Security

KEY MESSAGES

- As a threat multiplier, climate change exacerbates fragile situations and worsens social tensions and upheaval. Therefore, countries with fragile socioeconomic and political systems are especially susceptible to the security impacts of climate change.
- There can be no adaptation without security, just as there is no security without adaptation. Without effective governance and social and political stability, adaptation projects fall to the wayside, or may even risk exacerbating population vulnerability if they do not consider emergent security risks. Therefore, it is increasingly important to both "climate-proof" security and "security-proof" adaptation efforts.
- A range of early-warning systems (EWS) have emerged in the African context, which effectively warn and inform about dimensions of climate and conflict. EWS should rely on local actors and their knowledge in order to prevent maladaptation and to not enhance or exacerbate existing vulnerabilities of local and marginalized communities.
- Integrating dialogue into the planning and implementation stages of all adaptation projects is important for addressing community


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concerns. Otherwise, adaptation projects could create economic or social winners and losers, increasing instability among the local population. Dialogue programs help to avert these missteps toward maladaptation and establish local partnerships that are more resilient to climate and conflict risks.

- Regional and local security sectors in Africa have a significant opportunity to engage in climate adaptation and climate-security risk reduction. This is because, in many cases, they may be the only existing or best-equipped force to prepare for and respond to disasters.

> **"Without success in Africa, there can be no success in Europe. Our destinies are so intimately intertwined that if we are not collectively responsible for the development of Africa, for Africa being able to use the opportunities it has, we will still be intertwined without doing anything and we will sink together in an ocean of despair."**
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INTRODUCTION

Climate change impacts create novel security threats and also interact with existing social, political, and economic conditions and vulnerabilities. Climate-security analysis seeks to understand these risks as well as identify opportunities to prepare for and to prevent complex climate-related security risks.[1]

This chapter presents a climate-security adaptation framework to better understand the climate and security nexus and support the "security-proofing" of climate adaptation planning. The framework consists of five steps:

1. Identify areas of climate-security risk through an analysis of climate-conflict pathways;
2. Assess climate-security risk through forecasting and early-warning systems (EWS) that combine security and climate risks;
3. Develop "conflict-proof" adaptation planning;
4. Translate climate-security risk assessments into localized action; and
5. "Climate-proof" the role of local security sectors.

Following the framework's step-by-step logic, in the first section the chapter illustrates the nexus of climate change and security through seven climate-conflict pathways—i.e. potential routes in which climate change can impact violent conflict—and their application across Africa. The next section then shows how this theoretical understanding creates the foundation for developing tools such as EWS to predict where climate change will pose the greatest security risks on the continent. The next section is about making adaptation "conflict-proof"—that is, ensuring that high-level information is integrated into regional and local action on climate adaptation. This can be achieved in several ways: by linking the climate-security information network with information-sharing networks at the local level, conducting climate-security scenario exercises among experts and stakeholders to improve preparedness for conflict, and developing participatory and dialogue-based approaches to climate security. The final section highlights the role of the security sector, from regional institutions to local actors, in the implementation of climate adaptation by setting out the principles of a climate-security governance framework and focusing on specific examples of high- and ground-level security action in Africa.

The overall guiding conclusion from this chapter is that there can be no adaptation without security, just as there is no security without adaptation. Without effective governance and social and political stability, adaptation projects fall to the wayside, or may even risk exacerbating population vulnerability if they do not consider emergent security risks. Conversely, without strong climate adaptation measures in place, climate impacts increasingly damage social, political, and governance structures within society, leading to deteriorating security, particularly for vulnerable states and communities. Therefore, focusing on climate security and climate adaptation in concert is key for creating positive outcomes.

IDENTIFYING AREAS OF CLIMATE-SECURITY RISK THROUGH AN ANALYSIS OF CLIMATE-CONFLICT PATHWAYS

The security implications of climate change are undeniable. As far back as 2009, US President Barack Obama had linked the impacts of climate change to conflict, highlighting the vulnerability of fragile regions to deteriorating environmental conditions in a speech on climate change at the United Nations.[2] If institutions and governments remain incapable of mitigating the shocks of climate change, the fragility of states will increase.[3] Climate change can also act as a "threat multiplier,"[4] exacerbating fragile situations and worsening social tensions and upheaval.[5] Therefore, countries with fragile socioeconomic and political systems are more susceptible to the impacts of climate change than countries where the government can act as a buffer for the fallouts of climate change. Regions that are especially vulnerable to climate-related hazards such as droughts, heatwaves, landslides, tropical storms, and wildfires should be analyzed closely, in order to be able to project future pathways, anticipate emerging challenges, and undertake more timely and effective action.

Lower-resourced nations are more vulnerable to climate change and its impacts due to their lower adaptive and coping capacity to support their populations, and those same factors can also make them susceptible to the emergence of conflict.[6] To manage this vicious cycle, it is increasingly important to both "climate-proof" security and "security-proof" adaptation efforts.

Up to half of all African countries have been identified to be vulnerable to climate change and are regarded as very fragile. Nine of the 10 lowest-ranked countries on the ND-GAIN Index, which measures climate vulnerability and readiness to adapt, are in Africa; four among them—the Central African Republic, Sudan, Niger, and the Democratic Republic of the Congo—experienced high-intensity armed conflicts in 2021, and several others have experienced smaller-scale conflicts.[7] Access to water, food, and energy is threatened by climate change trends such as decreased rainfall, rising temperatures, and extreme weather events, leading to a loss of crop productivity, and leaving the continent exposed to further unrest and even conflict.[8]

For example, multiple regions in Africa have seen an increase in conflict between herders and farmers as climate-induced changes through droughts, wildfires and heatwaves decrease grazing lands and available natural resources.[9] If climate adaptation projects are not implemented in a conflict-sensitive way, it could lead to intercommunal tensions and violence. Poor governance and military state interventions that disregard conflict-sensitive approaches, along with the loss of livelihoods, generate further conflict and instability.[10] These factors make Africa especially relevant when it comes to developing adaptation plans that are both climate- and security-proof.

This section outlines seven pathways that shed light on the linkages between climate change and conflict. Further, it applies the climate-conflict pathways to the African context in order to underscore the need for early-warning mechanisms and climate threat assessments.

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Overview of Climate Change and Conflict Pathways

The 2021 State and Trends in Adaptation (STA21) report presented five causal pathways from climate change to conflict risks in the Sahel and the Horn of Africa. They were reduced livelihood security, increased patterns of marginalization and exclusion, the rise in terrorism and non-state armed groups, competition over scarce resources, and increased migratory movements.[11] Building on this, a 2022 study by The Hague Centre for Strategic Studies (HCSS) developed seven climate-related conflict pathways identifying factors that lead to further conflict.[12] These align well with the STA21 pathways and provide more detailed descriptions of the interacting factors for the individual pathways, delivering new insights to our existing understanding of the climate and security nexus. By building on a large and diverse body of literature, this chapter delivers a comprehensive and novel overview of potential routes in which climate change can impact violent conflict. The seven pathways are summarized in Table 1.

The seven pathways identified in the HCSS study are applicable in different regions of the African continent. Sub-Saharan Africa is especially affected by the interplay of climate change and conflict, in particular the Sahel region and the Horn of Africa. This is due to the high dependence on livelihoods based on agriculture and livestock—climate-sensitive sectors that enhance the impact climate change will have on the region and increase the likelihood for conflict to develop. The Sahel region is affected by rainfall deficits and severe droughts but also by heavy rains and floods, leading to conflict and migration.[14] The Horn of Africa is severely impacted by droughts, encouraging migration and ethnic tensions.[15] Migration, combined with poor integration of new migrants, can cause tensions between different ethnic groups that historically have not interacted with each other, heightening the risk of violent conflict.[16] As documented in Somalia, for example, communities that are displaced internally as a result of climate hazards are more susceptible to identity-related conflicts and recruitment by armed groups.[17]

Table 1. Seven Climate Change and Conflict Pathways

	Pathway description	
1	Climate change-related resource scarcity leads to conflict between pastoralist and sedentary communities	Changes in temperature and precipitation cause forms of scarcity that force pastoralist groups to alter their transhumance routes. This precipitates resource competition between groups, infringes on traditional customary regulations, and increases conflict risk.
2	Climate change-related resource scarcity leads to larger-scale intercommunal violence	Climate change–induced scarcity of water, food, and land resources, in combination with social, political, geographic, and economic variables, can trigger intercommunal tensions.
3	Climate change precipitates (internal) migration, leading to social unrest	Climate change can lead to migration, whether from rural to urban areas or between rural areas. This can spark social unrest by increasing resource competition and exacerbating feelings of relative deprivation, as well as by increasing the severity of intercultural clashes.
4	Climate change-related social unrest empowers non-state armed groups	Climate change interacts with state fragility and contributes to livelihood deterioration, creating fertile ground for the emergence and expansion of non-state armed groups (NSAGs).
5	Policies aimed at mitigating the effects of climate change have adverse effects	Climate change policies can trigger political exploitation and marginalization of groups, aggravating existing grievances and tensions.
6	Climate change-related social unrest precipitates large-scale political movements, provoking a government crackdown	Climate hazards can provoke a window of opportunity for violent and non-violent opposition to further undermine authorities. This erodes state capacity and exacerbates social vulnerability. Conflict arises as a result of the state's (violent) crackdown on dissent.
7	Disputes over transboundary resources cascade into interstate conflict	Climate change can foster tensions over transboundary resources in three main ways: 1) water scarcity raises tensions over transboundary freshwater resources; 2) temperature increases create a new frontier for disputes in the Arctic; 3) diplomatic disputes over climate mitigation measures and responsibility.

