binder et al. 2023).

In addition to climate change impacts, various other environmental factors can affect agricultural yields. A particular issue in Eastern Africa is pest infestation. For example, in the Karamoja cluster, desert locusts have decimated agricultural yields, including crops that were grown as a form of liveli-

hood diversification, aggravating rural livelihoods that were already severely strained by the COVID-19 pandemic (IGAD CEWARN 2022b). Evidence suggests that outbreaks of inter-communal conflicts in areas of Kenya are linked to desert locust invasions and the resulting destruction of pastures (IGAD CEWARN 2021).

For pastoralists, climate change can have a profound impact on livestock health and productivity. Excessive rainfall, for example, has led to a spike in the incidence of livestock diseases such as Rift Valley Fever, leading to high livestock mortality rates, threatening human health outcomes and prompting export bans, which have severely affected the meat trade in the region in the past (Whitaker et al. 2023).

In areas that are dependent on the blue economy, temperature regimes affect the biodiversity of aquatic ecosystems, with potentially negative impacts on fishing activities (IGAD 2022d). For inland lake fisheries, such as in the Great Lakes region, reduced precipitation and increased droughts can cause lake water temperatures to rise and levels to fluctuate, with negative consequences for the habitat of freshwater species (Lowe et al. 2019; Nyboer et al. 2022). Adding to the pressure on fish stocks are other environmental factors and human interventions. In the Great Lakes region, the introduction of predatory fish species, increased eutrophication, as well as population growth and increasing demand for aquatic resources have contributed to the decline in native fish populations (Nyboer et al. 2022).

The impacts of climate change on climate-sensitive livelihoods also have important gender implications. Because of gendered norms and divisions of labour that are prevalent in many areas of Eastern Africa, women are more heavily and directly dependent on small-scale agriculture and livestock production, which disproportionately places them at greater risk of climate-related impacts (Abebe 2014). For example, intense droughts in Madagascar have led to more reported cases of violence against women, as domestic tasks such as fetching water and preparing meals – tasks which are traditionally done by women – become more difficult to achieve, leading to violent repercussions from male household members (De Berry 2023). In the Great Lakes region, the impacts on fisheries could disproportionately affect women, as women make up around 44 per cent of the regional population engaged in small-scale fisheries, particularly as fish processors and traders (Chimatiro et al. 2021).

Moreover, because of the prevailing patriarchal settings and marginalisation of women in decision-making processes across Eastern Africa, women are often under-represented in resource management (Abebe 2014). Rural women in Eastern Africa, therefore, have weaker capacities in terms of adapting to livelihood and food insecurity compared to men. Conversely, men who have lost economic livelihoods derived from these sectors may resort to using violence against women to reassert their authority in the household (CGIAR 2022b).

Discontent arising from loss of livelihoods, as well as food and nutritional insecurity can undermine people's trust in state authorities, exacerbate ongoing grievances, and trigger social unrest and political instability (Yishak 2019; Belli et al. 2021). There is strong empirical evidence of these links throughout Eastern Africa. In Sudan, a temperature shock significantly raises the risk of civil conflict in areas where pastoralist groups are present, demonstrating the vulnerability of livestock-dependent communities to climate variability and their subsequent participation in violent activities (Maystadt et al. 2014). Similar observations have been made in areas of Kenya, where a high level of agricultural dependence makes it less likely for individuals to leave the region, increasing the likelihood of joining armed groups (Uexkull 2016). There is also empirical evidence from Kenya linking rainfall anomalies with increased malnutrition (measured via the incidences of child stunting) and subsequent cases of violence (CGIAR 2022b).

Conversely, infrastructural damage and livelihood disruptions caused by protracted conflicts impede the access of vulnerable groups to essential services and markets, the latter being an important factor for the economic viability of agricultural and livestock-dependent livelihoods. Moreover, protracted conflicts disrupt food and livestock production capacities, while also disrupting mobility and its potential as an adaptation strategy (CGIAR 2022a). These impacts create a reinforcing feedback loop that further perpetuates livelihood vulnerabilities and food insecurities.

Adaptation and maladaptation

When communities face economic difficulties, whether from climate- or non-climate-related factors, many turn to other forms of livelihood activities to cope with shocks and stresses. Mobility is an essential adaptation strategy in this regard (see also Eastern Africa chapter section on migration). However, communities also resort to other strategies

– known as maladaptation – that may ease their livelihood challenges in the short run but worsen their vulnerabilities over the longer term, while also exacerbating other climate-related security risks, particularly natural resource competition.

One form of maladaptation that has been widely observed in areas of Eastern Africa is charcoal production. The industry has become an important source of energy and economic revenue for many communities affected by conflict, displacement and environmental hardships, such as droughts. However, charcoal production provides a steady source of income for non-state armed groups, such as Al-Shabaab, thus feeding into the insecurity challenges faced in the region (Climate Diplomacy n.d.a; Foong et al. 2020b) (see also Eastern Africa chapter section on armed groups). At the same time, charcoal production is a major driver of deforestation and environmental degradation. Charcoal-associated deforestation is estimated to have caused the loss of around 2.7 per cent of trees in Somalia in just two years between 2011 and 2013 (Bolognesi et al. 2015). In turn, rapid deforestation further exposes rural communities to extreme weather events, creating a vicious cycle of maladaptation and vulnerability (Climate Diplomacy n.d.a). In Madagascar, poverty is driving communities to exploit mangroves – an important ecosystem for marine life and a key natural defence against coastal hazards – for firewood and construction wood as a source of income (Scales and Friess 2019).

Attempts to build up security and protection from violence could also inadvertently worsen environmental conditions and vulnerabilities to climate hazards. In Uganda, some communities fleeing from cattle raids have reportedly cut down trees to erect fences and protective infrastructure to shield themselves from armed attackers, leading to widespread deforestation and further livelihood degradation (GPPAC 2023).

Other forms of negative coping strategies can be found in the Great Lakes region. For example, in Lake Turkana, many pastoral communities that lost their livelihoods due to drought and cattle raiding have turned to fisheries or a mix of pastoralism and fisheries as alternative livelihood strategies. In some cases, this has led to lake communities competing over limited fish stocks, resulting in violent clashes and the theft of fishing equipment, events that typically intensify during dry periods. These impacts can also have important cross-border

implications, given that communities and the resources they depend on are spread across borders (Sax et al. 2022).

Similarly, in Lake Victoria, many fishing communities have had to transition to small-scale farming due to declining fish stocks and harsher fisheries regulations imposed by governments. However, the increase in flooding has disrupted their alternative livelihood sources. Many communities have had to revert to fisheries and, in particular, to fish deeper in the lake, increasing the risk of trespassing across international borders, and coming into conflict with neighbouring authorities and pirates (CGIAR 2022a).

Global shocks and high trade dependencies

Food and livelihood security in many areas of Eastern Africa are strongly tied to international trade. On the one hand, Eastern Africa is highly dependent on the import of many staple food products, which makes access to and the affordability of food in the region susceptible to global food price shocks and supply chain disruptions (Whitaker and Steinkraus 2023). At the same time, domestic agricultural production in many Eastern African economies is dependent on oil imports for energy, which leaves agricultural productivity in the region vulnerable to global oil price volatilities and shocks in oil-producing regions (Olamide et al. 2022).

The vulnerability of Eastern Africa's food security to global shocks is evident in light of significant global events in recent years. From a security perspective, food price spikes can have politically destabilising effects in Eastern Africa, in addition to humanitarian impacts. This can be seen during the global food price spikes in 2007–2008 and 2010–2011, which contributed to urban protests in Ethiopia, Madagascar, Somalia and Sudan driven in part by their dependence on food imports (Sneyd et al. 2013). These food price spikes were driven by a number of factors, including extreme weather events and export restrictions. For example, in 2011, Russia experienced a severe drought and heatwave that decimated wheat production. In response, Russia imposed a ban on grain exports that triggered global food price spikes and food insecurity in many import-dependent countries (Climate Diplomacy n.d.g).

Moreover, many Eastern African economies and livelihoods are dependent on access to export markets. In particular, the ability of local communities to diversify livelihoods and build resilience

hinges on their access to markets, which in areas of Eastern Africa are hindered by poor transport infrastructure (Destrijcker, Kyeyune and Diefenbacher 2023). At the same time, shocks that occur in export markets, whether from climate- or non-climate-related events, can severely affect the livelihoods of those engaged in the agricultural and livestock sectors. A case in point is the COVID-19 pandemic, during which Saudi Arabia, a major importer of Somali livestock, imposed a limit on the number of pilgrims allowed to perform the hajj. As a result, the demand for livestock products from Somalia plummeted, which severely impacted the livelihoods and financial security of many livestock breeders in the country (Faruk and Bearak 2020).

Conversely, a high dependence on international markets for export revenue can drive further environmental degradation at the local level. For example, the increase in international demand for highly prized wood products, such as rosewood and ebony, is feeding into large-scale deforestation in Madagascar. The situation is further exacerbated by limited forestry governance and enforcement in the country (Waeber et al. 2019). In areas of central Kenya, local communities have identified the growing access to international livestock black markets as one of the drivers of the intensification of cattle raiding activities in the area (Medina and Caroli et al. 2022).

COASTAL AND MARITIME SECURITY

Coastal and island communities across Eastern Africa are vulnerable to the impacts of climate change in a number of ways. Slow and rapid onset events such as rising sea levels and storm surges directly threaten people's safety and integrity. People also face challenges to their economic and food security due to the compounding impacts of human-made and environmental factors that affect marine ecosystems, including the intrusion of industrial fishing fleets.

