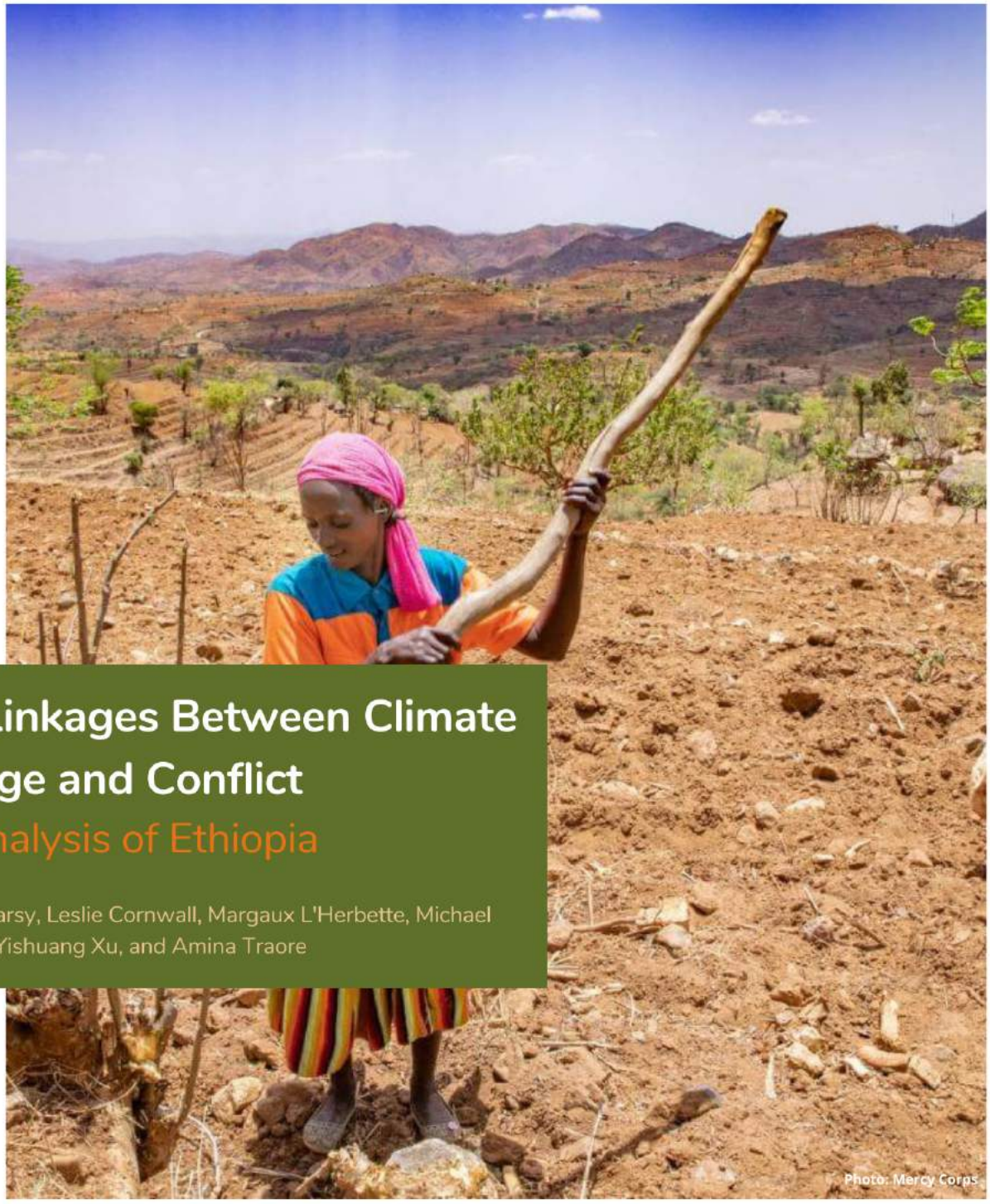


The Linkages Between Climate Change and Conflict

An Analysis of Ethiopia

Nabila Amarsy, Leslie Cornwall, Margaux L'Herbette, Michael Thomson, Yishuang Xu, and Amina Traore

COLUMBIA | SIPA
School of International and Public Affairs

Table of Contents

Acknowledgments

The Columbia Capstone team would like to extend our sincere gratitude to our interviewees and advisors who made our research possible. At SIPA, we are particularly grateful to Professor Deborah Schein, Adjunct Professor of International and Public Affairs, for her thoughtful guidance, feedback, and reminder to keep the "focus on the people." Additionally, we are thankful for the Columbia Capstone Program and to Suzane Hollman and Saleha Awal for their support. Finally, we would like to thank Dr. Adam Day for his support throughout this Capstone Workshop and to United Nations University for commissioning this research

Executive Summary

This report contributes to a body of literature examining the intersection and mutual influence of two accelerating trends of the early twenty-first century: the transformation of Earth's climate due to global warming and the spread of armed political conflict in an increasingly fragmented world. This collection of books, reports, toolkits, and articles seeks to define and interrogate the 'climate change and conflict nexus' by delving into the increasing frequency of specific climate hazards, and the risk these hazards pose to specific geographies and populations. This risk analysis also accounts for the vulnerabilities of certain populations given social, political, and economic dynamics and their variability across different segments of the population.

This report adds to existing case studies and meta-analysis by exploring the climate change and conflict nexus in Ethiopia through case studies of two of Ethiopia's regional states: Gambella and Tigray. These two case studies exhibit the ways in which similar climate hazards —droughts and floods— can impact nearby regions differently due to the region-specific sociopolitical drivers of conflict that are aggravated and transformed by these hazards. In Gambella, climate change-induced erratic rainfall patterns and frequent droughts have significantly deteriorated resource availability and accessibility. This negatively impacts livelihoods, especially for the most vulnerable populations including displaced women and children, refugees, smallholder farmers, and pastoralists. These targeted impacts justify prioritization on initiatives that enhance climate resilience and resource allocation to vulnerable populations.

In contrast to Gambella, the current conflict and crisis in Tigray is driven almost entirely by sociopolitical drivers. However, the increased likelihood of droughts and floods in the area due to climate change, combined with the vulnerability of certain segments of the population likely to be hit hardest by these hazards, has exacerbated the overall impact of the conflict in Tigray. These impacts of climate change on Tigray also necessitate climate change adaptation initiatives to increase the region's resilience to climate hazards. Finally, as this report demonstrates the multiplying effect of climate change on conflict drivers and the overall impact of conflict, it's important that Tigray the Gambella regions, as well as Ethiopia as a whole, address climate change and peacebuilding together. Therefore, climate change adaptation needs to occur alongside targeted peacebuilding initiatives aimed at mitigating the impacts of climate change on conflict

Introduction

This report seeks to expand upon the current body of literature on the nexus between climate change and conflict by analyzing their linkages in Ethiopia. This analysis will be framed by highlighting the Ethiopian regions of Gambella and Tigray as specific case studies. Each region's exposure, vulnerability, impact, and risk to climate hazards will be analyzed with respect to their interaction with conflict drivers. This will culminate in overarching policy recommendations for the United Nations, the Ethiopian government, non-governmental organizations (NGO), and local actors operating in Ethiopia to be applied to either Tigray, Gambella, or Ethiopia as a whole. These recommendations are grouped together in this report in order to provide a comprehensive policy toolkit to be utilized not only by actors operating in Gambella and Tigray, but also by those working within the wider Ethiopian context and even by the broader policy community examining the nexus of climate change and conflict.