Source: Authors' summary of Swejis et al., 2022, analysis[13]

These seven pathways highlight a variety of ways in which climate change could trigger conflict—and depending on the fragility of a state, a different pathway could apply. Projecting how a conflict could materialize provides the opportunity to meet climate-conflict risks with a higher level of preparedness, design more effective interventions, and thus moderate their trajectory to prevent the worst outcomes.

Each pathway shows the interaction between climate change and social, economic, and political factors that can produce violence. The index is meant to highlight the different roads conflict can take, while considering the impacts of climate change and the predisposed fragility of individual states. For Africa, pathways 1–6 of those listed in Table 1 are especially relevant. As mentioned above, multiple pathways can emerge and unfold simultaneously, increasing the risk of conflict even further.

As Figure 1 shows, countries in the Sahel and Horn of Africa are the most vulnerable to climate-conflict pathways. In these regions pastoral societies are forced to migrate into areas with sedentary agriculture and the types of production clash, which allows for conflict to emerge.[18]

For example, Niger is confronted with demographic and climatic pressures that are moving the frontier of cultivation north, affecting pastoralist zones and traditional routes.[19] The conflict between agricultural farmers and mobile pastoralist populations (pathway 1) in Mali have been ongoing since the droughts in the 1970s, which catalyzed the rebellion of Tuareg ethnic groups against others over challenges threatening their livelihoods (pathway 2).[20] The Tuareg groups in the Sahel have been migrating (pathway 3) southwards due to climate change effects like high climate variability with drought and flooding, resulting in conflict.[21]

In Kenya, climate-related conflict is characterized by clashes between sedentary farmers and pastoralists, who have been migrating due to severe droughts, leading to violence.[22] Pathway 2 is also applicable in Mali, which has been plagued by unreliable rainfall and land degradation, resulting in lower crop yield.

In most African countries or regions, more than one pathway is applicable, and it is worth pointing out some of the patterns in which they combine and ramify. The West African Sahel region comprising Mauritania, Senegal, Mali, Burkina Faso, Niger and Chad is plagued by high unemployment rates, weak

Figure 1. Climate-Conflict Pathologies Applied to Africa

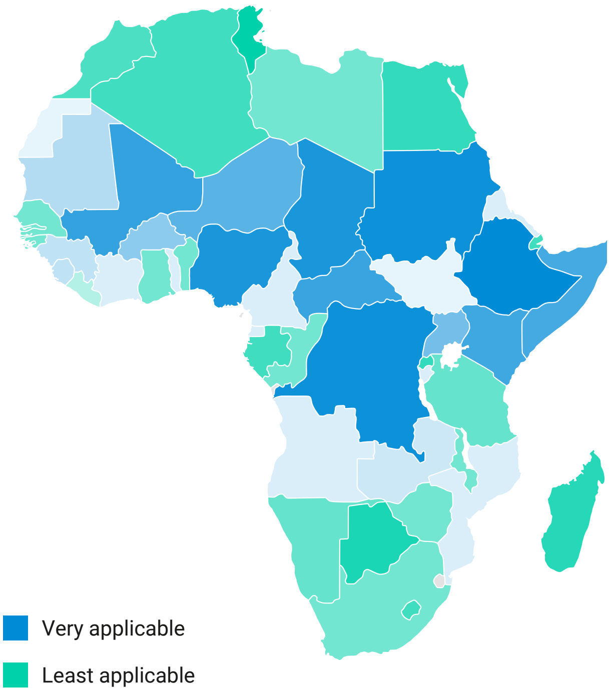

Photo: Djohan Shahrin/Shutterstock

governance, political unrest and radical Islamist groups (pathways 4 and 6).[23] Governments in Mauritania, Mali, Niger, Chad and Burkina Faso are all occupied with fighting separatist or minority ethnic group insurgencies as well as Al-Qaeda or Islamic State–affiliated groups, leading to high political turmoil.[24] This could lead to more social unrest and for non-state armed groups to emerge and gain momentum (pathway 4).

In Mali, fragile governance, political instability as well as livelihood insecurity, marginalization and inequality have led to more opportunities for armed groups to find recruits and support (pathways 4, 5, and 6).[25] There is also evidence to link a higher success rate in recruiting for extremist groups during and after low rainfall periods.[26] For example, when the Malian Government implemented land redistribution measures to advance agricultural productivity and combat the challenges of food insecurity, this approach was challenged by the pastoralist population.[27] Such a policy that focuses purely on expanding the amount of available resources may

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disregard preexisting intercommunal tensions and aggravate them.[28] This led to intensified conflicts between crop farmers and pastoralist groups, highlighting how the policies aimed at mitigating climate change effects instead increased conflict (pathway 5). With an annual 3 percent population growth, there is increasing competition over scarce resources, and as disputes between farmers and herders in Mali and in the Sahel are endemic, the potential for intercommunal conflict remains high.[29]

Overall, the Sahel and Horn of Africa regions, as well as the countries to the south of these regions (Figure 1), are most vulnerable to climate-induced risks, as they already have a precarious starting point through state fragility and ethnic fractionalization. Understanding these pathways and identifying vulnerable regions can facilitate the development of more specific data tools to predict and anticipate climate-security risks in Africa.

ASSESSING CLIMATE-SECURITY RISK THROUGH FORECASTING AND EARLY-WARNING SYSTEMS

Mapping the climate-related conflict pathways in African regions contributes to the development of effective EWS that can prevent or mitigate conflict risks. EWS are based on the idea that by understanding and assessing climate and security risks in advance, local, regional, and national communities will be able to avoid, prepare for, and become resilient against the insecurities that would otherwise emerge. Much early warning is focused on conflict and climate risks as primary threats to human security. EWS aim first to alert key government decision-makers, as well as community leaders, about existing risks. Second, EWS strive to improve decision-makers' comprehension of the risks' potential impacts. Finally, EWS facilitate preventative and mitigative measures known as early or anticipatory action.[30]

To summarize, EWS constitute the consolidated sets of tools, methods, and practices that allow for the systematic collection of data and information to create early-warning products like risk assessment (through monitoring, forecasting, and prediction), and inform early-action policies.[31] EWS help contextualize the crisis in terms of time, space, and potential tipping points embedded in economic, political, social, and cultural structures.[32]

Early-Warning Systems: Methods and Tools

A variety of methods and tools are available for EWS. Most EWS combine quantitative and qualitative methods but rely more heavily on the former. This can be explained by the wide availability of quantitatively based indices, which capture social, physical, and virtual indicators at various levels.[33] However, desk research of publicly available resources, field monitoring for granular and local-level insight, surveys, and crowdsourcing data are gradually being more implemented, along with new means of using artificial intelligence (AI) to process large amounts of virtual, written, and visual information. Digital tools are further applicable for EWS data analysis; correlational statistical models and machine-learning methods can provide interpretable results about relations between indicators and probabilities of risks. Beyond correlation, successful efforts are also being made to use machine-learning applications to formally identify and assess causal relationships between variables of interest.[34]

Support from qualitative or experimental findings can make predictive and causal models more robust. Expert insights and superforecasting tournaments can also reveal trends in data. These analyses are often embedded in frameworks like game theory, market dynamics, actor–network models, or theories of change.[35] One final information-gathering tool of crucial importance is reliance on Indigenous knowledge. As climate and conflict risks ultimately affect individuals on local levels most directly,[36] using existing and entrenched Indigenous knowledge systems can reveal the most culturally, geographically, and historically relevant indicators of risks and the corresponding ways to prevent it.[37]

It is also important to conduct reviews of the take-up of the information produced by the EWS. If the information is not implemented or does not even reach the target actors, then practices should be revised.[38] Additionally, next-generation technologies will inevitably emerge and improve the accuracy and efficiency of existing systems. Incremental improvements are crucial for EWS to remain relevant.

Combining the above-mentioned elements, a range of EWS have emerged in the African context, which effectively warn and inform about dimensions of climate and conflict. Table 2 offers a snapshot of the most relevant examples.

Table 2. Conflict Early-Warning Forecasting Models Currently Being Applied in Africa

Early-warning system	Origin	Focus	Purpose
Continental Early Warning System (CEWS)	The African Union (AU)	Continent-wide, interstate harmonization on a regional level	Anticipation and prevention of conflicts across Africa
Conflict Early Warning and Response Mechanism (CEWARN)	Intergovernmental Authority on Development (IGAD)	East African regional economic community	Sharing information, cross-border conflict monitoring, regional implementation of CEWS conflict analysis
ECOWAS Warning and Response Network (ECOWARN)	Economic Community of West African States (ECOWAS)	West African regional economic community	Detection and monitoring, regional implementation of CEWS conflict analysis
West Africa Early Warning and Early Response Network (WARN)	West Africa Network for Peacebuilding (WANEP)	West Africa	Enhancing human security through monitoring, reporting, and strengthening ECOWARN
Central African Early Warning Mechanism (MARAC)	Economic Community of Central African States (ECCAS)	Economic Community of Central African States	Data collection and analysis for conflict prevention, interstate network building
SADC Regional Early Warning System (SADC-REWC)	Southern African Development Community (SADC)	Southern African Development Community	Creation and management of National Early Warning Centers for information exchange
Water, Peace and Security (WPS) Global Early Warning Tool	World Resources Institute (WRI), The Hague Centre for Strategic Studies (HCSS), Deltares	Africa, Asia, and the Middle East	Identification of conflict hotspots before violence erupts
Five-country Anticipatory Action Framework Pilot Program	UN Office for the Coordination of Humanitarian Affairs (OCHA)	(pilot in) East Africa	Informing preventative action for humanitarian impact of climate and disease crises
Conflict Prevention and Reconstruction Unit	The World Bank (WB) Social Development Department	Global, Great Lakes Region, West Africa	Informing reconstruction post-conflict and preventing future conflict outbreaks
Global Facility for Disaster Reduction and Recovery (GFDRR)	The World Bank (WB)	Global	Developing and supporting planning and management of projects to develop resilience
Famine Early Warning Systems Network (FEWS NET)	USAID	Global	Providing information about food security and risks