Coastal disaster hazards

Eastern Africa's coastal areas are highly vulnerable to the combined impacts of climate-related hazards and human-made disturbances. Around 22 per cent of its coastline and 3.5 million people face high exposure to coastal hazards (Ballesteros and Esteves 2021), along with many important biodiversity and cultural sites. Coastal flooding and erosion threaten the region's rich diversity of seagrasses, the impacts of which could weaken the natural protection of coastal areas and heighten the risk of flooding, leading to negative social consequences (Vousdoukas et al. 2022).

The impacts are especially high for Eastern Africa's island and small island developing states. Island states in the southern Indian Ocean are generally at higher risk of extreme sea level events compared to continental coastal areas. This is because many of these island states have lower coastal elevation, which exposes them to a greater area of inundation during extreme events (Sreeraj et al. 2022). For example, the Aldabra Atoll, which is part of the Seychelles and the world's second largest coral atoll, could see up to 17 per cent of its land mass exposed to coastal extreme events by the end of the century under a high emissions scenario (Vousdoukas et al. 2022).

Extreme climatic events such as cyclones and storms are a major safety hazard for many coastal areas and island states in Eastern Africa (see Eastern Africa chapter section on cyclones). In addition to the loss of life, these events can cause widespread damage to buildings, and transport and port infrastructure, while also disrupting access to public services, affecting livelihood and food security, and causing significant economic losses (Adewumi et al. 2022). In the case of the Comoros, more than 3,000 homes and nearly 80 per cent of the archipelago's crops were destroyed when tropical Cyclone Kenneth made landfall in April 2019, resulting in food shortages and price spikes, which affected more than a third of its population (IFRC 2020). Indeed, the country's agricultural sector has been identified as one of its most vulnerable economic sectors to projected climate change impacts (Ministry of Agriculture, Fishing, Environment, Tourism and Handcraft, Comoros 2021).

Water security

Climate change could also have negative consequences for water security in Eastern Africa's coastal areas. Land subsidence as a result of rising sea levels leads to saltwater intrusion into coastal aquifers, an issue that is further exacerbated by droughts and erratic rainfalls that reduce groundwater recharge (Idowu and Lasisi 2020). This is the case, for example, for several coastal communities in Tanzania that depend on coastal rivers as a source of potable water. Coastal rivers, however, are facing increasing salinisation due to rising sea levels, leaking salt into aquifers and wells, which poses a threat to the water security of communities dependent on the rivers (Makoye 2013).

For Eastern Africa's small island states, the impacts of climate change on water security are particularly pronounced. Mauritius, for example, is already

considered moderately vulnerable to water insecurity, with water availability per capita just over the critical water-stress threshold of 1,000 m³ per year for the period 2000–2015. Considering the projected impacts of rising sea levels and the resulting intrusion of saltwater, water availability is expected to shrink to below 1,000 m³ (Boojhawon and Surroop 2021).

The negative consequences of sea level rise and other climate-related events are particularly high in coastal cities, where rapid population growth increases the number of people at risk to hazards. This is especially the case for major coastal urban centres such as Dar es Salaam and Mombasa (Ballesteros and Esteves 2021). While coastal cities continue to be an attractive livelihood option for inland communities affected by environmental and security problems (see Eastern Africa chapter section on migration), displacement out of urban areas, driven by rising sea levels and storm surges, could become a growing trend that warrants attention (Clement et al. 2021).

Pressure on fish stocks

Climate change is likely to have negative consequences on the livelihoods and food security of coastal and island communities across Eastern Africa that are dependent on fisheries as a source of income and essential nutrients (Belhabib et al. 2019). Warmer sea surface temperatures and ocean acidification affect the health of Eastern Africa's coral reefs, which act as important habitats for marine species but could shrink by up to 90 per cent under a 2°C increase in global warming (Binder et al. 2023).

Adding to the pressure on fish stocks are other environmental factors and human-made interventions. This includes overfishing by local fishers (UNDP 2023c), as well as the increase in demand driven by the migration of inland communities affected by droughts and conflict towards coastal areas (Belhabib et al. 2019). In some coastal areas, port development is negatively affecting the integrity and water quality of fish habitats, such as coral reefs and mangroves, thus affecting the small-scale fishing activities of coastal communities (Thoya et al. 2022). The growing pressure on limited fish stocks increases poverty and food insecurity within coastal communities, and heightens competition and tensions between migrant and non-migrant fishers (Belhabib et al. 2019).

Marine conservation sites can help to combat the decline in fish stocks and aquatic biodiversity. However, their establishment, if crudely implemented, can run the risk of disrupting small-scale fisheries and causing frictions with local communities. Such incidences have occurred across Eastern Africa. One example is the establishment of the Mafia Island Marine Park in Tanzania, which disrupted local livelihood activities, resulting in protests and violation of regulations by local fishers (Climate Diplomacy n.d.d).

The impacts on fisheries, whether from climatic, socioeconomic or security-related factors, could disproportionately affect women, given that women occupy important roles in the sector. In the Comoros, women have long been involved in harvesting marine species at low tide, selling half of their catch for income and keeping the rest for household consumption (Harper et al. 2013). In areas of Tanzania, women are engaged in harvesting small fish, seaweed and octopus. However, their roles in the sector are largely overlooked and are increasingly being displaced by men due to growing international demand for local aquatic resources (Porter et al. 2008).

Industrial fishing fleets and piracy

One important factor driving the decline in fish stocks is the intrusion of large-scale fishing fleets, many of which are foreign and illegal, into maritime zones that are primarily reserved for artisanal small-scale fisheries. While some maritime zones, such as those around Somalia and Eritrea, have restrictions in place that ban fishing by foreign vessels, foreign vessel incursions have continued to occur due in part to limited governance capacities to monitor coastal waters and enforce fisheries regulations. The resulting increase in competition and conflict with small-scale fisheries has threatened local livelihoods and food security, while also creating high levels of frustration among small-scale fishers (Belhabib et al. 2019).

The increase in industrial fishing vessel intrusions have also contributed to the emergence of and rise in piracy in the region (Belhabib et al. 2019). Following the droughts in Somalia in 2008, many drought- and poverty-stricken pastoralists turned to piracy as a source of income, with the number of pirate attacks on illegal foreign fishing vessels increasing at around the same time. While the number of attacks has declined considerably since 2010 following the consolidation of the federal government's authority and international military

support, the threat of piracy remains as climate impacts continue to undermine livelihoods (Climate Diplomacy n.d.i).

CHANGING MOBILITY PATTERNS

Populations in Eastern Africa move for various reasons. For many, including pastoralists, it is an adaptation strategy to cope with periods of shocks and stresses. For others, it provides an important escape from conflict, and economic and political instability. Climate change increasingly influences where, when and for how long people move by making environmental conditions harsher and less predictable. In general, climate change is amplifying and altering existing migration trends, particularly

rural-urban migration and cross-border migration, with differential impacts based on people's socioeconomic status. Some estimates project that approximately 41 million people could be displaced by climate-related impacts within countries in the region by 2050 (Amakrane et al. 2023) (see also Figure 24 internal climate mobility hotspots).⁴² In some cases, migration can increase the pressure on resources and services in receiving areas, heightening competition, and stirring tensions between host and migrant communities.

Pressure on resources and services

Climate change is a growing driver of forced migration in Eastern Africa (IOM 2020b), and can

Internal climate mobility hotspots areas in East Africa showing also current locations of refugee and internally displaced person camps