Ethiopia is a relevant country for this analysis, given that it has experienced a heightened frequency in climate change-related hazards over the past fifty years.[i] These hazards have most notably included drought, flood, increased temperatures, and overall rainfall variability.[ii] Climate change projections suggest that these trends will only continue to worsen.[iii] Looking at the wider Ethiopian context, this increase in climate hazards is illustrated by the fact that droughts that had previously occurred every ten years during the 1970s and 1980s now occur on average once every three years.[iv] Additionally, since 1900, Ethiopia has faced 47 major floods, the majority of these taking place after 1980.[v] Research has tied this increase directly to climate change-induced global warming in some regions, for instance in finding that increased frequency of heavy precipitation events in Ethiopia's Upper Blue Nile River Basin (UBNRB) is driven by climate change and will over time lead to an increase in flooding in the region commensurate with increases in global mean surface temperature (GMST).[vi]

This analysis is also particularly relevant given that Ethiopia is extremely vulnerable to the abovementioned climate change hazards. This is due to several reasons, most notably Ethiopia's geography being in a region highly susceptible to the harms of climate hazards, the limited capacity to adapt to the increased frequency of these hazards,[vii] and the fact that 85 percent of its population lives in rural areas as farmers and pastoralists who rely on consistent and predictable rainfall patterns to survive. This also has wider economic implications as agriculture plays a key role in Ethiopia's economy and in the livelihoods of the Ethiopian people, accounting for about 48 percent of its Gross Domestic Product (GDP) and 85 percent of employment.[viii]

Not only are climate change risks severe throughout Ethiopia, but the climate-related impacts are also diverse, relating to livelihoods, health, food insecurity, displacement, and the reversal of development gains. This complex combination worsens preexisting social and economic issues, therefore exacerbating conflict drivers throughout Ethiopia.[ix] This is further complicated by the underlying ethnic and communal divisions that persist throughout the country. These divisions are seen in the fact that even prior to Ethiopia's conflict in Tigray, 1.4 million people

were displaced in the country due to ethnic violence in 2018.[x] Furthermore, as human security, livelihoods, and the overall well-being of the population are imperiled in Ethiopia due to climate change related hazards, this could continue to multiply the country's existing ethnic tensions and communal violence.[xi]

Finally, two of Ethiopia's regional states —Gambella and Tigray— were chosen as the case studies for this research in order to contextualize the risks associated with climate change in Ethiopia and examine the ways that they impact conflict dynamics in specific regions of the country. These two examples will highlight the different ways in which climate change and its associated hazards impact conflict dynamics in Gambella and Tigray, respectively. Although situated in the wider context of Ethiopia, these two regions face differing levels and types of exposure, vulnerability, impact, and risk related to climate change. Additionally, the conflict drivers and key human security issues differ in Gambella and Tigray, which further alters how climate change multiplies conflict in these respective regions. This variation in the sociopolitical and economic factors in these two regions highlights the overall need to contextualize the climate change and conflict nexus in order to develop sound analysis.

This report is structured in five parts. First, it briefly reviews the existing literature on the relationship between climate change and conflict drivers, which provides a foundation and entry-points for the current study. Second, a brief synopsis of the methodological approach to this analysis is provided. Third, the guiding framework and associated terminology used within each case study are delineated. Fourth, the report provides an overview of the Gambella and Tigray case studies applying the identified framework. Finally, a series of policy recommendations are provided, beginning with those relating directly to conflict and concluding with climate change adaptation recommendations.

Review of the Climate Change and Conflict Nexus

Before examining the Gambella and Tigray case studies, it is pertinent to first review the literature on the linkages between climate change and conflict, which has become more robust over time and provides useful entry points to this case study analysis. As literature on the causes and manifestations of climate change expands, so too does the exploration of its impacts. These impacts span a range of research fields and professional disciplines, and much has been written about climate impacts on agriculture, finance, health, development, and global supply chains.[xii] As the research on climate change becomes more robust, the interlinkages between climate hazards and the social, political, and economic impacts of these hazards increases in complexity and nuance. These impacts are rarely singular or unmediated drivers of conflict. However, an immense body of literature on the nexus between climate change and conflict shows a significant indirect relationship between the two and an overall multiplying impact of climate change on conflict drivers.[xiii] This literature has underlined how climate hazards' interaction with existing sociopolitical and economic drivers of conflict leads to the exacerbation, transformation, and catalyzation of existing conflict dynamics.[xiv] Given the myriad forms these complex interactions can take, general reflections on the relationship between climate change and conflict can at times be vague and imprecise, which in turn muddies the ability of policymakers to enact preventative and adaptive policies to address climate change's impact on conflict. As a result, conflict analysts and policymakers have turned to two approaches to interrogate the climate-conflict nexus while extracting substantive and practical policy recommendations for practitioners in the field.

First, in-depth case studies provide ways to examine how climate hazards have contributed to conflict in a variety of settings.[xv] For instance, the UN Development Programme (UNDP) commissioned a series of case studies on the climate change and conflict nexus that explores this relationship in Chad, Tunisia, and Kenya. United Nations University (UNU) has analyzed this relationship in Bangladesh, Nigeria, and Chad. The Stockholm International Peace Research Institute (SIPRI) and Norwegian Institute of International Affairs (NUPI)'s *Climate-related peace and security risks project* has examined this nexus in Somalia, South Sudan, Mali, and the Sahel.[xvi] The expansion of this body of literature has informed an inductive approach to understanding the relationship between climate change and conflict, where literature reviews can reveal parallel trends and causal chains across case studies. For example, a common finding across these case studies is that governance of natural resources is key to conflict prevention and mitigation at times when heightened climate variability has increased the potential for crises to spark suddenly and catalyze long-term conflict. Additionally, early warning mechanisms should be paired with good governance to anticipate the impact and prepare responses to these crises before they arrive. Relatedly, these case studies reinforce the centrality of local solutions to local problems and the need to elevate and resource existing modes of resiliency that have emerged within populations exposed to increased climate variability.