Source: Compiled by authors from numerous international sources

Key indicators	Climate dimension	Method(s)	Term horizon
Political, economic, social, military, humanitarian	Access to scarce resources (land and water) is considered a root cause of conflict in the economic dimension	Structural, actor, and dynamic analysis. Scenario-building. Field research, behavioral analysis. Qualitative and quantitative data.	Long term, 1–4 years
Media, peacebuilding, state collapse, elections, forced migration, human rights and judicial reform, small arms proliferation, environmental degradation	Economic community initially focused on issues of drought and desertification. Focus on pastoralist conflicts including those caused by land depletion.	Bottom-up, process-oriented approach, local information collection networks, field monitors. Qualitative and quantitative data.	Live updates and long term, 1–4 years
Shared indicators with CEWARN	Natural disasters as amplifiers of conflict	Citizen and civil society cooperation. Statistical modeling. Field research.	Live updates and long term, 1–4 years
Shared indicators with CEWARN	Prediction of human-caused and natural disasters	Grassroots information, community-based surveys	Live updates and long term, 1–4 years
Existing indicators and rankings on peace, governance, security, human factors	Consolidating climate as a dimension of peace and security	Decentralized correspondents, qualitative and quantitative	Medium scale, several months
Socioeconomic, climate, poverty	Food and nutrition security, prevention of famine, drought warning	Qualitative and quantitative modeling and forecasting tools	Monthly forecasting
Community, conflict, economy, food, governance, and water	Water-related variables are assessed and correlated with conflict outcomes. Causal models provide insights into the interactions between variables.	Machine-learning–based methodology, employing a random forest (RF) model type	12-month forecasts
Climate, environmental, human security	Droughts and floods considered as large-scale natural hazards	Field research, quantitative monitoring	12 days (floods), several months (droughts)
Development, economic, social	Access to natural resources as source of conflict	Qualitative, structural and accelerator modeling	Various
Climate, environmental, economic, tangible and non-tangible values	Resilience to climate change, hydromet services and EWS, resilient cities and infrastructure	Modeling and quantification of disaster risk, desk research (Global Rapid Post-Disaster Damage Estimation–GRADE)	Medium to long term
Conflict-based, weather, and economic shocks contributing to famine		Food security classification data, quantitative	Medium scale, several months

Opportunities and Risks of Early-Warning Systems

EWS possess clear advantages. But their inherent complexity means that their use also presents certain risks of suboptimal outcomes, not to mention the risks of transgression of some ethical boundaries related to the use of data. If properly understood and accounted for, these risks can be mitigated with the requisite controls and precautions. This subsection presents an overview of these opportunities and risks, as well as mitigation measures to provide a more secure sense of how EWS work in practice.

Opportunities: There are three key opportunities presented by EWS. First, the use of EWS creates the chance that conflict risk warnings will be provided in a timely manner. If an EWS is further bolstered by extensive research, triangulated data, and past accuracy, then the legitimacy of a warning is amplified. This effect is reinforced by the fact that EWS can exist at and interact across multiple levels. For example, the CEWS provides broad-overview data, while EWS of economic communities (such as ECOWARN or CEWARN) focus on more granular and locally relevant information. As such, it is more likely that policymakers will pay attention to the warning and that better situational awareness will be established between actors possibly affected by and peripheral to a conflict.

Second, EWS increase the likelihood of early action. If the information distilled from EWS data is delivered to the right policymakers, then early action can take place to prevent and mitigate a conflict. Assuming that EWS contribute to shared awareness, EWS especially make it possible to align policy efforts between governments, local and transnational non-governmental organizations, and other stakeholders.[39] In Africa, the CEWS acts as an international hub for information exchange between the various regional initiatives, including ECOWARN and CEWARN, while the latter can support the operationalization of local and transnational findings.[40] This is especially true if EWS integrate Indigenous knowledge, which can serve as a platform of relevant and reliable information.

Furthermore, if local actors contribute to information, there will be a further stake in seeing the success of early action and adaptation. In turn, stakeholders who rely on EWS can gain domestic and international reputational benefits, signaling their commitment to conflict management. The close proximity and collaboration with local stakeholders are some of the main advantages of ECOWARN and CEWARN, making these international examples of effective EWS. Finally, the early-action initiatives brought on by EWS evaluations can have positive spillover effects into other policy domains, for example by promoting digitalization and improved efficiency as well as practices of transparency and bottom-up approaches.[41]

Risks: Yet EWS also present risks. First, like other predictive tools working on the basis of big data, EWS encounter problems of information inaccuracy. EWS could predict “false positives” (e.g. high conflict risk is predicted, but the risk is minor) or “false negatives” (e.g. no conflict risk is predicted, but conflict still occurs). A false positive may have fewer adverse consequences as it could still motivate useful mitigation efforts. However, a false negative reveals

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that the model is faulty and requires revision, leading to reputational losses.[42] A lack of trust in the results negatively affects the likelihood that policy actors will take the desired actions. False results may also be caused by malicious actors, motivated to manipulate results to their favor. Furthermore, even correct results must be presented in clear, understandable, and implementable ways, so as not to alienate policymakers lacking relevant training.

Second, EWS bring unique ethical risks. Data used by EWS is part of the debate on privacy and data ownership. Furthermore, when data stems from the Global South, there are additional concerns about exploitative extraction practices by actors from the Global North. Despite the acknowledged usefulness of Indigenous knowledge, the possible commodification of cultures and insensitivity toward their practices can make it difficult for such information to be accessed and integrated effectively into EWS. Overall, misuse of data can have reputational repercussions for the perceived reliability of EWS.[43] Simultaneously, a big data focus risks neglecting indispensable local perspectives, creating results that are ultimately irrelevant to local populations.

Finally, while EWS aim to warn against conflict, EWS research may aggravate humanitarian issues. The actions that are interpreted as "correct" or "necessary" based on EWS results can worsen and even create new types of conflict. For example, research has repeatedly come to the conclusion that military interventions tend to prolong conflict.[44] Yet, even without military interventions, mitigatory or preventative actions based on EWS can lead to local economic and political imbalances if implemented without a mind for sustainability.[45]

Mitigation: Fortunately, there are ways to mitigate EWS risks. First, it is important to triangulate data and models to minimize inaccuracy issues. The risks of EWS can be resolved by using mixed-method, quantitative–qualitative approaches from the outset. Second, to tackle the risks caused by ethical concerns, EWS initiatives should outline ethical and legal guidelines that address privacy risks, accessibility, and sourcing of data to avoid exploitation. Setting such a bar would mean that EWS draw upon the expertise only of trusted advisors who understand local actors and conflict dynamics, thus minimizing the risks of input manipulation or biased answers. Crucially, any early action that results from EWS should be carefully evaluated to avoid unsustainable choices or escalations of humanitarian crises. And finally, it is necessary to manage expectations about what EWS can and cannot do. Depending on the parameters, EWS are limited in the kind of information they can provide.[46] The stakeholders using EWS should be made aware of this, so they can use EWS to make the most informed choices for the purposes that they were meant for.

MAKING ADAPTATION ACTION "CONFLICT-PROOF"

EWS and other climate-security risk assessment tools provide helpful maps for developing adaptation strategies, yet the mere existence of such tools is not a silver bullet for addressing climate vulnerability. In order to translate quality information into action, climate-security actors require mechanisms to apply these tools on the ground. These actors can adjust existing climate adaptation programs to make them more "conflict-proof" and can create climate-security partnerships that provide new solutions to confront intensifying risks strategically. These programs and partnerships can ensure that high-level information is integrated into regional and local action on climate adaptation.

Given the interconnected nature of climate impacts, social vulnerability, and conflict risks, it is critical that climate adaptation programs be made "conflict-proof". Adaptation initiatives should integrate concerns regarding social vulnerability and include alternative pathways to respond to changing social and political conditions. This is particularly important given the long timescales that are required to design effective adaptation strategies. A 2020 brief from the International Institute for Sustainable Development noted that the timescales required for an effective National Adaptation Plan (NAP) process align well with relevant timescales for peacebuilding.[47] Post-conflict recovery can take decades to achieve long-term stability goals and climate adaptation planning often also requires a generational lens.