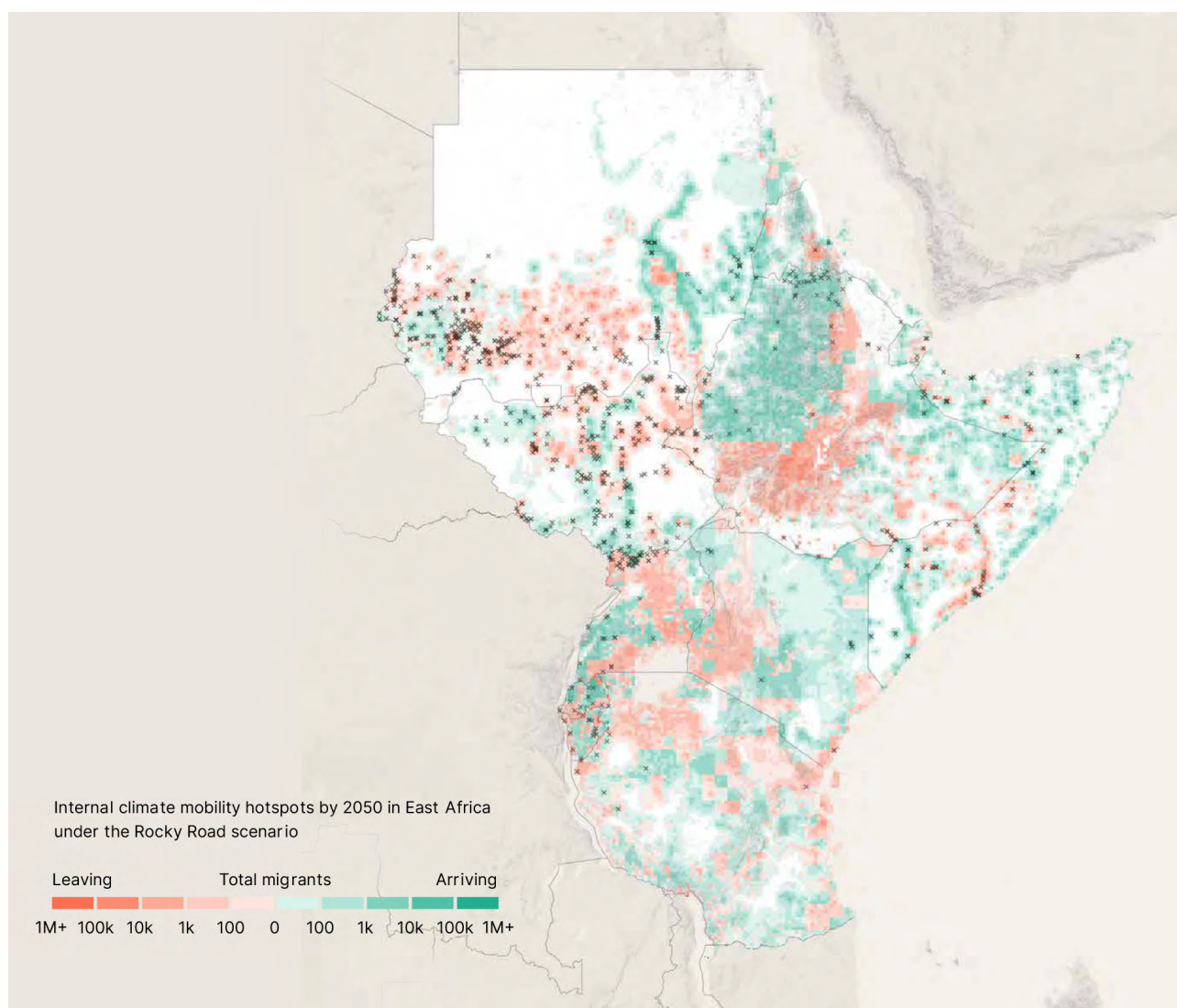


Figure 24: Internal climate mobility hotspots in Eastern Africa, showing current locations of refugee and IDP camps (Amakrane et al. 2023)

heighten conflict and security risks arising from mobility in a number of ways. It can make the availability of water and grazing resources less reliable and predictable, causing pastoralists to change grazing routes, which can amplify clashes with other pastoralists and farmers. Similarly, climate-induced migration of inland communities to coastal areas, a trend which is expected to persist in many coastal areas (see Figure 24 internal climate mobility hotspots), can increase competition over limited fish stocks (see Eastern Africa chapter section on maritime fisheries). Droughts can drive populations to areas with more favourable conditions for agriculture, leading to competition over cultivable land between migrant and resident populations. In the Great Lakes region, Lake Victoria is set to become a climate in-migration hotspot as early as 2030 due to its more favourable environmental conditions for agriculture. However, the area suffers from high poverty rates, and limited infrastructure and service provision, all of which could worsen as the population grows (Clement et al. 2021).

Competition and conflict between host and migrant communities are especially pronounced if tensions fall along ethnic lines, which can exacerbate historical inter-ethnic grievances (van Baalen and Mobjörk 2018). Host-migrant tensions can arise when certain groups perceive unequal access to services. For example, a survey in Kenya found that individuals who were displaced due to climatic events were more likely to participate in social movements, particularly when there was insufficient provision of and access to aid and services (Koubi et al. 2021).

Rural-urban migration

Rural-urban migration trends are prevalent across Eastern Africa, as urban centres are widely perceived to be economic hubs that provide more livelihood opportunities than rural areas (IOM et al. 2022), particularly in non-agricultural sectors such as retail, construction and services (Clement et al. 2021). The impacts of climate change on rural food and livelihood security will likely feed into this trend, which could over the long run create additional stress on infrastructure and services in urban areas (IOM et al. 2022). Moreover, a rise in migration to urban areas can trigger anti-migrant sentiments among host urban communities, particularly if host communities perceive migrants to be receiving more social welfare benefits from international organisations. In addition, host communities may attribute social problems such as rising urban crime rates to migrant groups without substantive evidence (Agwanda 2022).

Growing urban populations, partly driven by rural-urban migration, can amplify the economic and social damages caused by climate-related extreme events in urban areas. For example, Dar es Salaam, one of Eastern Africa's largest and fastest growing cities, is highly vulnerable to flooding, and its associated risks to infrastructure and assets (World Bank 2017a). Flood impacts are further amplified by the limited access of residents to essential services and the high levels of water pollution in the city's river systems, thus creating a number of health risks (Turpie et al. 2016).

In addition to rural-urban migration, out-migration from urban coastal areas could increase as a result of climate-related impacts in coastal zones. Between 2020 and 2050, approximately 750,000 people are projected to migrate out of Eastern Africa's coastal zones, driven by rising sea levels and associated flooding, as well as vulnerabilities associated with population growth and rapid coastal development (IPCC 2022).

International migration

Mobility in many areas of Eastern Africa is characterised by international, cross-border migration. This is particularly the case in border areas where pastoralists often cross borders in search of water and grazing resources (IGAD 2018). Elsewhere, international migration is an essential adaptation strategy for those seeking better employment opportunities beyond the borders of their respective countries.

Localised climate-related impacts on climate-sensitive activities and food security can increase the pressure on people to move across borders and to other regions for better livelihoods. Increasingly difficult conditions at home may even push more people to pursue irregular forms of migration, which exposes them to exploitation, human trafficking and smuggling (IOM 2022c). Moreover, climatic shocks and extreme weather events exacerbate existing resource disputes and sociopolitical tensions that can lead to conflicts and violence in countries of origin, reinforcing internal and cross-border displacement, and migration trends (IGAD 2022d).

Conversely, efforts to tighten border security can restrict cross-border migration as a key liveli-

42 This projection assumes a "rocky road" scenario in which global emissions are high and global warming is at least 2°C by 2050, as well as low levels of cooperation, high population growth, limited economic expansion and low educational attainment.

hood strategy to cope with adverse environmental conditions at home. In particular, the securitisation of borders hinders mobility, threatening the livelihoods of borderland communities that are dependent on pastoralism and cross-border trade (IGAD 2018). For pastoralists in particular, a combination of strict border controls, protracted conflicts and ineffective tenure policies hamper the ability of pastoralists to migrate across borders in search of water and grazing resources (CGIAR 2022a; IGAD 2022d).

Differential impacts of migration

The decision to migrate hinges on a number of socioeconomic aspects that can either push individuals to leave, deter them from moving or pull them towards certain areas. Wealth is an important factor in this regard. For example, in Tanzania, men from wealthier households with more assets such as land are found to have a better chance of migrating in the event of a temperature shock (Hirvonen 2016). This stands in contrast to lower-income households where the likelihood of migrating is significantly lower due to financial constraints and limited assets (Clement et al. 2021). In the worst case, this can lead to situations where certain population groups are not able to move, trapping them in a vicious cycle of climate vulnerability and livelihood insecurity (Clement et al. 2021). In some cases, potential migrants who need to move and have the economic assets to do so may be unwilling to move for cultural or social reasons, which inadvertently aggravates their vulnerabilities (IOM et al. 2022).

Gender is an important aspect that affects climate-related migration decisions and outcomes in Eastern Africa. In particular, women often lack the required resources to migrate. Notably, such resources include not only economic assets, but also social networks and information. Furthermore, social norms and cultural beliefs in the region, such as the prevailing belief that women are primarily responsible for childcare and reproductive responsibilities, often hinder women's ability to move. Thus, women and children are often left behind to face the impacts of climate change at the place of origin. Adding to the pressures they face is the fact that women also have to work the household farm in addition to caring for their families at home (Abebe 2014), increasing the security risks to their livelihoods. The higher likelihood of men moving out of rural farming households further contributes to a "feminisation of agriculture" in which women and girls are left behind to manage household farms (Caroli et al. 2022).

When women and children are able to migrate, they may not experience the same economic and livelihood opportunities, and security that migration offers to men. Instead, women and children often face greater risk of sexual and GBV en route or at their destination, and are more likely to be targeted by human traffickers, worsening their socioeconomic vulnerability. For example, studies have shown that young girls and women from rural areas of Ethiopia who move to bigger cities are often subjected to long working hours and low paying jobs in the informal sector due to a lack of education or skills, which they are unable to acquire because of gendered differences in access to schools, education and training opportunities (Abebe 2014). In Madagascar, women who migrated within and out of the country as a result of the droughts between 2018 and 2022 reported facing higher risks of gender-based discrimination and violence, including human trafficking (De Berry 2023). Similar experiences have been recorded among Eastern African migrants in other regions, such as the Middle East (Sultan and Mlowezi 2019).

Mobility in Eastern Africa has a strong generational aspect, with young people comprising a large proportion of migrants. In 2019, migrants aged 15–35 years made up more than a third of international migrants in the regional labour force (IGAD 2021). In areas of Kenya, out-migration rates from both rural and urban areas are highest for young adults (Clement et al. 2021). Such trends could disproportionately expose young people to potential risks en route or at the destination, while at the same time leaving a disproportionate number of dependents, including older people, to face livelihood risks at home (HelpAge International 2022).

EXPLOITATION BY ARMED GROUPS

Climate impacts are increasingly shaping the operational environment of armed groups in Eastern Africa. Armed groups in the region actively exploit conditions of food insecurity, loss of livelihoods, and political and inter-community grievances for recruitment and support. The extent of their activities depends on prevailing climatic and environmental conditions, which can either hinder or ease their operations, as well as on the existence and profitability of economic activities that provide them with financial support.