Second, the creation of policy recommendations and implementing guidelines can be applied in different situations to understand and address the impacts of climate change and conflict. This recognizes that different policy prescriptions are needed depending on whether one is interested in interventions before, during, or after a conflict. Furthermore, a number of lessons can be applied from this collection of policy toolkits and guiding frameworks. As mentioned above, there is a broad consensus that the climate change and conflict nexus should focus on indirect impacts of climate change on conflict, including the ways in which secondary and tertiary environmental impacts of climate change affect the sociopolitical and economic drivers of conflict. For instance, a rapid increase in mean temperatures in the Lake Chad Basin, combined with more variable and extreme rainfall patterns, have resulted in the population inhabiting the Lake Chad region facing highly uncertain futures that implicate both their livelihoods and security. This causation creates a feedback loop with existing conflict dynamics that accentuates incentives to pick up arms and erodes familial and communal bonds.[xvii]

Third, there are broad debates regarding this nexus that can be informed and elucidated by case study literature. For instance, it is argued that conflict is driven primarily by resource scarcity and population growth and that climate change will increase resource scarcity and thus further this dynamic.[xviii] This argument, however, has faced criticism for its emphasis on a neo-Malthusian framework that sees these two factors —resource scarcity population growth— as *the* key determinants of modern conflict and underrepresents the ways in which context-specific elements such as resource governance, social cohesion, and economic development impact conflict.[xix] Increasingly, and in response to the most salient aspects of the case studies mentioned above, frameworks for analyzing climate change and conflict center the processes through which climate shocks mediate sociopolitical and economic change. For instance, these frameworks seek to identify areas where exposure to climate shocks —droughts, floods, heat waves, cyclones, etc.— is highest and the degree to which the population living in these areas have the means to absorb these shocks. Two models are worth mentioning.

The first model, created by the United Nations, is the Climate Security Mechanism (CSM) Toolbox, which provides framing guidance, terminology, and a list of resources for practitioners and policymakers to understand how climate change impacts peace and security and to communicate this impact using standardized and consistent language.[xx] CSM's "Conceptual Approach" report recommends examining this interaction through "climate-related security risks," described as the overlap of climate shocks, groups exposed to these shocks, and the vulnerability of these groups in relation to their ability to manage and absorb these shocks.[xxi] Second, the United Nations Environment Programme and the World Meteorological Organization established the International Panel on Climate Change (IPCC), the international body that reviews and synthesizes contemporary publications on the nature of climate change and global warming, its impacts, and efforts to mitigate warming and adapt to its impacts. The IPCC is composed of three working groups, the second of which reviews literature on climate change impacts, adaptation, and vulnerability. The Ethiopia case studies examined in this report

use terms defined in the latest report published by the second working group, outlined in detail in subsequent sections.[xxii]

Methodology

The methodology for this report leverages a mixed approach consisting of a comprehensive literature review and expert interviews. The sources for the literature review included a combination of primary and secondary sources such as scientific papers, news sources, reporting from non-governmental organizations, think tanks, and multilateral organizations, as well as frameworks developed by the Ethiopian government and international organizations. Additionally, thirteen interviews were conducted with experts in the climate change, security and peacebuilding fields. These experts came from a diverse set of backgrounds such as UN peacekeeping, the UN Peacebuilding Fund, former government officials in the Horn of Africa and Ethiopia, technical specialists and program managers in INGOs operating in Ethiopia, representatives from multilateral institutions such as the FAO, conflict analysts at policy think tanks, as well as specialists on water resources and environmental peacebuilding. One limitation to this methodology is the absence of field research with Ethiopians in Tigray and Gambella to further understand their perspectives and experiences of climate change and conflict, as well as their approaches to adaptation and resilience. This constraint resulted from Covid-19 travel restrictions, reduced access to Ethiopia and Tigray in particular, and resourcing limitations. It is recommended that future research initiatives attempt to gain this access and accentuate these findings with on-the-ground insights.

The most recent IPCC Framework, as detailed in the IPCC Working Group II's Fifth Assessment Report, was the primary framework applied to analyze climate change risks in Gambella and Tigray. The IPCC Framework analyzes the way in which climate change shifts overall risk patterns in order to find adaptive solutions for these risks. This framework was selected because it was the most comprehensive model and provided a nuanced frame of analysis that incorporated distinctions and relationships between climate change hazards, exposure, vulnerability, impact, risk, and adaptation measures. Although the report highlights the wider global trends associated with climate change, this framework was applied through a more micro-level lens in order to contextualize the critical nuances found in a country analysis such as Ethiopia and even further through the regional analyses of Gambella and Tigray.

This analysis is then synthesized and enumerated as a series of concrete and realistic policy recommendations. These recommendations are tailored to four levels of the global community operating in Ethiopia: i) multilateral, ii) national, iii) non-governmental, and iv) local. Additionally, this report applies the conflict curve created by Michael Lund, a United States Institute of Peace fellow, as another conceptual tool to formulate recommendations. The curve visualizes the chronology of the archetypal conflict and provides a useful reference through which policy recommendations can be tied to specific conflict stages. This is particularly necessary when considering and responding to the varied impacts of climate hazards throughout each of the conflict stages. As mentioned in the Review of Climate Change and Conflict Nexus section of this report, the literature has highlighted an indirect relationship between climate change and conflict. The mediated and complex nature of this interaction makes it particularly difficult for

policymakers to identify the security risks that might develop when climate hazards are left unaddressed. As a result, the recommendations of this report place a high focus on decreasing pressure on existing systems at the early stages of the conflict curve.

IPCC Framework and the Conflict Curve

Various reports and literature define "hazard" as a possible threat or an event with the potential to cause harm. In the IPCC framework, the definition of hazard is further detailed and defined as **a potentially destructive physical phenomenon to people and their welfare within a given period and area (e.g., a flood, drought, earthquake, windstorm, or conditions leading to an outbreak of waterborne diseases.)** Other versions of this definition also include human-induced physical events that may cause loss of life, injury, or disease as well as damage and loss to property, infrastructure, and environment.[xxiii] However, as this paper investigates the climate and conflict nexus, it specifically focuses on natural hazards to determine the relationship among climate-related hazards, the impacts and risks of climate change, and conflict.

Climate-related hazards are not the only factor determining the character and severity of impacts from climate change. Exposure and vulnerability of the natural systems and socioeconomic conditions of the impacted population are the other two major determining factors. In the IPCC framework, **exposure describes the presence of people, livelihoods, species or ecosystems, environmental functions, services and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected by climate hazards**. On the other hand, vulnerability is defined as **the propensity of people, livelihood, and assets exposed to hazards to suffer adverse effects**.[xxiv] In other words, exposure relates to the people and assets are at risk when facing climate-related hazards, and vulnerability determines people's capacity to absorb and adapt to climate-related hazards. Both exposure and vulnerability are influenced by a wide range of social, economic, and cultural factors. As a result, differences in exposure and vulnerability arise from non-climatic factors and from the intersection of socioeconomic factors, which shape the potential magnitude of differential risks from climate-related hazards.