National climate policies such as Nationally Determined Contributions (NDCs) can also take into account the interplay between climate variability, extreme weather, land-use pressures, transhumance, and the potential for intercommunal conflict.[48] For example, Mali's NDC states that enhancing and protecting the natural resource base may serve as a good adaptation strategy to minimize conflict between farmers and pastoralists.[49] The country's National Adaptation Programme of Action, in 2007, had recognized that changes in natural flood systems and frequent droughts were weakening and degrading ecosystems, driving migration, which might result in land disputes and conflict.[50] Finally, successful climate change adaptation policies could be scaled up. In the case of Mali, that includes changes in the production and marketing strategies for livestock.[51]

While the extended timescales of NAPs and NDCs provide opportunities for peacebuilding, they also introduce more uncertainty into adaptation planning. Effective adaptation plans should acknowledge and address this uncertainty. Sociopolitical dynamics and conflict conditions can change drastically over the course of decades. Without effective plans in place to adapt existing adaptation programs in the face of disruptions, adaptation initiatives risk disintegrating quickly in the face of conflict, leaving populations vulnerable to both climate and conflict risks. Resilient adaptation planners, including donors, governments, and implementing actors, must prepare to pivot their interventions to remain resilient across a range of potential future scenarios, including conflict. Flexible operational protocols throughout the implementation of the adaptation strategies are necessary to account for changing factors over time.[52]

A final consideration for "conflict-proofing" adaptation programs is to avoid maladaptation, which can entrench or exacerbate the existing vulnerability of marginalized populations. Maladaptive solutions may address short-term climate risks while heightening long-term vulnerability. From a climate-security perspective, maladaptation could lead to risks such as decreased land tenure security; marginalization of minority groups; increased environmental degradation; and the exploitation of climate funding by biased, elite, or oppressive groups.[53]

Given these risks, it is important to understand the complexity of population vulnerability, ensure equitable stakeholder participation in project design and implementation, and implement robust evaluation of the success of adaptation programs in order to avoid maladaptation.[54] Local communities, including marginalized groups, have the most direct understanding of maladaptation risks, which may vary greatly at the subnational level. Therefore, another starting point for more security-proof adaptation policies is Local Adaptation Plans of Action (LAPAs), which can then help to shape broader National Adaptation Plans.[55] Local communities are the best choice for identifying conflict risks and potential solutions, and analyzing the impact of adaptation interventions on conflict dynamics.[56] It is exactly for these reasons that local communities should have a leadership role in responding to EWS. This issue is explored in greater depth in the next subsection.

Integrating Local Leadership into Early-Warning Systems

One major challenge for EWS in Africa is ensuring that the data and information they provide is applied on the ground to increase climate resilience in tangible ways. A lack of localized knowledge and data analysis in addition to challenges to disseminating information to local communities are barriers to effectively responding to climate and security risks. In response to this gap, a series of interviews with the International Military Council on Climate and Security (IMCCS) members based in Africa highlighted the opportunity to integrate information sharing and planning into existing local customs for adaptation to climate-security risks.

Robust systems for information sharing exist at the local level, yet they are often misunderstood or underappreciated by regional or state institutions. However, when those local information-sharing systems are utilized, they can be very effective at mobilizing communities to action and doing so at a low cost. In one example from expert interviews, an Indigenous local community leader in South Sudan was able to convene the community in order to warn them about an incoming flood based on meteorological predictions. In the meeting, the community also discussed the steps they might take to prepare for the incoming disaster. This community leader was able to accomplish information sharing that directly translated to collaborative action on an immediate timescale. In contrast, the expert predicted that the same process would have taken a traditional meteorological team extensive time and financial/personnel resources to accomplish.

As this example illustrates, expanding the opportunities for local engagement is common sense, and can help fill the gaps in traditional information-sharing methods. It can also guard against maladaptation by ensuring that the community's perspectives regarding its own security and climate adaptation are elevated to the highest levels of decision-making.

Active Climate-Security Scenario Exercises

EWS leverage data in order to assess and predict the likelihood of climate impacts and disasters. However, data often fails to predict the impact of less-measurable variables, such as governance decisions or social, cultural, or geopolitical dynamics. For example, in Ethiopia, adaptation planning based on climate predictions has informed the resettlement of pastoralist populations. However, that resettlement has contributed to the further marginalization of those groups in society,[57] a factor that likely could not have been predicted by data alone. Given the human dimensions of these dynamics, it becomes useful to combine data with the experience of practitioners, experts, and stakeholders through serious gaming and scenario exercises.

Climate-security scenario exercises provide participants with relevant background on climate conditions, disaster projections, history, culture, and politics in the country or region of interest. With this background, participants encounter a theoretical future risk, which they must seek to understand and respond to. The goal of these exercises is to bring together experts, practitioners, and stakeholders to address realistic future scenarios in an integrated way.[58] A collection of experts may be able to assess social, cultural, political, and governance dynamics in a way that data cannot. Scenarios can also bolster the preparedness of climate-security practitioners and community members to respond to emerging risks on a local, national, or regional level in Africa and develop effective climate-security adaptation strategies for action.

Box 1. A Case Study in Mobilizing Stakeholders to Action: The Water, Peace, and Security Partnership

The Water, Peace, and Security (WPS) partnership is a case study that illustrates how adaptation tools have been translated into stakeholder engagement and integrated action.[59] The WPS partnership has created a Global Early Warning Tool that seeks to anticipate the emergence of water-related conflicts. For example, the February 2022 quarterly analysis warns of possible emerging conflict in Kenya, Somalia, Ethiopia, South Sudan, and Cameroon.[60] The data analysis lays the foundation for identifying the most pressing risks, but it is only the first step of the partnership's work. The WPS partnership builds on its data tool in order to implement adaptation action through a four-step process: understand, mobilize, learn, and dialogue.

Figure 2. The Water, Peace, and Security Process

Source: Adapted from WPS website[61]

The early-warning tool developed by the WPS partnership synthesizes and analyzes data from around the world in order to help policymakers understand where water/climate risks intersect with political instability and threaten conflict. The publication of quarterly analyses makes complex data across a global landscape accessible to policymakers and humanitarian, peace, and security actors. The available information further drives analysis, engagement, and action on the ground.

The information provided through EWS is then intended to mobilize stakeholders and decision-makers to action. The WPS partnership has found that action to adapt to climate-security risks is more effective when it is integrated, as opposed to siloed. Therefore, adaptation projects should be co-created by a diversity of relevant stakeholders. For example, in Kenya, the WPS partnership has engaged in participatory workshops with government authorities, local civil society organizations, and national and regional organizations to develop a work plan for addressing water-related conflicts in the Turkana basin.[62] Ultimately, participatory processes mobilize diverse actors to reach more effective adaptation solutions.

WPS training programs can help to bolster stakeholder engagement by providing tools to the 4D community (diplomacy, defense, development, and disaster response) to understand and adapt to climate-security threats. This includes skills for identifying climate/conflict risk hotspots and engaging in conflict resolution and community mediation. Additionally, these trainings can include serious gaming and scenarios exercises as a way to build adaptation strategies.[63]

A key pillar of the WPS partnership is dialogue, an active peacebuilding practice. Climate challenges and water scarcity can serve as an impetus for collaboration, especially in the implementation of climate adaptation projects. In Mali, the WPS partnership has established three dialogue programs to engage communities on water and security links, gather their perceptions of key risks and potential solutions, and present tools and advocacy opportunities to strengthen the voices of communities.[64] The programs resulted in 15 sessions (five per location) and were devoted to an introduction to conflict analysis, mapping of key water-related security risks in each location, in-depth analysis of key risks, and the presentation of prospective tools.

Photo: Framalicious/Shutterstock

In Ethiopia, the WPS partnership's work is in the early stages of engaging with relevant stakeholders and it has conducted a four-day preliminary workshop with high-level decision-makers at the ministerial, regional, and basin levels. This resulted in a better understanding of the major challenges in the region's water resource management, serving to help the Omo-Gibe Basin development plan, identify potential pitfall traps, avoid repeated mistakes, and improve effective implementation.

Integrating dialogue into the planning and implementation stages of all adaptation projects is important for addressing community concerns. For example, adaptation projects could create economic or social winners and losers, increasing instability among the local population. Dialogue programs help to avert these missteps toward maladaptation and establish local partnerships that are more resilient to climate and conflict risks.

The WPS partnership provides a useful four-step model that can be applied to adaptation projects in Africa: understand, mobilize, learn, and dialogue. These steps can ensure that adaptation programs address the most serious climate-security risks and do so in a way that builds peace, rather than entrenching instability or exacerbating conflict risks.

"CLIMATE-PROOFING" SECURITY ACTION

The African security sector can make important contributions to climate adaptation action in a way that is "conflict-proof". Around the world, the military is increasingly on the frontline of responding to natural disasters. Traditional humanitarian institutions have raised valid concerns about the involvement of the military, especially in conflict or post-conflict societies where legacies of violence are pressing concerns for local communities. However, military forces, especially local security forces, are often the first and best equipped to take rapid action when disasters hit. They are also already primed for robust planning through training and scenarios exercises, which can inform anticipatory adaptation strategies.[65] Defining policies and best practices for security sector engagement in climate adaptation in Africa can help build on the opportunity for action.

The principles identified for a global framework in "The Responsibility to Prepare and Prevent: A Climate Security Governance Framework for the 21st Century"[66] translate well into an adaptation framework for Africa, which can guide the development of adaptation leadership and strategies. These principles include assessment and anticipation, elevation and translation, and coordination and alignment.

The first principle, assessment and anticipation, emphasizes the importance of establishing an oversight framework and body to anticipate risks. The African Union's Continental Early Warning System (CEWS), which currently focuses on conflict predictions alone, could become a natural home for more intersectional risk assessments.[67] An integrated risk assessment tool could analyze factors like natural disasters, drought, and climate-induced migration and predict the relationship between these factors and conflict risk. Following the example of the WPS early-warning tool, this information could be disseminated to regional and local actors, allowing them to anticipate and respond to oncoming risks.

The second principle, elevation and translation, focuses on the adoption of climate-security concerns and solutions by senior leadership. This high-level buy-in is critical because it can accelerate action across all levels of government and coordination between states. It can also enable conversations across the 4Ds (diplomacy, defense, development, and disaster response) for more integrated and effective climate-security action.