Exploitation of livelihood and food insecurity

In Eastern Africa, the impacts of climate change are worsening livelihood conditions and reducing income, which can contribute to more people join-

ing armed groups due to decreasing opportunity costs (van Baalen and Mobjörk 2018). While recruitment into armed groups is a complex phenomenon that is driven by a range of factors, including identity, religion, social and political marginalisation, as well as negative experiences with state security forces, it is also happening against the backdrop of increasing economic hardship and financial incentives that these groups offer. For example, in Somalia, Al-Shabaab offers cash incentives and other benefits to recruit fighters facing poverty and a lack of economic opportunities (Maystadt and Ecker 2014). Similar examples can be found in Sudan where armed groups have capitalised on weak state legitimacy, growing public grievances and inter-ethnic divisions (Foong et al. 2020b), as well as in Kenya where a combination of climate vulnerability, poverty and marginalisation makes certain communities more susceptible to recruitment by bandits (CGIAR 2022a).

Gender is an important factor in the recruitment process of armed groups in Eastern Africa. For men, joining armed groups is sometimes seen as a way to live up to social expectations of masculinity, particularly in the context of widespread unemployment and limited education opportunities (Saferworld 2014). For women, their involvement in armed group activities, whether passive or active, can partly be attributed to social protections that such groups offer, particularly to marginalised women in areas with limited access to justice (ICG 2019). For community-based armed groups, women play important roles in providing logistic and recruitment support. In some cases, women also participate in armed violence (Matfess 2020). Recruitment into armed groups is seen as a means for men to enhance their marriage prospective, and vice versa for parents to improve their financial, social and security status through their daughters' marriage to members of armed groups (ICG 2019). Young people are especially vulnerable to recruitment by armed groups. Young people who stay behind in rural areas, partly because they may not have the resources to leave in search for better livelihood opportunities elsewhere, can grow discontented with their poor education and employment access making individuals vulnerable to recruitment by armed groups who offer economic incentives (CGIAR 2022b). This is especially the case for young pastoralists who, because of the diminishing economic prospects of pastoralism and rising hunger driven in part by harsher climatic conditions, choose to leave their traditional pastoral roles behind and join armed groups (IGAD CEWARN

2022b). The likeliness of participating in armed group activities and violence is especially high for young people who face high levels of political exclusion and injustice (IGAD CEWARN 2023).

Refugee camps in areas of Eastern Africa, particularly those located in border areas, are also key targets for many armed groups in the region. This is due to the dense conditions in border camps, the lack of employment opportunities faced by refugees, and the flow of aid into camps which are often informally taxed by armed groups (Camarena 2023). Moreover, armed groups as well as organised criminal networks often exploit the region's porous borders and weak state control over border areas, enabling these groups to operate at the transnational level (IGAD 2018).

Revenue for armed groups

Across Eastern Africa, extreme wet conditions and an abundance of resources are linked with increases in communal conflicts due to the opportunities such conditions provide for rent-seeking behaviour and recruitment of people to participate in violence (Raleigh and Kniveton 2012). In Somalia, the shift towards charcoal production has increased the revenue base of armed groups such as Al-Shabaab by as much as USD 38 million to USD 56 million annually (Climate Diplomacy n.d.a). Through taxation of charcoal and other natural resources, armed groups have been able to consolidate their power and influence, aggravating conflict and security risks in the region (Whitaker and Steinkraus 2023).

A similar situation can be found in Sudan, where artisanal gold mining has become an important source of revenue for the Rapid Support Forces. At the same time, gold mining has undermined the resilience of local communities to environmental degradation, while also contributing to health problems due to the use of toxic substances during the extraction of gold (Foong et al. 2020b).

Tactical considerations

Where, when and how armed groups initiate attacks depend on a number of economic and environmental factors that offer more tactical advantages. Rainfall variability, for example, can affect the operations and tactical decisions of armed groups. Wetter conditions have been found to enable better camouflage and raiding opportunities, while drier conditions ease movement and improve logistics (van Baalen and Mobjörk 2018). Evidence of this has been found in Uganda, where

the timing of rainfall events significantly influences when conflict actors decide to act (Carter and Veale 2015). In areas around the Ethiopian-Kenyan border, droughts have been identified as a trigger for armed groups to attack water supply points (Peña-Ramos et al. 2022).

The influence of climate change impacts on strategic and tactical decision-making apply to peacekeeping operations. Climate-related hazards such as flooding and sandstorms can reduce the mobility and combat performance of peacekeeping troops (Krampe 2021), necessitating peacekeeping missions to anticipate climate-related events. In the aftermath of South Sudan's catastrophic floods in recent years, UNMISS has been preparing for future rainy seasons, particularly focusing on personnel training and equipment provision (Mandoreba 2023).

Responses and good practices

Compared to other regions across the African continent, Eastern Africa has some of the strongest strategies, policies and mechanisms to prevent and respond to climate-related security risks. This stems from a long history of recognition and understanding of these risks by governments, policymakers and other key decision-makers in the region.

In this section, interventions that seek to address climate-related security risks in Eastern Africa are presented in three parts: (1) regional approaches, (2) national approaches and (3) community-level initiatives.

REGIONAL APPROACHES

Eastern Africa is one of the most advanced regions on the African continent in terms of regional cooperation on matters related to climate change and security. Countries in Eastern Africa are members of a number of international and regional organisations and mechanisms that seek to promote economic, political, social and cultural integration across the region. Several of these organisations and mechanisms are at the forefront of bridging the climate security gap in their mandates and strategies.

The United Nations

Several UN bodies and missions working on peacebuilding and security in Eastern Africa have begun to incorporate elements of climate-sensitivity into their operational structures. In particular, the UNSOM stands out as one of the world's first cli-

mate-sensitive political missions. This is reflected in the UN Security Council Resolution 2408, which recognises “the adverse effects of climate change, ecological changes and natural hazard-induced disasters among other factors on the stability of Somalia,” and emphasises “the need for adequate risk assessments and risk management strategies” (UNSC 2018).

In 2020, an environmental and climate security adviser was deployed to UNSOM, enhancing the mission's work on climate security. The adviser's work centres on three pillars: (1) mainstreaming environment and climate across UNSOM's mandated areas of work; (2) coordinating the work of climate actors (including other UN agencies, funds, programmes, government actors and NGOs) through a “triple-nexus” approach that spans development, humanitarian and peacebuilding issues; and (3) supporting the federal government of Somalia to develop, fund and coordinate climate action plans and policies (Hodder 2021; Russo 2022).

According to interviews with UN agency staff conducted by Russo (2022), the UNSOM adviser has achieved notable successes. Notably, the adviser has supported the programmes of other UN and governmental bodies in sustainable flood management, alternative livelihoods to charcoal production, climate-adaptive displacement and sustainable fisheries. However, the adviser faces a number of challenges, including financial and organisational constraints. For example, it is funded by extra-budgetary contributions that are only secured on a year-to-year basis, which limits its ability to plan for the long term and ensure continuity in its work (Russo 2022).

In addition to UNSOM, the UNMISS has its own climate and security adviser, and assessments conducted by its joint mission analysis centre frequently consider climate-related security risks (Sarfati 2022). Furthermore, the Office of the Special Envoy for the Horn of Africa has a climate security adviser who, in close cooperation with other UN agencies and regional organisations such as the IGAD and African Union, coordinates the implementation of sustainable natural resource management and climate resilience initiatives in the region.

The UNPBF has several projects in Eastern Africa focusing on the climate-conflict nexus. For example, in South Sudan, several UN agencies (e.g. the FAO, IOM and UNWOMEN) are working together

on a project in Bor, Pibor and Malakal to promote local solutions for building climate resilience, and advance peace and stability. The project is centred around three resilience capacities, which include absorptive capacities to anticipate and plan for climate shocks, as well as adaptive and transformative capacities. The latter aims to create sustainable structures to respond to stressors and shocks peacefully (Peacebuilding Fund 2023).

BOX 1:

TACKLING FOOD INSECURITY THROUGH PEACE

The Fighting Food Crises along the Humanitarian-Development-Peace Nexus Coalition aims to “contribute to ending hunger through pursuing peace and unleashing the potential of sustainable food systems to enhance the prospects for peace” (Global Network Against Food Crises n.d.). Launched by the UN Food Systems Summit in September 2021, the coalition is a partnership involving several international and regional organisations, NGOs, research centres, and UN member states, including two from Eastern Africa (Ethiopia and Sudan). The coalition conducts food security hotspot analyses and high-level forums that seek to address challenges associated with the climate-peace-security nexus (Global Network Against Food Crises n.d.).

The Intergovernmental Authority on Development (IGAD)

According to the IGAD’s regional strategy for 2021–2025, regional economic cooperation and integration constitute one of the IGAD’s main pillars of intervention, along with food security, sustainable resource management, and peace and security (IGAD 2020a). As such, the IGAD is well-positioned to mobilise political will and facilitate cooperation in addressing shared conflict and climate risks, particularly through its specialised institutions that have climate risk analysis and conflict prevention mandates.

The IGAD’s work on assessing climate, peace and security-related risks are led by: (1) the Conflict Early Warning and Response Mechanism (CEWARN), which analyses and shares information related to violent conflict, and develops case scenarios and formulates response options; and (2) the IGAD Climate Prediction and Applications Center (ICPAC), which offers climate services, including information-sharing, forecasting and

early warnings; and (3) the IGAD Centre for Pastoral Area and Livestock Development (ICPALD), which is mandated to establish links with CEWARN and the ICPAC in its work to support pastoralist livelihood development, and livestock and dryland management and development (ICPALD n.d; IGAD CEWARN n.d; IGAD 2022d).