The IPCC framework defines risk as the interaction of hazard, exposure, and vulnerability. It also points to the importance of not only describing outcomes within the physical system, but explicitly links the consequences of such climatic events to human or ecological systems.[xxv] Moreover, the IPCC framework emphasizes the necessity of applying risk to both impacts of and response to climate change where it may not be self-evident, regardless of whether an outcome is related to a climate change impact or a response to climate change.[xxvi] Finally, connecting the climate-related hazards, exposure of natural systems, and vulnerability of human systems, the IPCC framework defines impact as the **effect on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction climate hazards and the vulnerability of an exposed society or system**.
Conceptual risk framework after the IPCC (2014)

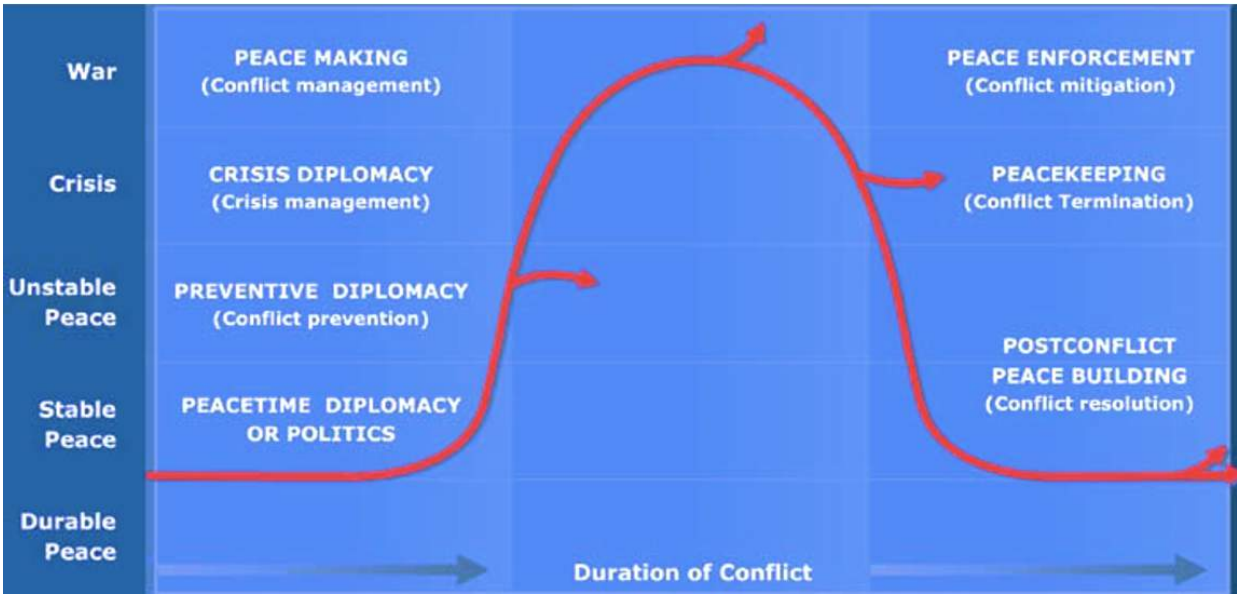
Apart from these five significant elements categorized by the IPCC framework, this report recognizes the necessity to not only theorize the climatic hazards, exposure, vulnerabilities, impacts, and risks from a general perspective but also to adjust and tailor these factors to the

local context in Gambella and Tigray. This, therefore, enables more accurate and precise assessments from multiple levels such as the regional, national, and international. Through applying the context-relevant IPCC framework to targeted areas, this report provides a more comprehensive understanding of the most vulnerable groups to climatic hazards, their susceptibilities to climatic impacts, and their ability to adapt to climate change. In addition, this more contextual analysis facilitates the identification of the gaps and priorities of international, national, and regional initiatives and the provision of feasible and actionable policy recommendations for designing short-term, mid-term, and long-term solutions that are addressed to the different levels of stakeholders. These policy recommendations also leverage bottom-up and top-down approaches as well as cross-sector partnerships.

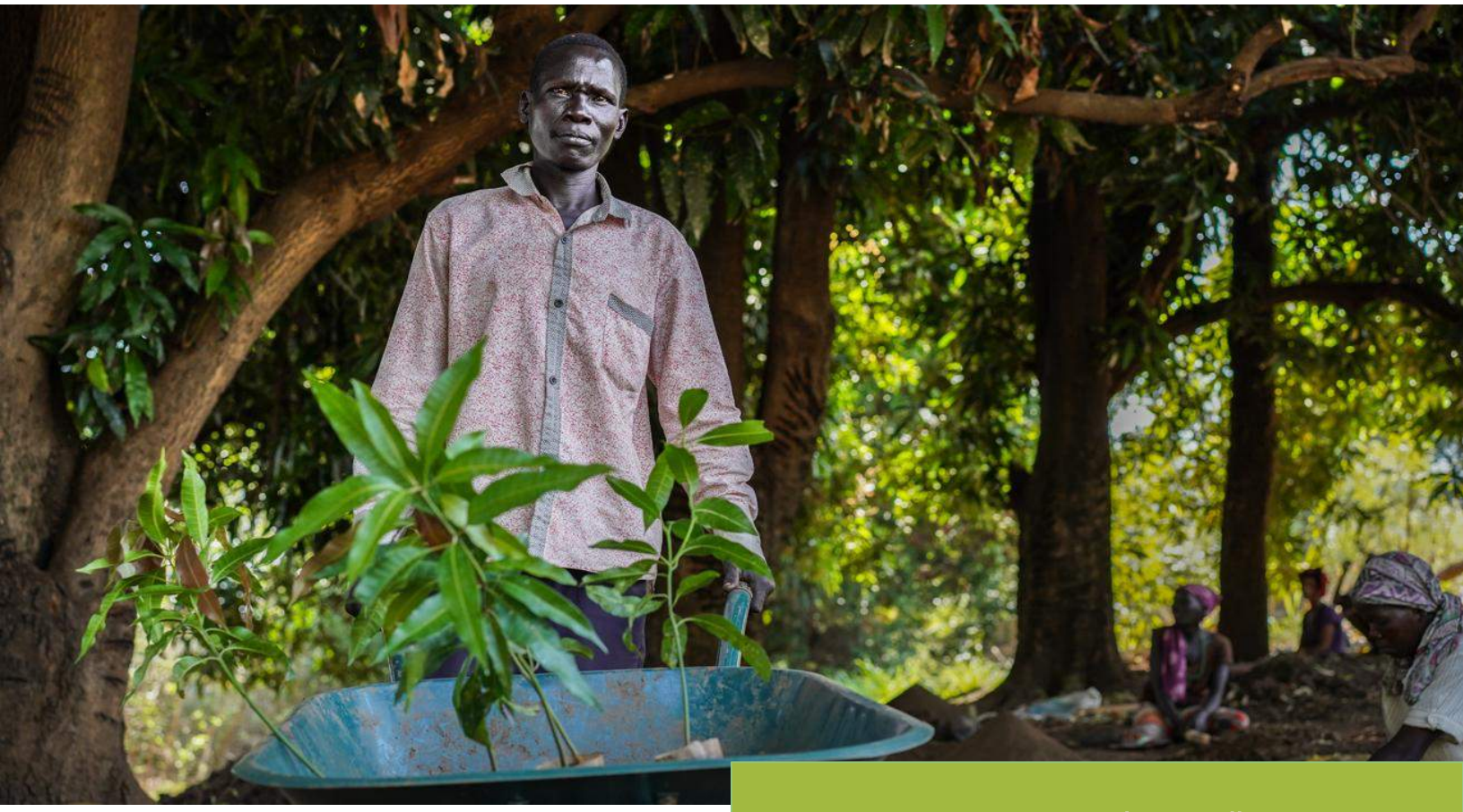
Hazards	A potentially destructive physical phenomenon (e.g., an earthquake, a drought, a windstorm, a flood).
Exposure	The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.
Vulnerability	The propensity of exposed elements such as human beings, their livelihoods, and assets to suffer adverse effects when impacted by hazard events.
Impact	Effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate hazards and the vulnerability of an exposed community or system.
Risk	Interaction of vulnerability, exposure, and hazard.