The third principle, coordination and alignment, seeks to align climate policy and action with security policy and action. As previously discussed, it is important to "conflict-proof" adaptation. Complementarily, it is important to "climate-proof" peace and security interventions. Climate practitioners should be responsive to conflict risks and security institutions must be prepared for climate risks.

Examples of Regional and Local Security Actors Undertaking Climate Action

The UN Office for West Africa and the Sahel (UNOWAS)

In 2020, the mandate of UNOWAS was updated to, "Take into consideration the adverse implications of climate change, energy poverty, ecological changes and natural disasters, among other factors, including by assisting the governments of the region

and the United Nations system in undertaking risk assessments and risk management strategies relating to these factors."[68] This mandate represents a significant positive step in the elevation of climate-security concerns and translation into action at senior levels.

Already, actions taken by UNOWAS include the establishment of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS), research on emergent conflicts between pastoralists and farmers in the region,[69] and collaboration with the Economic Community of West African States (ECOWAS) on conflict-sensitive approaches to NAPs.[70] In addressing the implementation of adaptation plans, the UNOWAS–ECOWAS partnership has found that it is critical to draw on existing local knowledge, customs, and capacity in order to minimize the burden on local actors and find solutions that work in the given context.[71]

One of the largest recommendations for further work in the UNOWAS is to create mechanisms to respond to existing EWS and transfer the information they provide into existing local networks and governance systems. Existing tools like the Pastoral Early Warning System, which tracks drought, or an EWS developed by scientists to track locusts are available, yet the information they provide must be disseminated to the local communities that must adapt to changing climate impacts.[72]

Photo: UN Photo/Catianne Tijerina/Flickr

The African Union

The African Union has set a positive example for integrating climate-security concerns into their policies and frameworks, building a foundation for expanded action on these accelerating risks. The policy frameworks that address, in part, the security impacts of climate change include the African Union Master Roadmap of Practical Steps to Silence the Guns in Africa by Year 2020, the Continental Structural Conflict Prevention Framework (CSCPF), and the Africa Peace and Security Architecture (APSA) Roadmap 2016–2020.[73]

To examine one of these frameworks, the CSCPF creates a process for the development of country-specific vulnerability and resilience assessments, intended to understand the underlying structural dimensions that inform conflict. The document explicitly names environment and climate change as a potential structural cause of conflict and instability in the region and encourages assessments to shape effective structural vulnerability mitigation strategies. It is also tied to a continental EWS through the Africa Prospects tool.[74] This approach provides a theoretical foundation for addressing systemic risks, and follows the recommendation to link early-warning data with a strategic policy framework for response.

Given this foundation, moving from the development to the implementation of these policy frameworks is a clear next step for African Union leadership, which has the opportunity to elevate climate security to high levels across the continent. One of the African Union's largest strengths is its opportunity for cross-sectoral collaboration, which is already increasing on climate security. Leveraging partnerships to integrate climate-security policy frameworks into a diversity of portfolios of action including food security, humanitarian intervention, conflict prevention, and development is key to addressing the root causes of instability.[75]

Local Security Actors

In a series of interviews, IMCCS members based in Africa expressed the critical importance of local security forces in climate adaptation planning and disaster response. Even in locations where disaster management committees exist, they are often under-resourced and ill-equipped to respond to disasters in real-time. Therefore, local communities are most likely to turn to the military and/or the police to respond in times of crisis. When disaster strikes, deliberating on which kind of actors would be best to respond is a luxury. Those who are present and equipped to act become the default first responders, with few questions asked.

One former government official explained further that security forces are equipped with resources and personnel that would need to be externally contracted by a disaster response unit. While an under-resourced disaster response committee is working to contract medics for their mission, military medics are already on the ground responding to communities in need when disaster hits. Given the current distribution of resources, security forces play an essential role in responding to intensifying climate impacts and preventing loss of life.

A key role of security forces is strengthening the capacity of non-military actors to engage in long-term strategic planning in the face of climate and conflict risks. This would enhance the coordination between security forces and communities during disaster response initiatives, while also creating an environment in which climate-security adaptation measures are effective in the long term and managed by local stakeholders. In addition to making these approaches conflict-sensitive, interviews revealed that gender-sensitive approaches are also critical to prevent exacerbated risks for vulnerable communities.

Ultimately, regional and local security sectors in Africa have a vast opportunity to engage in climate adaptation and climate-security risk reduction. In many cases, they may be the only existing or best-equipped force to prepare for and respond to disasters. Creating strategies to improve this engagement for the benefit of local communities will guide future efforts to weather the increasing intensity of climate impacts.

RECOMMENDATIONS

The security landscape in Africa is evolving in response to rapidly shifting climate conditions. Integrating climate and security action is critical for adapting to the unprecedented challenges of a climate-changed world. As this chapter shows, climate adaptation projects cannot be designed and implemented in isolation of policies meant to address economic, social and political challenges faced by local populations, and vice versa. The climate-security adaptation framework presented in this chapter can support efforts to design more timely, effective, and resilient adaptation-based plans that are “conflict-proof” and “climate-proof”. Some points for policymakers to consider are:

1. Developing a conflict-sensitive climate adaptation strategy and a climate-sensitive security strategy requires a deep understanding of the climate-security nexus and of the ways in which this applies to the local context. Research on the climate-security risk nexus has identified several pathways by which climate change impacts can produce social, political and economic conflict. Many of these pathways have a direct application to Africa, and specific combinations of them can be identified in particular regions. Understanding these pathways and identifying vulnerable regions can facilitate the development of more specific data tools to predict and anticipate climate-security risks in Africa.
2. The design and deployment of effective EWS is an indispensable part of dealing with climate-security risk. Based on triangulated research methods involving local communities and climate-security practitioners, an effective EWS can be developed that informs the development of adaptation programs to address climate-security risks. EWS should rely on local actors and their knowledge in order to prevent maladaptation and to not enhance or exacerbate existing vulnerabilities of local and marginalized communities. Any action informed by EWS must be carefully evaluated to avoid unsustainable choices, unintended consequences for local communities, or escalations of humanitarian crises.
3. Regional institutions in Africa have begun to integrate climate-security risks into their policy frameworks, but urgency is required in translating those frameworks into action, especially by

building on the strengths of local security actors. UNOWAS and the African Union have both demonstrated strengths in the development of EWS and policy frameworks to understand climate-security risks. However, it is important for regional institutions to move from assessment into action to ensure adaptation for communities in practice. Local security actors play an important role in the application of adaptation strategies on the ground, as they are often the first and best equipped to respond to increasing climate risks.

4. Translating climate-security assessment into action requires participatory engagement through, for instance, scenarios exercises, training and dialogue, and co-creation with local communities. These tools can help to eliminate gaps in data dissemination and climate adaptation action, especially for vulnerable and/or disconnected communities.
5. Local communities should have a leadership role in responding to EWS. Local communities are the best choice for identifying conflict risks and potential solutions and analyzing the impact of adaptation interventions on conflict dynamics. Robust systems for information sharing exist at the local level, yet they are often misunderstood or underappreciated by regional or state institutions. However, when those local information-sharing systems are utilized, they can be very effective at mobilizing communities to action and doing so at a low cost. Therefore, another starting point for more security-proof adaptation policies is LAPAs, which can then help to shape broader NAPs.

Photo: MONUSCO/Force/Flickr

Migration and Climate Change

(based on the World Bank Groundswell Report Series)

In Africa, most climate-related migration currently takes place within countries (internal climate migration) or between neighboring states, rather than to distant high-income countries.[1] Migration can be influenced by many inter-related factors: social, political, religious, economic, environmental, or climatic. Population distributions in Africa historically have been influenced most by climate impacts on the water and agriculture sectors and will continue through impacts on ecosystems and increased climate risks (sea-level rise, floods, droughts, storm surges). These impacts influence the attractiveness and perception of the safety of a location by interacting with other aspects of the living environment and impacting livelihoods.

As highlighted in the "Conflict and Migration" chapter[2] in the 2021 State and Trends report, the loss of livelihoods due to climate change can trigger migration, though social, economic, demographic, and policy incentives encouraging or obstructing migration are likely to play a more prominent role. Generally, areas that are perceived to have more economic opportunities or that see positive deviations in water and productivity also see more in-migration.

Some attempts have been made recently to predict the impact of climate change on migration in Africa. For instance, the World Bank's first Groundswell report,[3] published in 2018, adopted a population gravity model to project mobility in Sub-Saharan Africa under different climate scenarios, covering countries in East Africa, West Africa, and the Lake Victoria Basin region. The study constitutes a robust model with crucial insights for the future, but still contains many uncertainties. In particular,


Photo: yoh4nn/iStock

> **Climate change for us in Djibouti, as well as for African countries, means vulnerability. It is synonymous with poverty, migration and displacement. Djibouti is a country which sees several million migrants crossing toward the Middle East, North Africa, and most certainly toward the countries of Europe. In general, these migrants are not only migrants due to conflicts but also due to climate change."**
>
> **Ilyas Moussa Dawaleh**
> Minister of Economy and Finance, Djibouti

the projections are based only on populations at risk, rather than the population who might decide to migrate. Furthermore, the modeling also falls short in accounting for the adaptive capacity of individuals or their degree of agency. Here we present the latest numbers given for North and West Africa and the Lake Victoria Basin countries, with overviews of specific countries per region.

Migration Projections under Different Scenarios for North Africa and Sub-Saharan Africa, with a Deep Dive Into Morocco

The second Groundswell report, published in 2021,[4] applies the population gravity model to three new regions: the Middle East and North Africa, East Asia and the Pacific, and Eastern Europe and Central Asia. The model projects mobility under different climate scenarios and estimates changes in population distribution by the year 2050, based on climate and development trends across three scenarios.