There is a high level of collaboration between the IGAD’s specialised institutions and their respective mandates reflect the strong climate-conflict links of their work. For example, since its establishment in 2000, CEWARN’s mandate, structure and early warning indicators have been broadened to include climate and environment (IGAD 2022d). A 2022 study on the climate-conflict nexus in the IGAD region exemplifies this. Using both CEWARN and ICPAC data, the study identifies several climate-related factors, including vegetation and natural hazard-induced disasters, as top predictors of conflict outcomes in the region (IGAD CEWARN 2022a).

The IGAD’s specialised institutions work closely with regional and international partners to address specific thematic areas in the climate security field. Together with the FAO, the ICPAC co-chairs the Food Security and Nutrition Working Group to provide early warning analysis on food security, and a platform to collectively address issues facing policy and interventions on food security (ICPAC n.d.). The ICPAC also hosts the IGAD Disaster Operation Centre, jointly established by the African Union, UNDRR and IGAD. The centre plays a key role in multi-hazard monitoring and early warning analysis for extreme weather events, pests and food insecurity in the region. In addition, the centre is connected to the AU Continental Situation Room for Disaster Risk Reduction (UNDRR 2021).

The IGAD has achieved several notable successes in addressing some of Eastern Africa’s most pressing climate-related security challenges. Following the devastating droughts of 2010–2011, the IGAD established the IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI) to strengthen the IGAD’s overall regional strategy on drought resilience. One of its priority intervention areas is peacebuilding, and conflict prevention and resolution for drought-prone communities, particularly those in cross-border areas (IGAD 2013). However, there is a need to extend the IDDRSI’s approach towards addressing broader climate security chal-

43 Input provided during the regional consultation on climate security in Eastern Africa, hosted by adelphi and the IGAD in Nairobi on 5 May 2023.

lenges, and other socioeconomic and political factors that affect climate security risks, particularly those pertaining to development issues.⁴³

In the Karamoja cluster, the IGAD has been instrumental in bridging the climate-conflict gap and in engaging with local stakeholders in the process. The IGAD's Cross Border Development Facilitation Unit facilitates cross-border dialogue in the cluster, while also developing cross-border bankable resilience projects with high community involvement (IGAD n.d.a).

Recognising the value of mobility for many livelihoods in Eastern Africa, IGAD member states endorsed the Protocol on Free Movement of Persons in the IGAD Region in February 2020. The protocol seeks to enable orderly cross-border mobility and migration in the aftermath of disasters, while also supporting regional integration and development. In addition, the protocol guarantees citizens the right of free movement between, and residence and employment in any member state. The protocol thus contributes to the development of a more coordinated and protection-centred response to disasters, focusing on enabling people to move in response to natural hazards. IGAD will continue working with IGAD countries and partner organisations on its implementation (IGAD 2020b). Similarly, for natural resources such as land, IGAD is implementing the IGAD Land Governance Project, which aims to address issues among its member states surrounding land policy and governance (IGAD n.d.b). For aquatic and maritime environments, IGAD member states endorsed the IGAD Blue Economy Strategy (2021–2025) in April 2022, which seeks to strengthen regional cooperation and integration in addressing some of the key challenges faced by the blue economy (IGAD 2022c).⁴⁴

The IGAD's work on climate security was further strengthened following the 48th Ordinary Session of IGAD Council of Ministers in November 2022. During the session, the council established the regional Climate Security Coordination Mechanism, which aims to build the capacity of member states to “anticipate, prevent and mitigate the outset of climate-induced conflict and displacement” (IGAD 2022a).⁴⁵ Experts have noted that stakeholder and policy-level discussions on addressing core climate-related security challenges have become more focused and targeted thanks to the mechanism. Furthermore, experts note that, through the mechanism, the IGAD – together with international organisations such as the African Union and United Nations – is able to jointly address the climate,

peace and security priorities of IGAD member states, based on the complementarity and comparative advantages of their respective mandates.⁴⁶

In 2022, the IGAD launched its Regional Climate Change Strategy and Action Plan for 2023–2030. Among other things, the document identifies climate-sensitive sectors, security, displacement, gender and young people as priority areas. The document also provides a detailed implementation plan, with the ICPAC leading its implementation and coordination (IGAD 2022b).

The East African Community (EAC)⁴⁷

The EAC aims to strengthen “economic, political, social and cultural integration” across its member states, and has several semi-autonomous institutions that are directly mandated to improve trans-boundary natural resource management (AU 2021). These are (1) the Lake Victoria Basin Commission (LVBC), which aims to coordinate sustainable development and management in the Lake Victoria Basin among its five member states including Burundi, Kenya, Rwanda, Tanzania and Uganda (LVBC n.d.b); and (2) the Lake Victoria Fisheries Organization (LVFO), which is responsible for managing and developing fisheries and aquaculture resources in the region, specifically between Burundi, Kenya, Tanzania and Uganda (LVFO n.d.a).

Both the LVBC and LVFO have made headway in fostering cooperation on resource management through several regional projects and programmes. The LVBC's Integrated Water Resource Management (IWRM) programme aims to build an integrated IWRM strategy for the entire basin, while also addressing water quality issues in the lake through close collaboration with its member states (LVBC n.d.a). On the other hand, the LVFO has supported the establishment of community-based structures for the sustainable management of fisheries and aquaculture resources, including beach management units (LVFO n.d.b).

The EAC has a long history of providing an enabling environment for mobility across its member states, dating back to the Treaty for East African Cooperation that was signed between Kenya, Uganda and Tanzania in 1967, which ensured the free movement of people within the region (UNECA n.d.a). With regards to climate-induced migration, IGAD and EAC member states signed the Kampala Ministerial Declaration on Migration, Environment and Climate Change in July 2022. The declaration calls for countries to work together to address the risks associated with climate-induced migration, includ-

ing rural-urban migration. It also calls for the establishment of an inter-ministerial working group on climate change, environment and migration, and the development of an associated implementation plan. To provide a more supportive environment for migrants and displaced people, the declaration calls for deeper engagement with multilateral development banks and financial institutions to extend funding for countries hosting migrants and displaced people (Government of the Republic of Uganda et al. 2022).

The Horn of Africa Initiative (HoAI)

The HoAI was established with the aim of deepening regional cooperation and integration on development in the Horn of Africa, specifically between Djibouti, Eritrea, Ethiopia, Kenya, Somalia, South Sudan and Sudan. One of its four pillars focuses on building resilience to climate change impacts and other shocks (e.g. conflict and displacement) in the region's borderland areas (HoAI n.d.b). Projects under this pillar have a strong transboundary, regional cooperation focus. For example, projects that aim to promote resilience in borderlands include activities that enhance social cohesion, knowledge exchange and dialogue between communities (HoAI 2022). Moreover, through several programmes funded by the World Bank, the HoAI aims to strengthen food system resilience and water security in the region (HoAI n.d.a).

The Consultative Group for International Agriculture Research (CGIAR)

The CGIAR has a very active presence in Eastern Africa through its well-developed portfolio of projects and tools focusing on the links between climate and security in the region. A key milestone was the launch of the Climate Security Observatory (CSO) in May 2023.⁴⁸ The CSO is an evidence-based decision-making support tool that uses a mixed-method approach to explore the climate-conflict link, identify the most vulnerable areas and groups to climate-related security risks, and assess what actions need to be undertaken to address the risks. One of the distinguishing features of the CSO is its innovative approach that places a strong emphasis on the user, in particular, by streamlining evidence on climate security links to support policymakers in developing climate- and conflict-sensitive solutions (Kluckner and Liebig 2023).

The CGIAR has developed the Climate Security Sensitiveness Scoring Tool (CSST), which assesses the conflict-sensitivity of climate adaptation interventions, such as climate-smart agricultural

practices and participatory rangeland management in pilot areas. The CSST has been piloted in several villages in Kenya, and provides important recommendations for policymakers to improve conflict-sensitiveness and peace responsiveness of climate action programmes (Sarzana, Melgar, Laderach and Pacillo 2022; Sarzana, Melgar and Meddings et al. 2022).

Furthermore, the CGIAR has within its network a number of research centres based in Eastern Africa that are dedicated to specific topics related to climate security. The Alliance of Biodiversity and the International Center for Tropical Agriculture (CIAT) host the CGIAR FOCUS Climate Security Team, which actively leads climate security activities in Eastern Africa. Co-hosted by Kenya and Ethiopia, the International Livestock Research Institute focuses on addressing food and livelihood security through its extensive work on livestock research. Other relevant institutions include the World Agroforestry, which is based in Kenya and works closely with the Center for International Forestry Research to explore the links between climate change, livelihoods, and the forestry and agroforestry sector (Destrijcker and Foong et al. 2023).

The Drylands Learning and Capacity Building Initiative (DLCI)

Working specifically on dryland management in the Horn of Africa, the DLCI (previously known as the Regional Learning and Advocacy Programme) includes conflict sensitivity as part of its mandate to support community-centred policy and practices of dryland management (DLCI n.d.).

The DLCI's work on resource-related conflict management in the region has achieved a number of tangible results at the community level. One example relates to the violent conflict over land competition – a dispute that dates back to 1992 – between the Rendille, Gabra and Borana groups in Marsabit county, Kenya, in June 2020. Since July 2020, the DLCI has facilitated inter- and intra-ethnic meetings, and inter-generational dialogues to build sustainable peace and cohesion (Mokku 2020).

44 The IGAD Blue Economy Strategy (2021–2025) can be downloaded here: <https://igad.int/wp-content/uploads/2022/03/IGAD-Blue-Economy-Strategy-Draft.pdf>.

45 The decision was endorsed by IGAD heads of state in June 2023 (ICPAC 2023b).

46 Input provided during the regional consultation on climate security in Eastern Africa, hosted by adelphi and the IGAD in Nairobi on 5 May 2023.