As mentioned earlier in the paper, we have used the Conflict Curve, shown below, to identify which recommendations would effectively prevent or mitigate violence exacerbated by climate shocks at different points in the conflict's expansion and diminution. While generic, the Conflict Curve provides a useful reference for practitioners and policymakers to articulate more precisely how interventions could address conflict at different stages.

The first stage is prevention and generally takes place during peaceful times or when tensions are rising but have not escalated into a conflict; violence at this stage may occur, but is erratic and does not rise to the level of war. At the second stage, the conflict has escalated in violence and severity, calling for more substantial interventions to stop the violence and arrive at a political settlement. The third and final stage of the conflict curve focuses on initiatives to terminate a conflict and transition back to peace through peace processes, peacekeeping, and peacebuilding.



The Conflict Curve (Lund, 2009)



Gambella Case Study

Photo: Jilke Tanis

Gambella

Context

Gambella is one of the nine regional states that make up the Democratic Republic of Ethiopia.[xxvii] It is situated in Western Ethiopia and borders South Sudan and three federal states: Benishangul-Gumuz, Oromia, and the Southern Nations, Nationalities, and Peoples' Regional State (SNNPR).[xxviii] Gambella, a region that lies at the bottom of several development indices, serves as a useful case study for this discussion because it has been the site of recent efforts to decrease climate vulnerability through village and agricultural modernization programs, many of which have had contradictory impacts and increased rather than reduced tensions in the region.[xxix] Such unintended consequences occur when policy agendas disregard the underlying social, political, and ecological context of the region in question.

Gambella is divided into three administrative zones (Anuak, Majang, and Nuer), 12 woredas or districts, and one special district (Itang). Sixty-four percent of the population lives in rural areas, whereas 36 percent lives in urban areas.[xxx] With a population of 463,000, the region makes up 0.5 percent of the total Ethiopian population. The Ethiopian government has classified Gambella as a Developing Regional State. Gambella relies on federal grants more heavily than most regions due to its weak institutional capacity, political instability within the region, and low economic base.[xxxi] Furthermore, where governance is concerned, the region suffers from a lack of coordination among stakeholders, weak administrative capacity, and poor public service delivery. A significant portion of the territory is made up of the Gambella national park, which is home to the Anuak and Nuer people. Whereas the Nuer are predominantly agro-pastoralists, the Anuak primarily depend on agricultural production. The UNHCR reports that as of the end of 2019, there were over 300,000 refugees in the region. Notably, the number of refugees from South Sudan, mostly of Nuer ethnicity, [xxxii] is almost equal in number to the host population, which has contributed to contestations for power.[xxxiii]

The climate in Gambella is influenced by the tropical monsoon from the Indian Ocean, which is marked by high rainfall in the wet period (May to October) and little rainfall during the dry season (November to April).[xxxiv] The land in the region is arid, semi-arid, and humid, and generally well-suited for agriculture. While at lower altitudes, the annual rainfall of the region ranges from 900 to 1,500 mm, at higher altitudes it varies from 1,900 to 2,100 mm.[xxxv] The climate in the region is also characterized by high variability in the intensity and timing of rainfall, leading to frequent droughts by average rainfall.[xxxvi] In Western Gambella, the Gillo and Baro rivers allow for flood-retreat cultivation. The people primarily depend on pasture, subsistence farming, beekeeping, and hunting. There are three major rivers in the region, including the Akobo, Baro, and Gilo. These bodies of water are central to both commercial and small-scale farming. The arable land in Gambella has attracted significant foreign investments in irrigation-based agriculture. These investments have modernized traditional farming techniques and introduced new employment models.[xxxvii] However, these developments have come at a significant social cost as they have

put pressure on nature preservation and water resources, and increased competition over land.[xxxviii]

Livelihoods in Gambella are climate dependent with crop production constituting the primary livelihood (55 percent), followed by livestock (29.3 percent), hunting, fishing, and collecting wild food (9.6 percent).[xxxix] Livelihoods in Gambella are also characterized by frequent mobility as an adaptive mechanism. For example, agriculturalists generally practice floodplain recessional agriculture, leveraging soil moisture once higher river flows recede during the dry season.[xl] Similarly, during the wet season, pastoralists move to higher pastures and return to the riverside during the dry season. Yet, while traditional migratory practices protect against moderate degrees of climatic variability, drought or flooding that exceed regular seasonal variation can result in significant damage to pastoralists and agriculturalists.[xli] Thus, traditional migratory practices cannot protect populations against extreme weather events, which highlights the need for more robust adaptation measures.

Gambella's sociopolitical context plays a key role in determining climate change adaptation and human security conditions in the region.[xlii] A history of political instability, a lack of infrastructure, and low levels of human capacity have foiled attempts to exploit the region's existing natural resources. These developments have been a detriment to the region's socio-economic development.[xliii] Consequently, Gambella is ill-equipped to face climate variability. Inter- and intra-communal conflicts that have historically arisen in Gambella from conflicting perspectives over land ownership, now extend into tensions over access to services, infrastructure, and governmental authority.[xliv] Ethnic federalism, which affirms that each ethnic group has a right to self-determination, has contributed to competition among populations such as the Nuer and Anuak. These groups compete for political power within the regional government.[xlv] Conflict between the host Anuak and Nuer refugees escalated in 2016 due to disputes over the unequal distribution of resources.[xlvi] One of the main drivers of conflict in the region is the concentration of host communities and newcomers in the same areas, namely, the Barro and Gilo river banks. This dynamic has contributed to increasing tensions between groups due to over access to natural resources.[xlvii]

These complex political dynamics explain why the existing climate adaptation and development policies in Gambella prioritize certain dimensions of human security over others and lead to contradictory outcomes.[xlviii] Vulnerability to climatic shocks are linked to constraints on land access and mobility due to population shifts, conflicts and other encroachments.[xlix] Identity politics at the sub-national level and questions regarding territory influence climate adaptation policies and public acceptance.[l] This highlights the need to raise public awareness on the climate conflict nexus in order to ensure widespread acceptance. The Gambella case study demonstrates the relationship between climate change and conflict, as food and human security are negatively impacted by climatic factors. Climate hazards in the region exacerbate resource related conflicts as historical tensions influence environmental vulnerabilities leading conflict to emerge as a response to marginalization of certain groups' livelihood needs.

Applying the IPCC Framework:

Hazards

> "The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or […] damage and loss to property, infrastructure, livelihoods, service provision and environmental resources" —IPCC Framework

The Intergovernmental Authority on Development (IGAD) Climate Prediction & Applications Centre (ICPAC) report indicates that the global mean temperature will increase between 0.9°C and 1.1°C by 2030, which will likely increase the intensity and frequency of drought globally and in certain regions of Ethiopia.[li] As global temperatures rise, the magnitude of climate hazards in Gambella, including flood and drought, will intensify. During the rainy season, the water level of major rivers rises and floods surrounding areas in Gambella. This has already had severe consequences in the region, as the Disaster Preparedness and Prevention (DPP) Office of Gambella reported that, in 2017, nearly "40,000 people have been affected by floods in the eleven chronically flood-prone districts," namely, Gog, Itang, Lare, Wanthoa, Akobo, Dimma, Jor, Abobo, Jikaw, and Makuey.[lii] Climate projections suggest that southwest Ethiopia, including Gambella, is expected to experience an increase in rainfall in both quantity and variability, with subsequent severe flooding and droughts.[liii] Flood hazard studies indicate that the Itang district is subject to different flood levels, from very high to very low.[liv] With varied degrees of flooding *within* districts, it is essential to predict the impact of climate change on future flood characteristics to reduce impacts on human security.