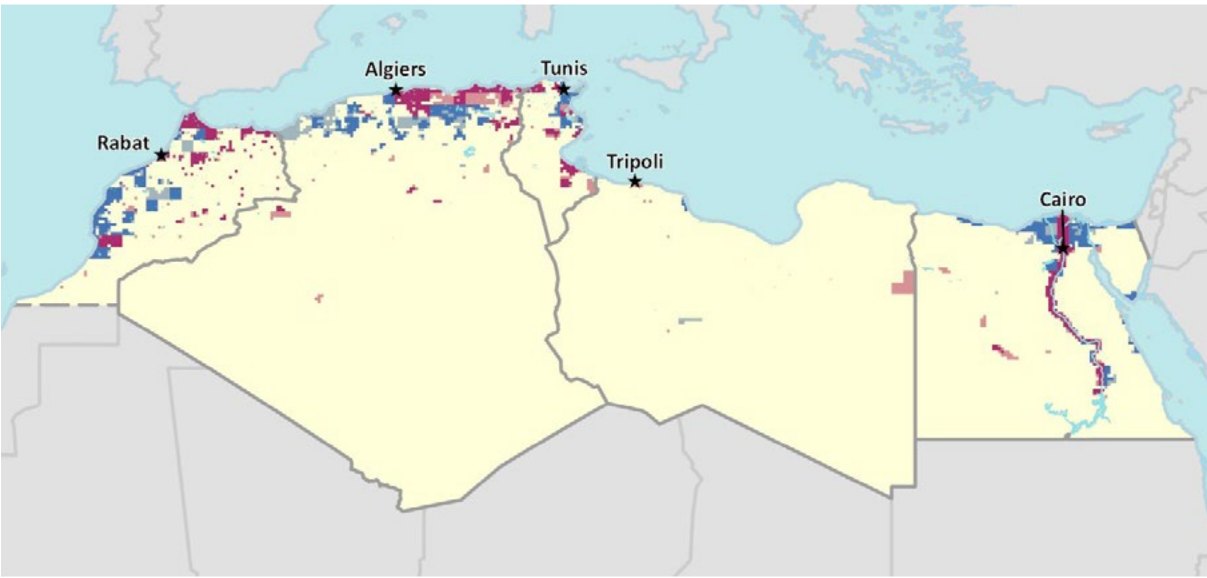
The scenarios are based on combinations of two Shared Socioeconomic Pathways—SSP2 (moderate development) and SSP4 (unequal development)—and two Representative Concentration Pathways—RCP 2.6 (low emissions) and RCP 8.5 (high emissions). The pessimistic RCP 8.5/SSP4 scenario (termed the "pessimistic reference scenario" in the report) projects high global greenhouse gas (GHG) emissions combined with an unequal development pathway; the RCP 8.5/SSP2 scenario (called the "more inclusive development scenario" in the report) projects equally high emissions with a more equal development pathway; and RCP 2.6/SSP4 projects a scenario (the "more climate-friendly scenario") with lower emissions and an unequal development pathway.

The model correlates spatial patterns with population change while inputting geographic, socioeconomic, and demographic characteristics of the landscape and existing population distribution. It accounts for climate impacts through four models with indices on water availability and crop productivity. Outputs were averaged to have a meaningful result. According to the model, under the pessimistic high emissions and unequal development scenario, the regions of North and Sub-Saharan Africa could witness 13 and 71 million internal climate migrants by 2050, respectively (Table 1). Under the lower emissions scenario, North and Sub-Saharan Africa could record 4.5 and 28.3 million climate migrants, respectively.

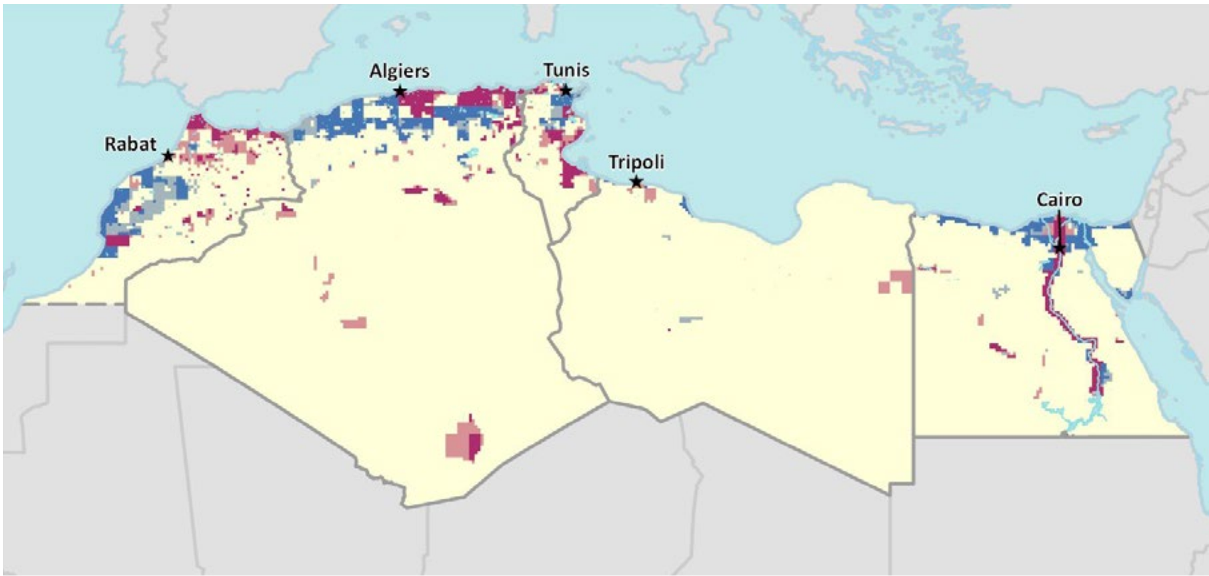
Given the projections across all development and climate scenarios for Sub-Saharan and North Africa, it becomes crucial to consider the influence of climate-induced migration on the present and future development of plans, policies, and strategies for the region. The Groundswell report's Migration and Climate-informed Solutions (MACS) framework could help governments mainstream climate migration considerations into multilayered planning through its core policies and action domains.

Figure 1. Areas Projected to Have High In-Migration and Out-Migration in North Africa, 2030 and 2050

a. 2030



b. 2050



In-Migration
- High certainty in high levels of climate in-migration
- Moderate certainty in high levels of climate in-migration

Out-Migration
- High certainty in high levels of climate out-migration
- Moderate certainty in high levels of climate out-migration

Note: High certainty reflects agreement across all three scenarios modeled, and moderate certainty reflects agreement across two scenarios.

Source: Reproduced from Figure 3 in Clement et al. (2021)[5]

For North Africa, major climate out-migration hotspots[6] due to sea-level rise and water scarcity might impact several coastal areas, such as the Nile Delta (eastern and western portions, including Alexandria); the northeast coast of Tunisia, including Kelibia; coastal areas in the northwest of Algeria, including Oran; and smaller areas of the west and the southwest coast of Morocco, including Agadir and Safi, by 2050. Inland out-migration would include the central Atlas foothills in Morocco due to the impact on rainfed croplands. Major in-migration hotspots[7] are projected to be in the Nile Valley and central Delta; the northwest and south coast of Tunisia, including the Gulf of Gabes; the eastern portion of the Algerian coast; and the northern coast of Morocco. Furthermore, densely populated urban centers like Cairo, Algiers, Tunis, Tripoli, the Casablanca–Rabat corridor, and Tangiers might also have an inflow of climate migrants (Figure 1).


Photo: UN Photo/Albert Gonzalez Farran/Flickr

Table 1. Projected Numbers and Shares of Internal Climate Migrants by 2050 for North Africa, Morocco, and West Africa

Region/country	Scenarios: Pessimistic reference (RCP8.5; SSP4)		Scenarios: More inclusive development (RCP8.5; SSP2)		Scenarios: More climate-friendly (RCP2.6; SSP4)	
North Africa						
Average number of internal climate migrants by 2050 (million)	**13.0**		**9.9**		**4.5**	
Minimum (left) and Maximum (right) (million)	6.6	19.3	5.8	13.9	2.9	6.1
Internal climate migrants as percent of population	**6.05**		**4.22**		**2.10**	
Minimum (left) and Maximum (right) (%)	3.08	9.02	2.50	5.94	1.36	2.84
Morocco						
Average number of internal climate migrants by 2050 (million)	**1.9**		**1.5**		**0.5**	
Minimum (left) and Maximum (right) (million)	1.1	2.7	0.9	2.1	0.3	0.7
Internal climate migrants as percent of population	**5.4**		**4.0**		**1.3**	
Minimum (left) and Maximum (right) (%)	3.7	7.7	2.3	5.6	0.8	1.9
Sub-Saharan Africa						
Average number of internal climate migrants by 2050 (million)	**71.1**		**53.4**		**28.3**	
Minimum (left) and Maximum (right) (million)	56.5	85.7	42.1	64.8	17.4	39.3
Internal climate migrants as percent of population	**3.49**		**3.01**		**1.39**	
Minimum (left) and Maximum (right) (%)	2.78	4.21	2.37	3.65	0.85	1.93

Source: Authors' synthesis of Groundswell modeling results[8]

Morocco

For Morocco, an upward trend in the number of internal climate migrants is projected across all three scenarios by 2050. A substantial difference can be seen between the pessimistic scenario with unequal development (an average of 1.9 million) and the "more climate-friendly development" scenario (an average of 0.5 million). Projections estimate that climate out-migration hotspots by 2050 will focus on the central foothills, including around Marrakech, on the west and southwest coast around Casablanca and Safi, and south of Agadir to Tiznit. Conversely, climate in-migration hotspots, partly fueled by migrants searching for job opportunities, may form in the southwest near Agadir, around Rabat, and the Tingitana Peninsula, including Tangiers.