47 Overview of the EAC: <https://www.eac.int/overview-of-eac>.

48 For more information on the CSO see: <https://cso.cgiar.org>.

BOX 2:**COOPERATION ON COASTAL SECURITY**

Countries in Eastern Africa have made considerable progress in shoring up maritime security through enhanced regional and international cooperation. For example, the decline in the number of pirate attacks along Eastern Africa's coasts can be attributed to improved security measures resulting from international cooperation with Eastern African coastal countries (Belhabib et al. 2019).

In terms of fisheries, countries in Eastern Africa, including several island states, are actively cooperating to safeguard fish stocks from illegal fishing operators. A notable cooperation in this regard is Fish-i Africa, a partnership involving eight countries in the Western Indian Ocean (Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, and Tanzania), regional organisations and international experts that aims to tackle illegal fishing in the region. Through a task force, the partnership enhances regional cooperation on timely access to and sharing of information on illegal fishing operators, which has led to more targeted and effective enforcement actions (Stop Illegal Fishing n.d.).

NATIONAL LEVEL POLICIES AND STRATEGIES

At the national level, countries in Eastern Africa have implemented policies and strategies that aim to address the drivers of climate-related security risks. These initiatives have been developed through close collaboration between the national governments of each country, and regional and international organisations such as the United Nations. This section provides an overview of some examples.

Gender inclusivity

In September 2022, the federal government of Somalia launched its National Action Plan (NAP) for the implementation of the Somali Women's Charter and UN Security Council Resolution 1325. The NAP aims to enhance the inclusion and participation of Somali women in peacebuilding and decision-making at all levels, recognising the security issues faced by Somali women, including those related to climate change, GBV and access to justice. Based on the NAP, five of Somalia's federal states are in the process of developing and launching their own respective local action plans (UN Women 2023).

Climate-sensitive livelihoods

Recognising the cultural and economic importance of pastoralism for many rural livelihoods, as well as the role pastoralism plays in many of Eastern Africa's conflicts, the government of Kenya has a dedicated parliamentary group composed of pastoralists. The Pastoralist Parliamentary Group was established in 1998 to provide a collective voice for pastoralists on issues relating to security and economic livelihoods in the parliament (FAO n.d.). Since its establishment, the parliamentary group has been active in the parliament and has ensured that governmental policies are geared towards ensuring equitable support for pastoralists, particularly in terms of access to water and markets.⁴⁹

For small island states in Eastern Africa where marine and coastal resources are the backbone of their economies and livelihoods, there is a strong degree of integration of climate resilience-building strategies in policies pertaining to the blue economy. For example, the Seychelles launched the Blue Economy Strategic Policy Framework and Roadmap for 2018–2030, which seeks to integrate the island state's approach to ocean-based sustainable development, with economic diversification and food security being among its strategic priorities for action and investment (SMSPP 2018). While climate resilience features prominently in its policies, implementation is limited due to its status as a high-income country,⁵⁰ which limits its access to necessary aid and funding. In turn, this limits the country's capacity to effectively monitor and manage marine resources, and thus respond to the impacts of climate change.⁵¹

Climate-conflict sensitivity

The government of Kenya has already implemented a number of policies and strategies on climate, environment and food security that understand and acknowledge climate-related security risks and the conditions under which such risks emerge. Strategies related to development and disaster risk reduction are particularly well-advanced in terms of overall coherence and awareness of climate security links. However, peace, security and gender-related policies have limited sensitivity to climate security risks. Moreover, Kenya's policies and strategies remain limited in terms of implementing climate security-sensitive programming that explicitly aim to address and prevent such risks (Schapendonk et al. 2022).

The government of Uganda is increasingly embedding aspects of livelihood resilience and grassroots engagement in its responses to conflict and security issues. Learning from past limitations in addressing conflict and violence in the Karamoja cluster, which were heavily focused on coercive militaristic disarmament campaigns, the government launched the Karamoja Integrated Disarmament and Development Programme (KIDDP) in 2006. Among its measures, the KIDDP worked closely with civil society and inter-governmental organisations in the region to support the provision of basic social services, alternative livelihood means, and conflict management and peacebuilding processes alongside disarmament activities. Importantly, the KIDDP began to include a wide range of non-state actors to improve coordination and foster community trust in state interventions (Kachope 2021).

Human health

National level climate policies in Eastern Africa are increasingly recognising the importance of human health considerations in addressing climate-related impacts. The government of Kenya has created the National Climate Change Action Plan, which includes a commitment to enhance knowledge of climate-related impacts on mental health, and incorporate mental health considerations into programmes and policies on climate change. Similarly, the government of Rwanda has launched the National Climate and Environment Fund, which supports programmes that provide community-based psychosocial support networks to enhance mental health and well-being. Through its nationally determined contributions, the government of South Sudan is aiming to strengthen the climate resilience of its health systems, and to better understand the links between human health and climate change (ICPAC 2023a).

Conservation and resilience

Environmental conservation can often be a good entry-point for socioeconomic development, building climate resilience, and preventing or resolving conflicts around natural resources. In Rwanda, Volcanoes National Park applied tourism revenue sharing to integrate wildlife conservation with rural development. Through this programme, tourism revenues are directly or indirectly channelled to residents who live adjacent to protected areas. Despite existing challenges, this approach can help to create mutual benefits and build local support for conservation (Munanura et al. 2016).

COMMUNITY-LEVEL INITIATIVES

Community-level initiatives have historically played important roles in conflict mediation, peacebuilding and resource management in many areas of Eastern Africa. Given the very localised impacts of climate-related events on climate-sensitive livelihoods, community-level interventions continue to be an important factor in ensuring climate-related security challenges are effectively addressed in the region.

In Eastern Africa and especially in the Horn of Africa, community-level adaptation initiatives can be broadly placed into one or more of the following four categories: (1) holistic approaches that incorporate aspects of early warning, environmental protection, conflict management and prevention, and livelihood resilience; (2) resource management approaches that are centred on governance, peacebuilding and early warning; (3) environmental rehabilitation and enhancement (e.g. reforestation); and (4) approaches that strengthen livelihood resilience (e.g. enhancing agricultural productivity and market access) (UNDP 2023c).

Integrated responses

Due to the multidimensional and multicausal character of climate insecurity, integrated responses, for example, that combine livelihood opportunities with social cohesion and peace objectives appear to offer more promise for building climate resilience (Kurtz and Elsamahi 2023). Projects that focus solely on creating employment opportunities, for instance, are found to have limited impact on peace more broadly (Brück et al. 2021). An analysis of USAID programs that focus on peacebuilding, climate change, and environmental issues in the Horn of Africa found that integrated approaches, such as combining livelihood support with social cohesion, have consistently improved people's ability to manage conflicts and cope with climate-related shocks (USAID 2020). A project implemented in Uganda's West Nile region supported refugees to broker land-sharing agreements with local farmers to engage in agroforestry, which helped to boost agricultural production and generate revenue for both stakeholders. In addition, the project helped to counter environmental degradation, and

49 Input provided during the regional consultation on climate security in Eastern Africa, hosted by adelphi and the IGAD in Nairobi on 5 May 2023.
50 Income level as defined by the World Bank: <https://data.worldbank.org/country/SC>.

51 Input provided during the regional consultation on climate security in Southern Africa, hosted by adelphi and the SADC in Gaborone on 7 June 2023.

appeared to improve social cohesion and peaceful coexistence between refugees and host communities (Destrijcker, Kyeyune and Dieffenbacher 2023). Finally, research on integrated peacebuilding programming⁵² on the border of Kenya and Uganda suggests that such interventions contribute to enhanced access to water and pasture for pastoralists, which helps pastoralists prevent and cope with livestock losses during periods of drought (Carson et al. 2021; Kurtz and Elsamahi 2023).

Research conducted in southern Ethiopia has shown that peacebuilding initiatives⁵³ have contributed significantly to the resilience of pastoralist groups in the face of drought by enabling mobility and resource access (Kurtz and Elsamahi 2023). Furthermore, the research found that enabling pastoralists to have greater freedom of movement and access to natural resources made them less likely to rely on distressful coping mechanisms – including violent competition – in response to extreme drought and more likely to employ peaceful adaptive capacities, compared to groups without such access (Kurtz and Scarborough 2012). Similarly, evidence from the Abyei Administrative Area, a contested zone located on the central border between South Sudan and Sudan, indicates that implementing community-based animal health veterinary services within an agricultural livelihood support strategy played a pivotal role in enhancing community relationships and maintaining peace. Increased dialogue between clashing groups over natural resources resulted in a local peace accord that improved access to shared grazing zones and water access (FAO 2017b).

Civil society groups

Civil society groups are making important contributions to early warning and early response systems across Eastern Africa. Such support has largely come through formal and informal networks, such as the East African Civil Society Organizations' Forum (EACSO) (GPPAC 2022).⁵⁴ For example, in Kenya, civil society organisations are an integral part of the country's conflict early warning and response strategy. For example, religious councils and local peace committees in Kenya have been instrumental in providing essential early warning information, as well as filling governance gaps where the state's presence and capacity to provide services are limited (Babatunde Amao et al. 2014).

Civil society groups play important roles in natural resource management in Eastern Africa. In par-

ticular, a number of community-led initiatives are leading the way in ensuring that communities are at the forefront in managing key climate-sensitive resources such as forests, land, water and marine ecosystems, while at the same time ensuring that communities are effectively engaged in conflict mediation and peacebuilding processes (see Box 3: Northern Rangelands Trust).