Exposure

> "The presence of people, livelihoods, species or ecosystems, environmental functions and service and resources, infrastructure, or economic social or cultural assets in places and settings that could be adversely affected by climate hazards" —IPCC Framework

In the Gambella region, the assailable characteristics of elevations and slopes of the land and soil types and their moisture contents expose the population to natural climate hazards including flood and drought.

Elevation and Slope

The levels of runoff and waterlogging in Gambella are influenced by the downward flow of water from higher to lower elevations as well as different slopes. The river basin has the lowest elevation of about 390 m and the highest elevation of about 3,244 m. The majority of the people in the Gambella region live along the riverbank in lowland areas, which makes them susceptible to yearly flooding.[lv] Lower elevations are more exposed to floods, and research shows that the western part of the Gambella region is more affected by flooding due to low elevation and proximity to the floodplain of the Baro River. Naturally low slopes and low elevation have thus been key factors in Gambella's high rating as a flood-prone area, and the results of reclassified elevation based on the natural break indicate that about 776.52 km2 (35.67 percent) of Itang has low elevation and is highly prone to flooding, while only 5.89 percent of this district of Gambella has a low likelihood of flooding.[49]

Moisture Content and Soil

The moisture content of the soil in Gambella directly affects the land's capability of absorbing water, which indirectly affects the flooding condition. Soil with lower moisture content will have more capacity to absorb water when facing flood hazards, which in turn mitigates the impacts of floods and waterlogging. Research shows that wetlands along the Baro and adjacent areas of Lare are highly affected by flooding due to a higher percentage of soil with high moisture content, like cropland (49.2 percent), woodland (37.7 percent), and wetland.[lvi] Intensified agricultural activities significantly reduce vegetation cover in Itang and have increased runoff by substituting vegetation cover with paved surfaces that have limited capacity to prevent runoff and mitigate flood hazards. The infiltration capacity of the soil also influences flood impacts and increases the exposure of certain areas to flood hazards. According to the soil classification of Ministry of Water, Irrigation and Electricity (MoWIE), most of the different soil types (1,149.5 km2 of soil area) in Itang are highly vulnerable to floods because of their nature, i.e dystric and eutric fluvisols[lvii] that occupy 53.2 percent of the area.[lviii]

Vulnerability

> "The degree to which a system is susceptible to, or unable to cope with, adverse effects of. climate change, including climate variability and extremes" —IPCC Framework

From a micro perspective, in the Gambella region, women and children, as well as smallholder farmers and pastoralists who are displaced by floods lack the resources and support to immediately respond and lack the capital and knowledge to adapt in a long-lasting, sustainable manner. From a macro perspective, poor infrastructure and unsustainable land management further deteriorate the vulnerability of the region.

Displaced Women and Children

As mentioned above, the Gambella region has been repeatedly affected by flash and extreme floods whenever rivers draining down to the region from the western highlands fill up and burst their banks. Different levels of household characteristics like income, livelihood sources, class, gender, and education cause drastic differences in the response capacity to extreme events and ability to recover. The situation is now even more unpredictable, and flood-induced displacements make the women and children in the region extremely vulnerable. Problems of security and protection directly and profoundly impact all aspects of their lives. Tangible assets (resources and stores) and intangible assets (claims and access) have been universally denied, repeatedly, and devastatingly seized from women and children.[lix]

Eighty-eight percent of Gambella's refugee population are women and children, the majority of which live in semi-permanent housing structures. Overcrowding, stagnant and polluted water, and poor sanitation are causing diarrhea and malaria among flood victims, which further deteriorates the health conditions of women and children. The Gambella region has the highest rate of children under five years with diarrhea in the country, which is also the major cause of death for young children in Ethiopia even though the rate reduced from 27 percent in 2000 to 15 percent in 2016. In the region, 23 percent of children under 18 are deprived of at least five basic needs or services compared to the 43 percent average across Ethiopia.[lx]. The lack of information on treatment, availability of health services, and accessibility to health facilities also forms barriers to parents seeking treatment for their children. Furthermore, the heightened vulnerability of Gambella's women and children is intrinsically linked to their problems of security, lack of protection, and access to resources, which indicates their high susceptibility and low adaptability to climate hazards.

Pastoralists and Farmers

Historically, teff, wheat, maize, sorghum, and barley are the five major cereal crops in Ethiopia, accounting for about three-quarters of the total area cultivated and 29 percent of agricultural GDP.[lxi] More specifically for the Gambella region, between 2016 and 2017 maize crop accounted for 57 percent of the Gambella region's crop production by small-scale farmers and 56 percent of the region's harvested area. The more frequent floods in the Gambella region caused devastating damages to the maize crops. The situation is worsening, and yields are further decreased due to the waterlogging on the farmlands, which are caused by a lack of flood management infrastructure and post-flood recovery capacity. Most of the smallholder farmers and pastoralists are extremely poor and are highly vulnerable in terms of food security when facing floods and other natural hazards. Research has shown that individuals who relied on crop cultivation as their main source of livelihood were less successful in avoiding severe negative effects than those who mainly relied on livestock keeping, mainly due to the mobility of livestock that enabled farmers or pastoralists to move to higher grounds. Research also shows that recurrent internal clashes over land, natural resources, or vendettas among and between local agro-pastoralist Nuer and agrarian Anuak communities have, at least temporarily, displaced

some 40,000 people. As a result, the external pressures and impacts triggered by natural hazards confronting farmers and pastoralists, combined with the internal conflicts mainly resulting from competition over resources, impact on their overall human security and increase their vulnerability.

Unsustainable Land Use

The government claims that changes in land use are the main contributing factor for the increased frequency and magnitude of floods in the Gambella region.[lxii] Before 1984, the Gambella region was occupied by fewer indigenous people than today. However, between 1983 and 1996 several thousands of people relocated to the region. The relocated population cleared more than 140 km^2 of natural forest. The rapidly growing population caused more water diversion to the agricultural fields for crop irrigation, which increased food output and reduced food insecurity. Human interference within the catchment due to improper land use planning exacerbates the resource competition and compromises the region's sustainability. Unfortunately, settlers were also not able to prevent floods from eroding soil nutrients and damaging crops, leading to increased fertilizer usage, runoff, and high sediment yield, which in turn reduced the water holding capacity of rivers. Deforestation further damages the environment, leading to higher runoff volumes which, combined with climate change, increases the severity and frequency of floods in lowland areas. Research shows that flood recession agriculture - planting in alluvial soils as the floodwaters drain away - is a crucial production opportunity. However, the planning of water resource projects and agricultural productions are relying on historical data. Updated data reflecting changing rainfall patterns and soil erosion would help in the development of better water management and adaptation measures. The lack of environmental impact studies in the region, especially at the catchment scale, combined with the high susceptibility of the region and lack of adaptability to floods, could worsen the situation and exploit communities' vulnerability to flood hazards.