Using the anthropogenic biome classes defined by Ellis et al. (2010),[9] the Groundswell Report II identified Morocco's three main livelihood zones: rainfed croplands with scattered irrigated croplands, pastoral and rangelands, and semi-natural and wildlands. Migration into or out of one of the zones implies changes in the livelihoods of those who migrate and might be partially driven by climate. The projected net change in the number of climate migrants by 2050 across Morocco would see small positive net climate migration on pastoral lands and rangelands, potentially exceeding 200,000 people in the two high-emissions scenarios. Rainfed croplands would see a small negative net climate migration by 2050, though the uncertainty range shows negative and positive values.

Migration Projections under Different Scenarios for the Lake Victoria Basin Countries (Tanzania and Uganda) and West Africa (Nigeria and Senegal)

Two subsequent Groundswell Africa reports applied an enhanced climate migration model to conduct regional studies for West Africa and the Lake Victoria Basin countries, along with four country

Photo: piccaya/iStock

studies, intending to better inform policy action and dialogue. The enhancements include shorter time steps, more climate impact parameters, adding non-climate factors such as age and gender, higher spatial resolution, and developing a fourth "optimistic" scenario (RCP2.6/SSP2). The reports held virtual multistakeholder consultations in February/March 2021 to further enhance the model.

While there is some level of uncertainty across the models in each study, it is clear that policies geared toward equitable development and low emissions can significantly reduce the number of climate migrants. Further, the uncertainty in scenario projections presents an opportunity for resilient development if concrete early action is taken.

Table 2. Projected Numbers and Shares of Internal Climate Migrants by 2050 for the Lake Victoria Basin countries, Uganda, and Tanzania

	Scenarios							
	Pessimistic reference (RCP8.5; SSP4)		More inclusive development (RCP8.5; SSP2)		More climate-friendly (RCP2.6; SSP4)		Optimistic development (RCP2.6; SSP2)	
Lake Victoria Basin								
Average number of internal climate migrants by 2050 (million)	**31.9**		**25.8**		**26.2**		**22.5**	
Minimum (left) and Maximum (right) (million)	25.3	38.5	21.0	30.6	18.9	33.6	16.6	28.4
Internal climate migrants as percent of population	**8.7**		**8.2**		**7.2**		**7.2**	
Minimum (left) and Maximum (right) (%)	6.9	10.5	6.7	9.8	5.2	9.2	5.3	9.1
Uganda								
Average number of internal climate migrants by 2050 (million)	**10.9**		**8.8**		**8.6**		**7.1**	
Minimum (left) and Maximum (right) (million)	9.7	12.0	8.1	9.5	7.7	9.6	6.4	7.8
Internal climate migrants as percent of population	**9.68**		**9.45**		**7.7**		**7.6**	
Minimum (left) and Maximum (right) (%)	8.6	10.7	8.7	10.2	6.9	8.5	6.9	8.3
Tanzania								
Average number of internal climate migrants by 2050 (million)	**13.4**		**11.2**		**11.4**		**9.8**	
Minimum (left) and Maximum (right) (million)	10.2	16.6	8.5	13.9	7.2	15.6	6.5	13.1
Internal climate migrants as percent of population	**11.25**		**10.94**		**9.60**		**9.57**	
Minimum (left) and Maximum (right) (%)	8.53	13.97	8.30	13.58	6.08	13.13	6.32	12.81

Source: Authors' synthesis of Groundswell modeling results[10]

Lake Victoria Basin: Tanzania and Uganda

The 2007 freedom of movement protocols established under the East African Community (EAC 2002) allows citizens of the five Lake Victoria Basin countries (Burundi, Kenya, Rwanda, Tanzania, and Uganda) to live and work throughout the region. Given the connectivity and free movement among these countries, the influence of climate-induced migration is crucially relevant to informing planning, policy, and actions in the region.

Across the Lake Victoria Basin region, climate migrants could represent half of all internal migration by 2030 under the pessimistic scenario.[11] Major climate in-migration hotspots are projected in the immediate areas surrounding the lake in Tanzania and eastern Uganda. Areas in Rwanda with high levels of climate in-migration are the central region close to Kigali and in the north near the Uganda and Tanzania borders. In Burundi, a narrow and long out-migration strip is found in the west, close to Lake Tanganyika. A band of climate out-migration, predominantly driven by declining water availability and crop productivity, is projected in southwest Kenya, including Kisumi. This lies alongside a band of climate in-migration, due to increasing water availability and crop productivity, covering Eldoret, and expanding into other areas of the Rift Valley.

Tanzania and Uganda together represent around three-quarters of the total numbers of climate migrants regionally, with between 6.5 and 16.7 million projected in Tanzania and between 6.4 and 12 million in Uganda by 2050 under a pessimistic scenario. The stark difference in climate migration projections with other countries is partly informed by the considerable projected population increases in both Tanzania and Uganda. Table 2 presents projected internal climate migrant numbers for the region and both countries.

United Republic of Tanzania

For the United Republic of Tanzania, temperatures can be expected to rise between 2.3°C (RCP2.6) and 5.2°C (RCP8.5) by the end of the century, which is set to have an impact on migration flows.[12] An upward trend in the number of internal climate migrants is projected across all four scenarios between 2025 and 2050. The average number of internal climate migrants under the pessimistic scenario by 2050 is projected at 13.4 million, representing 11.25 percent of the total projected population. This number is the lowest in the optimistic scenario, with a projected 9.8 million climate migrants, representing 9.57 percent of the total population. The more climate-friendly and inclusive development scenarios for the same period project an average of 11.4 million (9.6 percent) and 11.2 million (10.94 percent), respectively. .

The number of internal climate migrants is projected to outpace the share of other internal migrants by 2030 in three of the four scenarios. By 2050 under the pessimistic scenario, this number is 13.4 million climate migrants in contrast to 10.9 million other internal migrants. As derived from the current model, climate migrants reflect mobility driven by adverse impacts of climate in contrast to other internal migrants who move for economic opportunity, urbanization, population growth, income, and education.

Climate in-migration hotspots could emerge in the northern part of the country, particularly around Lake Victoria. High-certainty in-migration levels are seen for cities such as Magu, Mwanza, which is expected to emerge as a high-intensity hotspot as early as the 2030s, and Geita, which is expected to emerge as a high-intensity hotspot by the 2040s. Increasing water availability in this region may offer a possible explanation for its attractiveness to climate migrants, despite being partially offset by projected decreases in crop yield. Smaller in-migration hotspots are also found scattered in the west in Sumbawanga and Mpanda.

Out-migration hotspots are projected in the east and south, including such cities as Dar es Salaam, Arusha, Korogwe, Dodoma, and Morogoro. Arusha may

emerge as a high-intensity hotpot in the 2030s, and the same may be seen in Dar es Salaam in the 2040s. One hotspot is found in Kigoma, near the border with Burundi.

Migration projections by livelihood zone[13] from 2030 to 2050 present net positive climate migration for rainfed croplands consistently across the four scenarios, ranging from 190,000 (more inclusive development scenario) to 317,000 (more climate-friendly scenario) projected by 2030. Negative net migration is seen for irrigated croplands, dense settlements, and pastoral and rangelands. Rice-growing croplands and semi-natural and wildlands show mixed results across scenarios and timelines.

Uganda

Projections in the number of internal climate migrants in Uganda present an upward trend across all scenarios.[14] Under the pessimistic scenario, the country could see up to 12 million internal climate migrants by 2050. The lock-in for internal climate migration (the low end of the optimistic scenario) is 6.4 million by 2050. The more inclusive development and more climate-friendly scenarios show averages of 8.8 and 8.6 million internal climate migrants, respectively. The optimistic and more climate-friendly scenarios have the smallest proportions of climate migrants as a percentage of the total population, with mean percentages of 7.6 and 7.7, respectively. The same for the more inclusive development and pessimistic scenarios are 9.45 and 9.68, respectively.

Photo: guenterguni/iStock

Under the pessimistic scenario, internal climate migrants could overtake the share of other internal migrants by 2050. For both the more climate-friendly and more inclusive development scenarios, the scale of climate migrants is projected to be similar to that for other migrants.

The locality of Mbale, located in the southeast, and its surrounding areas, may emerge as a high-intensity in-migration hotspot by 2030. Mount Elgon, the capital Kampala, as well as the southwestern locality of Ntungamo, could all be high-intensity hotspots by 2050.

Three major out-migration hotspots are projected to emerge by 2050, mainly in the northwest and central-west areas around Lake Albert. The locality of Koboko could be a high-intensity hotspot by 2030, with rapid escalation expected between 2040 and 2050. Gulu and Lira could become out-migration hotspots by 2050.

Climate in- and out-migration hotspots in Uganda are predominantly driven by negative and positive changes in crop productivity and water availability. Drought-induced migration in the Karamoja area, for example, sees movement of agro-pastoralists with their livestock to areas with water and pastures within the region and to neighboring sub-regions of Teso and Acholi. This, in turn, fuels resource conflicts and violence with the host communities, further increasing vulnerability.[15]

Migration projections by livelihood zone show negative net climate migration for rainfed croplands and rice-growing areas, and positive net climate migration in dense settlements and semi-natural and wildlands, across all scenarios for all decades. Mixed results are seen for irrigated croplands and pastoral and rangelands.