For example, water resource users associations have been established in areas of Kenya with the aim of regulating water use, conserving water resources, and mediating and mitigating water-related conflicts, with strong stakeholder involvement, including of water users and riparian landowners (UNDP 2023c). In the Great Lakes region, beach management units have been set up to strengthen community participation in the sustainable management of fisheries, and to enhance social cohesion and collective action (Vaccaro I et al. 2013; Nyboer et al. 2022). Some beach management units have worked closely with women and young people to enhance reproductive health, family planning and economic opportunities, while simultaneously promoting sustainable lake resource management (Pathfinder International 2018).

In coastal areas, locally managed marine areas known as *tengefus* have been established to conserve marine and coastal biodiversity and habitats, while enhancing sustainable livelihoods, and ensuring secure and collective tenure of marine resources by coastal communities. *Tengefus* have helped diversify coastal livelihoods by supporting activities that are in line with marine conservation principles (e.g. ecotourism, coral farming and rehabilitation), and have been successful in restoring fish populations and coastal habitats (UNDP 2023c).

Many civil society organisations, however, face challenges in terms of inadequate institutional and technical capacities, and financial resources to ensure the timeliness and effectiveness of their work (Babatunde Amao et al. 2014). The beach management units in the Great Lakes region, for example, were initially successful in enhancing adaptation and addressing aspects of illegal fishing; however, the effectiveness and legitimacy of some beach management units have waned due to corruption, management issues, a lack of sustained engagement and insufficient funding (Nyboer et al. 2022).

In addition, peacebuilding concepts are rarely included in resilience programming and alterna-

tive livelihood generation initiatives at the community level across the region. One notable exemption is the participatory biosphere management plan for the Majang Forest Reserve in Ethiopia. The programme previously had a peacebuilding component, which participants saw as an important factor that improved the programme's overall results, particularly in developing dialogue and mutual understanding between community groups (UNDP 2023c). This example highlights the need for community-based adaptation and development initiatives to fully incorporate and institutionalise peacebuilding components in their programming.

BOX 3:

NORTHERN RANGELANDS TRUST (NRT)

The NRT is a community-based organisation that aims to develop community-led conservancies in the northern and coastal regions of Kenya and Uganda. Specifically, the NRT aims to enhance livelihoods, build peace, and conserve landscapes and wildlife by promoting community-led efforts to sustainably manage natural resources, including forests, land, river and marine ecosystems (NRT n.d.). The NRT has made important achievements in collecting data on weather conditions, conflict incidents and vegetation conditions, while also building peace, devoting considerable efforts to involve women and young people as peace ambassadors, and ensuring continuity and local ownership of resource management processes (UNDP 2023c).

Traditional authorities and cultural norms

Traditional authorities have historically played an important role in managing and mediating cattle rustling activities (Idris 2018). Across Kenya, empirical studies show how local conflict resolution mechanisms have kept the risk of inter-group violence to very low levels (Ide et al. 2014; Linke et al. 2015; van Baalen and Mobjörk 2018). In the lower Omo region of Ethiopia, some pastoralist groups have been able to reduce the risk of conflict over grazing land through negotiations and interplays between individual actors in the absence of formal resource-based rules (Tadie and Fischer 2017). In South Sudan, church-based organisations have played an instrumental role in conflict resolution and peacebuilding between pastoralist groups, such as the Dinka, Murle and Nuer, by providing a space for dialogue and reconciliation between groups (Climate Diplomacy n.d.c).

Moreover, local cultural norms influence how potential conflicts are mitigated or addressed. In areas of Eastern Africa, particularly where Islam is practised, mutual trust and shared understanding of cultural norms prohibit people from committing crimes and violence. These norms are well-understood by local communities and have been incorporated in several peacebuilding initiatives in the region. For example, the Wajir Peace and Development Committee, based in the Wajir District in Kenya, incorporates traditional Islamic mechanisms and values in its conflict resolution initiatives, and has made notable achievements in monitoring tensions and preventing violence in the district, while also raising awareness of women's contribution to peacebuilding in communities (Lado Tonlieu 2021).

There is evidence showing that indigenous customs are instrumental in maintaining the health and integrity of natural landscapes, and thereby conserving natural resources such as forests. Examples include the Tepeth and Pokot societies in Uganda, where strict adherence to traditional resource management practices has kept the forests they inhabit in relatively good condition. Similarly, along Kenya's coasts, where Kaya elders retain an active role in resource management, tree growth and overall environmental conditions remain healthy (UNDP 2023c).

Private sector

In Eastern Africa, the private sector has significantly contributed to climate adaptation by providing adaptive climate services, including agricultural extension services and livestock insurances. In areas of Eastern Africa, private agents and NGOs providing agricultural input and extension services have been able to reach more farmers than formal providers (Nkonya et al. 2018). In Uganda, for example, private insurance providers are enabling barley farmers to access agricultural insurance services more quickly and at lower costs through digital tools, with major barley purchasers such as Nile Breweries covering the upfront insurance costs and deducting the fee from farmers' crop payments at the end of the season (GSMA 2020).

There are examples across Eastern Africa where the private sector has contributed towards enhancing climate resilience of climate-sensitive livelihoods through interventions along the value chain. For example, East African Breweries Limited in Kenya has developed a new type of beer

that provides small-scale cereal producers with direct access to a market for more climate-resilient crops (Gannon et al. 2020).

Financial institutions are empowering the private sector to take a more active role in climate action. The Kenya Commercial Bank (KCB) is accredited to the Green Climate Fund to boost private sector access to green financing in Kenya (KCB n.d.). In Rwanda, the Rwanda Green Climate Fund enables the private sector to access funds for climate change adaptation and mitigation at interest rates below market rates in an effort to strengthen private sector engagement in climate action (Rwanda Green Fund n.d.).

BOX 4:

THE KARAMOJA CLUSTER

The Karamoja cluster, a region shared by pastoralist and agropastoralist communities in Ethiopia, Kenya, South Sudan and Uganda, provides an example of how civil society groups and traditional authorities have played important conflict-mediating roles. In Kenya, “peace caravans” have made headways in promoting dialogue and solutions to conflict, while also lobbying for state-sponsored development and peacebuilding (Okumu 2013). Councils of elders have traditionally mediated conflicts between pastoralist groups by determining the terms of conflict settlement and compensation, and mutual natural resource management, such as grazing rights. However, the role of these councils has diminished due to the proliferation of arms and weapons, which has led to an escalation in violence, especially cattle raiding, as well as incoherent land tenure institutions (Climate Diplomacy n.d.b).

Community peace rituals also play an important role in enabling communities in Karamoja to coexist peacefully. For example, lactating mothers from the Jie and Dodoth communities sometimes exchange their infants for breastfeeding, which analysts have found can sustain long-term peace between the communities (IGAD CEWARN 2022b).

Although women have an integral role to play in the conflicts in Karamoja through, for example, the provision of intelligence and supplies for cattle raiders, women are largely excluded from and have no direct role in formal or infor-

mal conflict resolution and peacebuilding processes. Recent observations, however, suggest that this may change, as women are starting to take on more prominent roles as conveners of conflict resolution dialogue and counselling – roles that were previously reserved for traditional male leaders (UNDP 2022b).

Although intermittent clashes and thefts still occur, the Karamoja cluster is relatively free from deadly violent cattle raids, owing to the recognition and active implementation of climate-sensitivity and grassroots support in security interventions (Kachope 2021).

Sahel: A region under pressure

Geographical and climatic conditions

While definitions vary, the Sahel can be described as a transitional region located between the Sahara Desert to the north and the tropical savannahs to the south (OSCDS and UNHCR 2022). It spans from the Atlantic Ocean in the west to the Red Sea in the east, and covers a number of countries that are part of Western, Central and Eastern Africa. Common definitions include Senegal, Mauritania, Mali, Burkina Faso, Niger, Nigeria, Chad, Sudan, Eritrea, Ethiopia and Djibouti as Sahelian states.

An escalating cycle of insurgency and counter-terrorism operations has destabilised the security situation in the Sahel. In 2023, the Central Sahel suffered the highest number of conflict fatalities in recent years (Luengo-Cabrera 2023). Separatist and, more recently, Islamist armed groups are being fought by military-dominated governments and, occasionally, foreign actors such as the Russian Wagner mercenary group. This cycle of violence has strongly affected the civilian population (Puig Cepero et al. 2021). The conflicts have largely centred on Burkina Faso, Mali and Niger, but have started to spill over into Western African littoral countries such as Côte d'Ivoire and Benin (ACLED 2022). Following the destabilisation of Sudan, the eastern Sahel is also under increasing pressure.

Current trends and future projections for the Sahel indicate an increase in rainfall variability, rising temperatures, and the growing severity and frequency of extreme weather events, namely droughts and flooding (Puig Cepero et al. 2021). Rising temperatures add to already high temperatures, increasing the number of very hot days above 35°C (IPCC 2022). Population and economic growth across the Sahel are driving increased land use, including deforestation. Despite these developments, areas of the Sahel have seen increased wetting and greening conditions after the heavy droughts of the 1980s (Nagarajan 2022). However, uncertainty regarding these models and particularly precipitation projections is high, and it is unclear if the positive gains in vegetation growth will be countered by rapid population growth, overgrazing and other human-made interventions (Puig Cepero et al. 2021).



Climate security risks

In terms of climate-related security risks, there are a number of common risks that are shared across the Sahel region:

1. Livelihood insecurity and natural resource conflicts: Livelihoods and resource access and availability across the Sahel are highly sensitive to the impacts of climate change. Most countries in the Sahel are characterised by low levels of economic diversification, with climate-sensitive sectors such as agriculture and pastoralism being the dominant economic activities (UNECA 2019). Today, conflicts over natural resources – in particular land and water, but also forests and fisheries – are a major security challenge in the region.