Poor Infrastructure

Major rivers in the region like Baro, Akobo, Gilo, and Alwar, which originate from the highlands, have been causing the river banks to overflow beyond the normal flood zones. The lack of functional drainage systems contributes to Gambella's increased vulnerability to the impact of flooding, especially with increased rainfall. Communities' traditional systems to manage floods by constructing boundary walls and digging ditches around the houses and farmlands to divert the water away from their properties have become less effective with the increased severity of the floods experienced in recent years. Many houses in the region are built from wood, grass, and mud walls that are easy to reconstruct and are a deliberate adaptation to the increasing frequency and severity of floods. Raising the floor level of the houses could potentially prevent the impact of floods. However, these building materials would not withstand an extreme flood, and the average individual living in Gambella does not have the capacity to rebuild their severely damaged properties. On the other hand, the public sector lacks the resources to provide infrastructure and managerial capacity to accommodate temporary and permanent resettlement.

The government has provided temporary shelters, but they were overcrowded, with up to 50 people living in a single room.[lxiii] The Government of Ethiopia lacks the capacity and financing to mobilize resources investing in structural preventive measures like wide drainage canals and flood retention basins. The lack of public services and facilities provided in newly established villages that are away from the flood-prone areas are also causing concerns among people and preventing them from resettling.[lxiv] Under-capacity drainage systems, temporary houses, and crowded shelters further deteriorate the potential adaptability of people living in flood-prone areas, while increasing their overall susceptibility to flood hazards.

Impacts

> "Effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific period and the vulnerability of an exposed society or system."
> —IPCC Framework

Droughts and floods are recurring hazards that have a significant direct and indirect impact on human security and natural systems in the Gambella region, including water supply and quality, agricultural systems, public health, food security, and the economy. In addition, the impacts of climate change hazards are progressively emerging as an unprecedented global challenge to social and economic development in Gambella, particularly among rural households, which account for approximately 64 percent of the total population in the region.[lxv]

Water and Food Insecurity

Land and water are intrinsically linked. Consequently, due to climate change and conflict, the availability and access to arable land have been lost at a rate that outpaces the rate of erosion and pollution. Simply put, the natural processes to replace diminished soil cannot keep pace. The majority of the people in Gambella are dependent on land and water for farming and grazing for livestock. Therefore, land and water availability is crucial. Primarily, the South Sudanese Nuer refugees and Anuak ethnic groups have been competing over the control of land and water in the region. Although the Nuer comprise a majority of the population in Gambella, the Anuak own the majority of the arable land and water resources, creating conflict as they fight for control of these precious resources.[lxvi] As the population increased in Gambella, access to arable land became scarce. Although water supply is not an issue, quality and access to water are due to inadequate sanitation, especially in refugee camps. Water sources are often located at sites that are near riverbanks and areas prone to runoff and flooding as chemical and biological contaminants are absorbed into the soil and flow into rivers and wells. Moreover, the effects of

ethnic conflict over land and water drive water scarcity and food insecurity. These conflicts disrupt crop production, deplete livestock, and increase market prices, making it difficult to produce enough food to support the population.

Livelihoods

Much like the rest of Ethiopia, access to land and water is essential to people's livelihoods. Climate change and conflict over land and water access directly impact farmers and pastoralists. Agriculture-related livelihoods cannot meet production and food quality demands due to lower crop yields and lower livestock productivity. Increasing temperatures and drought negatively affect photosynthesis, which causes faster development of crops, shorter life cycle, shorter reproductive duration, and ultimately results in smaller plants and lower yields.[lxvii] In general, flooding and sustained drought increase the probability of political unrest to 24% and 15% respectively, driving people to resort to violence as they compete for scarce resources.[lxviii]

Displacement

Environmental hazards and violent conflict in the region have led to the significant displacement of people. Gambella's shared border with South Sudan is also subject to transnational refugee migration. This is primarily characterized by ethnic Nuers fleeing persecution and famine caused by conflict, floods, and drought in South Sudan.[lxix] The ethnic composition of the region has changed dramatically as almost 70,000 refugees from South Sudan migrated to Gambella, which greatly changed the ethnic composition of the region as the Nuer population outnumbered the Anuak population by a factor of three.[lxx] Violent incidents between the Anuak and Nuer communities have broken out due to socio-cultural reasons, increasing competition over resources. The Nuer population, mainly pastoralists, have been expanding into Anuak territory, searching for water access and grazing land during the dry season. Political power and ethnic entitlement add another layer to displacement in the region as the Anuak and Nuer communities attempt to gain leverage through political representation in a government defined by ethnic federalism.

Public Health

The adverse health impacts of flooding and drought in Gambella are death, disease, and crop destruction. Climate change events and conflict in the region are a direct threat to public health. Given that mosquitos and pathogens prosper in warmer and wetter weather, the increased rainfall, humidity, and temperatures affect the transmission dynamics, geographical range, and drivers of infectious diseases such as water and vector-borne diseases. The risk of drought-induced undernutrition due to food shortages from low crop yields also leads to displacement, an increased burden on public health services, and the spread of disease, therefore heightening existing socioeconomic tensions and potentially multiplying conflict. Communicable diseases are significantly more common in the overcrowded conditions of a refugee camp than in the host community.[lxxi] As refugees flee conflict, they spread disease throughout the region because they

often live in circumstances that facilitate the transmission of infectious diseases, which places a significant burden on the health system since access to health services is limited in rural parts. Conversely, if equivalent health services are not provided to host communities, the disparity in support creates another layer of conflict. Furthermore, adverse health impacts due to climate change harms the economy. For example, in 2004 the prevalence of stunting in children from Gambella was 40.5 percent, which leads to arrested growth and brain development, as well as higher maternal mortality. Every 1 percent decrease in height equates to a 1.4 percent decrease in productivity, leading to an estimated three percent loss of GDP between 2006 and 2015.[lxxii]

The impacts on food security, water security, livelihoods, displacement, and public health due to climate change are clear in Gambella. However, unlike ethnic identity, competition for scarce resources, and political dynamics, the effects of climate change are not the main drivers of conflict in the region. Though climate change may not drive conflict in Gambella directly, it clearly plays a significant role by exacerbating existing social, economic, and political factors. Extreme weather events are a threat multiplier and can make it more likely for conflict to occur and become more intense. Additionally, the indirect effects of conflict can also result in further environmental degradation and reduce the population's resilience and ability to adapt to climate change. Current trends suggest that addressing these impacts and their effects is urgent, especially in host and refugee communities. Stakeholders at all levels should conduct further studies to improve conflict mitigation and climate adaptation efforts in Gambella to help those most vulnerable and exposed to environmental hazards.