West Africa, Nigeria, and Senegal

West Africa could see as many as 32 million internal climate migrants by 2050 under the pessimistic scenario.[16] Without any adaptation actions in place mitigating climate impacts on the region, people are expected to migrate from areas with lower water availability, declining crop yields and ecosystem productivity, and from areas affected by sea-level rise compounded by storm surges. Under the pessimistic scenario, Niger, Nigeria, and Senegal are projected to have the highest numbers of internal climate migrants by 2050: reaching a high of 19.1 million, 9.4 million, and 1 million, respectively, under the pessimistic scenario.

Considering that internal climate migration is not uniform across countries, as it depends on demographic patterns and economic trends, it is increasingly important to pursue tailored concrete climate and development action to yield a reduction of internal migration. Within a low-carbon and equal-development scenario the region would see a stark contraction in the projected average internal migration of 11.9 million people by 2050—going from 19.3 under the pessimistic scenario down to 7.4 million under the optimistic scenario.

Table 3. Projected Numbers and Shares of Internal Climate Migrants by 2050 for West Africa, Senegal, and Nigeria

	Scenarios							
	Pessimistic reference (RCP8.5; SSP4)		More inclusive development (RCP8.5; SSP2)		More climate-friendly (RCP2.6; SSP4)		Optimistic development (RCP2.6; SSP2)	
West Africa								
Average number of internal climate migrants by 2050 (million)	**19.3**		**14.8**		**11.0**		**7.4**	
Minimum (left) and Maximum (right) (million)	8.7	32.0	4.9	27.0	2.5	22.7	0.9	16.9
Internal climate migrants as percent of population	**2.44**		**2.18**		**1.39**		**1.09**	
Minimum (left) and Maximum (right) (%)	1.10	4.06	0.72	3.99	0.31	2.87	0.14	2.50
Senegal								
Average number of internal climate migrants by 2050	**602,646**		**382,214**		**133,769**		**91,574**	
Minimum (left) and Maximum (right)	189,283	1,016,008	153,886	610,540	70,279	197,259	60,069	123,078
Internal climate migrants as percent of population	**1.98**		**1.58**		**0.44**		**0.38**	
Minimum (left) and Maximum (right) (%)	0.62	3.33	0.63	2.52	0.23	0.65	0.25	0.51
Nigeria								
Average number of internal climate migrants by 2050 (million)	**8.3**		**5.1**		**3.9**		**1.1**	
Minimum (left) and Maximum (right) (million)	7.3	9.4	3.6	6.6	1.9	5.9	0.4	1.8
Internal climate migrants as percent of population	**1.93**		**1.38**		**0.91**		**0.30**	
Minimum (left) and Maximum (right) (%)	1.68	2.18	0.98	1.79	0.45	1.37	0.12	0.49

Source: Authors' synthesis of Groundswell modeling results[17]


Photo: Immanuel Afolabi/Flickr

Nigeria

By 2030, the total number of climate migrants is projected to represent 1.48 percent of the total projected population. Under the pessimistic scenario, Nigeria could see an average of 8.3 million climate migrants—one of the highest in West Africa. That number under the more inclusive development scenario is projected to be 5.1 million. Under both scenarios, an acceleration of the trend is seen in 2045. The more climate-friendly scenario could see an average of 3.9 million internal climate migrants by 2050. This scenario also exhibits the slowest increase in numbers from 2020 to 2050.

The number of other internal migrants exceeds that of climate migrants across all scenarios through 2050, largely owing to the large population growth projected for the country. Climate migrants as a share of total internal migrants, however, will increase steadily through 2050.

Hotspots of climate in-migration are projected in the far north, across the states of Kano, Katsina (these could emerge as high-intensity hotspots by 2030) and Jigawa, and the northwest states of Sokoto (emerging as a hotspot in the 2040s) and Kobi. These hotspots are located in rainfed cropland areas, and likely driven by projected increases in water availability and crop production along the border with Niger. These regions are also characterized by the highest poverty levels in the country.

Climate out-migration is projected with high certainty, particularly in the southeast and southwest regions, by 2050. Lagos and Rivers could emerge as high-intensity climate out-migration hotspots by 2030. Ogun and Akwa are projected to emerge as the same in the 2040s. Climate out-migration hotspots are likely due to sea-level rise and other coastal risks. They coincide with both low and high levels of poverty, thus cutting across the socioeconomic context.

Livelihoods in rainfed croplands show positive net climate migration numbers consistently across scenarios and decades. Negative net climate migration numbers are projected for dense settlements, with an estimation of –0.07 million (optimistic) versus –0.24 million (pessimistic) by 2030 and –0.23 million (optimistic) versus –1.28 million (pessimistic) by 2050. These are consistent with the projected decrease, albeit modest, in water availability in the coastal urban region. Livelihoods in pastoral land and rangelands show varying net migration numbers across scenarios.

Senegal
For Senegal, an upward trend in climate migration is seen across all scenarios. Between 2025 and 2050, under the optimistic scenario, the number of internal migrants could see a 2.7-fold increase, while a 4.6-fold increase could be seen under the pessimistic scenario. The mean number of climate migrants projected under the more inclusive development scenario is on average 382,000, representing 1.58 percent of the projected population, by 2050. Under the climate-friendly scenario, Senegal could see a mean number of over 134,000 (0.4 percent of the projected population) climate migrants by 2050.

Coastal zones in Senegal are predominantly areas of climate out-migration except for a small area of in-migration northeast of Dakar. Under the low-emission scenarios (optimistic and more climate-friendly) 41,000 and 77,000 coastal migrants are projected respectively, versus a projected 206,000 people under the pessimistic scenario (by 2050). High-intensity out-migration hotspots are projected along the Dakar–Diourbel–Touba corridor, which is prone to flooding. These hotspots could emerge in Dakar, an important economic center in the country, and Rufisque, as early as 2030 and in Thies by 2040. The primary climate drivers are sea-level rise compounded by storm surges along the coast and declining water availability in the west-central area. Kaolack, which is located in the low-lying Saloum Delta region, is projected to emerge as a high-intensity out-migration hotspot by 2030.

In-migration hotspots are projected near Ziguinchor on the Guinea-Bissau border, which could emerge as a high-intensity hotspot by 2030, and in the town of Matam on the Senegal River, which could emerge by 2040. In-migration hotspots are also projected in eastern Diourbel and western Kaffrine. A high-intensity hotspot is expected to emerge in the east of Tambacounda by 2050. Climate pull factors appear to be increasing water availability, net primary production and crop productivity in these areas. Notably, these areas are also characterized by high levels of poverty.

By livelihood zone, negative net migration numbers are consistently seen in dense settlements, which have an upward trend, and rainfed croplands across scenarios and decades. A downward trend appears under the more climate-friendly scenario, with −10,459 projected in 2030, −9,090 in 2040, and −2,273 in 2050. Positive net climate migration numbers are generally seen for irrigated croplands, pastoral and rangelands, rice-growing areas, and semi-natural and wildlands, across scenarios and decades.

RECOMMENDATIONS

The MACS framework stems from the Groundswell report and subsequent deeper dives of Groundswell Africa, which sought to better understand the implications of climate-induced migration and mainstream it into development policies, plans and programs.[18] The Groundswell report emphasized four lines of policy action to tackle climate-induced migration, which must be buttressed with a set of action domains to drive planning and action at scale. The core policy directions aim to assist governments in reducing forced migration due to climate change, while the action domains are meant to bolster the delivery of these core policy directions to ensure sustainable development and adaptation outcomes.

To mitigate climate migration, governments should consider the following four core policy directions:

Cut GHGs now to reduce climate pressure on people's livelihoods and the associated scale of climate migration

Lowering emissions through mitigation policies such as carbon pricing, urban and land use planning, and innovations in performance standards can reduce climate pressure on ecosystems and livelihoods, which in turn will lower the need to migrate from certain regions.

Pursue inclusive and climate-resilient development policies with targeted investments to manage the reality of climate migration

Policies need to be anticipatory and climate-resilient in nature, accounting for the connections migration has with future climate impacts and responding to the issue over the medium and long terms.

Embed climate migration in development planning for all phases of migration and across time scales

Successful adaptation measures would allow communities to stay in place through investments in climate-smart infrastructure, diversifying income-generating activities, and building a responsive financial protection system for vulnerable groups. Nevertheless, policies must focus on addressing the full migration cycle, adapt in place when possible, enable mobility to lower-risk areas if adaptation cannot respond to all the climate impacts, and provide an adequate ecosystem for people after migration.

Invest now to improve understanding of internal climate migration

Investment is needed to understand migration and its connection to climate through an enhancement of modeling resolution, and improvement of data gathering and monitoring in countries.

Climate-induced internal migration as a cross-cutting issue needs to be addressed through policy-informed action that is farsighted in its approach and implementation. Through its five action domains, the MACS framework can bolster the impact of core policies and help mitigate and reduce climate migration when possible:

1. Conduct spatio-temporal analytics to understand the emergence of climate migration hotspots.
2. Enable and embrace landscape and territorial approaches for farsighted planning to avert, minimize, and address climate-induced migration.
3. Address and harness climate-induced migration as an opportunity for jobs and economic transitions.
4. Nurture development–humanitarian–peace partnerships for end-to-end action at the national and local levels.
5. Bridge the gap in legal mandates and frameworks on climate-induced migration.

The MACS framework is designed to be flexible and adaptive. Its application is not restricted to any single local, country, or regional context and its operationalization is not predetermined.

Photo: Sadik Gulec/istockphoto