2. Armed groups are actively exploiting climate security risks: Areas of the Sahel have been a hotspot of activity by violent Islamist groups such as Al-Qaeda and Boko Haram. Armed groups are actively exploiting climate change-induced state weaknesses and livelihood insecurities, among other things, to provide economic incentives that foster grievances against the state and strengthen their own position (DeConing and Krampe 2021).

3. Maladaptation: In the face of deteriorating livelihoods, communities across the Sahel are trying to adapt. Some adaptive strategies, however, bring their own risks. For example, in Sudan, many IDPs as well as pastoralist groups, facing poverty and lack of employment, have resorted to charcoal production (UNEP and HCENR 2020), resulting in deforestation and renewed conflicts as timber exploitation encroaches upon new areas (Foong et al. 2020a). Similarly, artisanal gold mining across the region provides an important livelihood, but also contributes to the financing of armed groups from Mali to Sudan (Waal 2019).

4. Migration: Human mobility, particularly seasonal and circular migration, is an important coping strategy for many Sahelian communities in times of economic and environmental stress. However, displacement and irregular migration in response to changing environmental conditions and violence are significant challenges that sometimes further aggravate local resource competition and strengthen armed groups when they facilitate human trafficking through the Sahel.

Regional responses

Recognising the converging risks posed by climate impacts and conflict on security and development in the Sahel, states in the region, the United Nations and international partners have established a number of initiatives and specialised bodies dedicated to addressing these challenges.

- The **UNISS** was established in 2013 and operationalised in 2018 through the **UN Sahel Support Plan**, with the aim of bringing greater coherence, coordination and efficiency to the collective responses to crises in the Sahel. UNISS hosts the Sahel Predictive Analytics project, initiated by the UN High Commissioner for Refugees (UNHCR) in 2019, to guide data sharing, preparedness and evidence-based decision-making related to climate security in the Sahel (OSCDS and UNHCR 2022).
- The **UN Special Coordinator for Development in the Sahel**, appointed by the UN secretary

general, leads collective and integrated efforts across the Sahel to scale up development in the region. The Office of Special Co-ordinator for Development in the Sahel (OSCDS) is responsible for leading collective efforts, including financing, to implement the UNISS.

- The **Permanent Interstate Committee for Drought Control in the Sahel (Comité permanent inter-État de lutte contre la sécheresse au Sahel, CILSS)**, along with its regional centre Aghrymet, is an early warning initiative specialised in providing climate forecasts, surveys and training. This includes climate forecasts and predictions, and the monitoring of agriculture and herding, which help farmers prepare for extreme weather events. Both institutions conduct hydrological and ecosystem surveys to track ecosystem evolution and degradation.
- The **G5 Sahel** is an institutional framework between the five Sahel countries, namely Burkina Faso, Chad, Mali, Mauritania and Niger. It was founded in 2014 and sits in Mauritania. It coordinates development policies and security matters.
- The **Sahel Alliance**: In July 2017, France, Germany and the European Union announced the launch of the Sahel Alliance to respond to G5 needs and increase coordination between partners for the implementation of assistance and projects. The founding members were joined by the World Bank, the African Development Bank, the UNDP and other countries.⁵⁵
- The **Great Green Wall (GGW) of the Sahara and the Sahel** is an AU project to combat desertification across the Sahel, which, among other things, contributes to climate change mitigation and adaptation (UNCCD 2020). Launched in 2007, the reforested area is supposed to stretch 7,000 km, but only a small percentage of these plans have been achieved so far (Bove 2021; Gravesen and Funder 2022; Mutanda Dougherty 2023). Nonetheless, the initiative provides a valuable impetus and important lessons learned (see page 33 for a more detailed discussion).

In recent years, several Sahelian countries,

including Mali, Burkina Faso, Chad and Niger, experienced a series of military coups that started to shift the intra-regional and geopolitical relations in the Sahel. Following international condemnation and sanctions, the three military-led governments of Burkina Faso, Mali and Niger quit ECOWAS, citing their intent to better counter terrorists in their countries and sever

ties with Western countries active in the region (Dini-Osman 2024). These developments have weakened regional cooperative efforts around international security, which consequently poses a threat to cross-border security that can worsen existing humanitarian crises, food insecurity, transnational crime and environmental hazards (Dan Suleiman 2023).







Annex

How to read the plots

The maps and plots included in this report provide an overview of projected climate change parameters and related sector-specific impacts in African regions until 2080 under two different climate change scenarios (RCPs). RCP2.6 represents a low emissions scenario that aims to keep global warming below 2°C above pre-industrial temperatures, while RCP6.0 represents a medium-to-high emissions scenario. Projections are provided up to 2080, with each year showing the mean value of a 31-year period.⁶⁵

The **line plots** show climate impact projections averaged over the whole country, with the blue colour representing the RCP2.6 scenario and the red colour representing the RCP6.0 scenario. While the lines depict the best estimate (representing the multi-model median of 10 climate models), the shaded areas represent the likely range (strongly shaded area) and the very likely range (lightly shaded area), indicating the range of model agreement of at least 66 per cent and 90 per cent of all model projections, respectively.

How to read the plots

	historical
	RCP2.6
	RCP6.0
	best estimate
	likely range (central 66%)
	very likely range (central 90%)

The **map plots** display regionally explicit climate information under RCP2.6 and RCP6.0, in a spatial resolution of approximately 50 x 50 km. While the leftmost column represents the baseline period as found in the model data, the other three columns represent future projections in comparison to that baseline period. The colour values depict the multi-model median of the underlying models at each grid cell. The presence of a dot means that at least

75 per cent of the models agree on the sign of change depicted for the specific grid cell and scenario (i.e. whether an increase or a decrease can be expected). Conversely, the absence of a dot represents the lack of model agreement on the predicted change.

UNCERTAINTIES IN CLIMATE CHANGE PROJECTIONS

It is important to acknowledge that uncertainties are always part of climate change projections. Uncertainties arise from a variety of factors, including natural variabilities, uncertainties in GHG emissions scenarios and differences in the models use. Consequently, no future (climate change) projection comes without some level of uncertainty. The levels of (un)certainties, however, differ. We present the results of 10 different global models. To indicate the (un)certainty of the projections, we consider model agreement. The more these models agree the higher the certainty, the more they disagree the lower the certainty. For example, if different models project a similar result under the same scenario, the projected changes demonstrate low levels of uncertainty. However, if the models project very different changes (in terms of range and even direction) under the same scenario, then the projections are uncertain.

Line plots and map plots depict uncertainty differently and cannot be compared. The line plots indicate the level of certainty through the shaded areas, depicting the likely (central 66 per cent) and very likely (central 90 per cent) range of all model projections. Generally, the smaller the shaded areas, the more certain the projections. The map plots depict the level of certainty through the presence or absence of dots. If dots are present, at least 75 per cent of all models agree on the direction of change or, in other words, on an increasing or a decreasing trend. If the dots are absent in a specific region or scenario, then model agreement within this specific region and scenario is below 75 per cent.

To simplify the interpretation of the projections, all line plots and map plots that are subject to high levels of uncertainty are marked with a symbol ().

This does not imply that these plots have no informational value, but rather draws attention to the limitations of such projections for future planning. Consequently, they should be very carefully interpreted when they are used for planning measures. In the case of high uncertainty, additional information will be provided on how to interpret the data.

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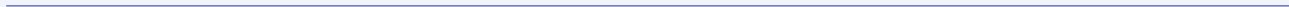
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This report is authored by Lukas Rüttinger (adelphi), Lucas Destrijcker (adelphi), Héctor Morales Muñoz (adelphi), Adrian Foong (adelphi), Jakob Gomolka (adelphi) and Lisa Binder (PIK), in close collaboration with co-authors Taye Abdulkadir (AU), Titilope Akosa (Centre for 21st Century Issues), Anna Belli (CGIAR), Matthew Brubacher, Mabaye Dia (UNOCA), Matthieu Guillier (Alp Analytica), Salma Kadry (CGIAR), Benson Kenduiyo (CGIAR), Grascious Maviza (CGIAR), Chantelle Gloria Moyo (KAS), Serge Ndjekouneyom (UNDP), Linda Ogallo (IGAD), Michel Saraka (ECOWAS), Barbora Šedová (PIK) and Victor Villa (CGIAR).

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AUTHORS

Lukas Rüttinger (adelphi), Lucas Destrijcker (adelphi), Héctor Morales Muñoz (adelphi), Adrian Foong (adelphi), Jakob Gomolka (adelphi), Lisa Binder (PIK)

CO-AUTHORS

Taye Abdulkadir (AU), Titilope Akosa (Centre for 21st Century Issues), Anna Belli (CGIAR), Matthew Brubacher, Mabaye Dia (UNOCA), Matthieu Guillier (Alp Analytica), Salma Kadry (CGIAR), Benson Kenduiyo (CGIAR), Gracious Maviza (CGIAR), Chantelle Gloria Moyo (KAS), Serge Ndjekouneyom (UNDP), Linda Ogallo (IGAD), Michel Saraka (ECOWAS), Barbora Šedová (PIK) and Victor Villa (CGIAR)

REVIEWERS

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adelphi research gemeinnützige GmbH
Alt-Moabit 91, 10559 Berlin, Germany
+49 (0) 8900068-0
office@adelphi.de
www.adelphi.de/en

CONTACT

Lukas Rüttinger
ruettinger@adelphi.de

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