Risks

> "The interaction of hazard, exposure, and vulnerability" —IPCC Framework

The interaction of the exposure and vulnerability of an area to climate hazards, in addition to the impacts of these hazards on vulnerable populations, infrastructure, livelihoods, and the environment are key determinants of risk. Vulnerable populations, particularly women and children, are more at risk of experiencing the adverse effects of climate change. Therefore, risk mitigation strategies should consider approaches that address these factors.

Flooding

Gambella experiences major flooding almost every year as climate change increases the frequency and magnitude of this hazard.[lxxiii] Higher average annual temperatures are expected to increase rainfall 18 percent in the region.[lxxiv] Climate change adaptation strategies can reverse the impact of flooding in many cases. However, most adaptation measures that help reverse the impact of flooding are realized in the long term and require significant commitment in resources

which makes the potential to reduce the risk of flooding somewhat limited. The vulnerability and exposure to flooding are persistent since most people in the region live in flood plains. Furthermore, most working-age people in Gambella are farmers and pastoralists and are heavily reliant on access to land and water.[lxxv] The IPCC differentiates between four qualitative risk levels; i) *Undetectable*; ii) *Moderate,* in which risks are detectable with at least medium confidence; iii) *High,* in which risks are significant and widespread; and iv) *Very High*, in which there is a very high probability of severe risks and impacts become irreversible or persistent of impacts. Based on the IPCC criteria and the likelihood of harmful consequences or losses from the interactions between the flooding hazard, exposure, and vulnerability, the overall risk assessment is evaluated to be **very high**.

Risk Assessment Matrix			Flooding			
			Criteria Impact Level			
			Very High 4	High 3	Moderate 2	Undetectable 1
CRITERIA	I	Magnitude				
	II	Probability				
	III	Irreversibility of impacts				
	IV	Timing of Impacts				
	V	Persistent Vulnerability or Exposure Which Contribute to Risks				
	VI	Limited Potential to Reduce Risks				
Overall Risk Assessment 4 – Very High 3 – High 2 – Moderate 1 – Undetectable						

Droughts

The interaction between the drought hazard, exposure, and vulnerability is high. Although droughts have moderately affected Gambella has been affected moderately by droughts, droughts have severely impacted the rest of Ethiopia and South Sudan, indirectly impacting Gambella through displacement and poor crop yields.[lxxvi] Climate adaptation strategies to reverse the impacts of drought are currently low due to the region's expansion of agricultural activity, industrial development, and population growth. The expanding agricultural and industrial sectors and growing population strain the limited usable land and scarce water supply. As a result, the vulnerability and exposure to flooding are persistent. In addition, most people in the region are farmers and pastoralists and heavily rely on land and water to produce crops and livestock grazing. Therefore, the likelihood of harmful consequences or losses from the

interactions between the drought hazard, vulnerability, and exposure makes the overall risk assessment level **high**.

Risk Assessment Matrix			Drought			
			Criteria Impact Level			
			Very High 4	High 3	Moderate 2	Undetectable 1
CRITERIA	I	Magnitude				
	II	Probability				
	III	Irreversibility of impacts				
	IV	Timing of Impacts				
	V	Persistent Vulnerability or Exposure Which Contribute to Risks				
	VI	Limited Potential to Reduce Risks				
Overall Risk Assessment 4 – Very High 3 – High 2 – Moderate 1 – Undetectable						

Tigray Case Study

Tigray

Context

Tigray is the northernmost regional state in Ethiopia, bordering Eritrea to the north, Sudan to the west, and Ethiopia's federal states of Amhara and Afar to the south and east, respectively.

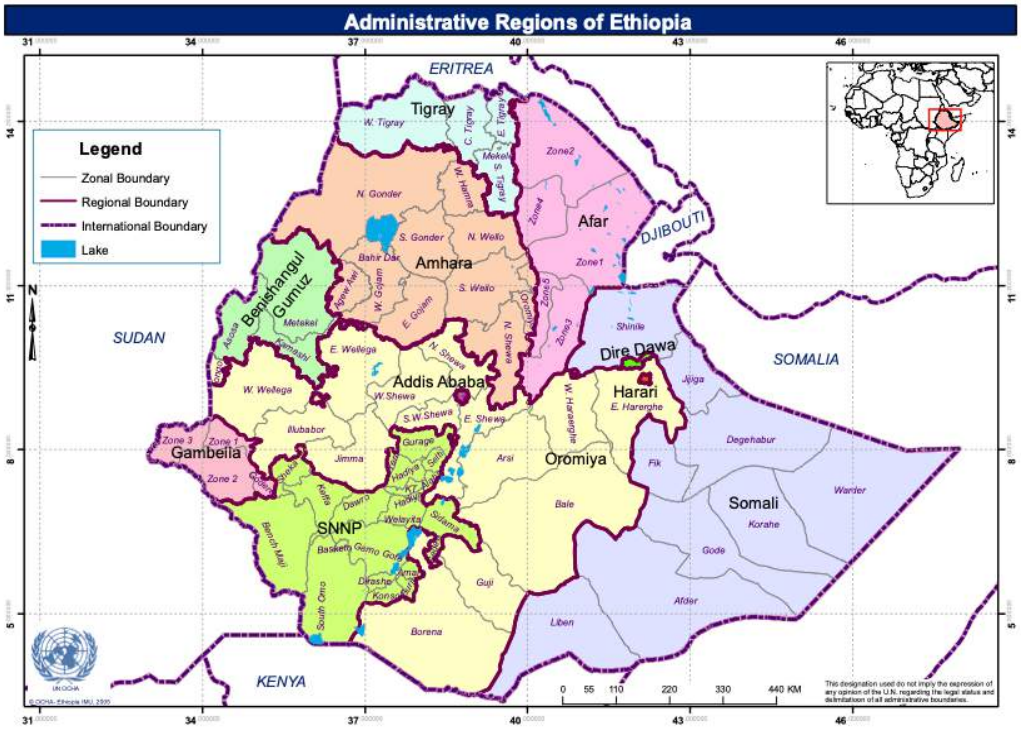


Photo source: OCHA 2005

Tigray hosts the majority of Ethiopia's estimated 7 million Tigrayans, who themselves compose approximately 6 percent of Ethiopia's population.[lxxvii] Roughly 3 out of 4 Ethiopians living in Tigray sustain their livelihoods through farming and depend on local seasonal harvests for survival. This cycle depends on relatively predictable weather patterns that provide a growing period stretching from June to September, preceded by a ploughing period between March and July.[lxxviii] Even before the recent outbreak of conflict, 27 percent of Tigray's population lived below the poverty line, and a disproportionate number of children living in poverty compounded with a disproportionate percentage of female-led households have made these groups particularly vulnerable to livelihood shocks.[lxxix] This vulnerability and its implications for the climate change and security nexus will be reviewed in more detail in subsequent sections.

At the time of this report's publication, Ethiopia's Tigray region is enveloped in one of the most contentious and volatile political and territorial disputes anywhere in the world. The chronology of this conflict spans decades and is integrally tied to Ethiopia's system of ethnic federalism that spawned from Ethiopia's civil war in the 1990s.[lxxx] While this system afforded limited ethnic

autonomy to Ethiopia's multi-ethnic population through the creation of "ethnic-based territorial units," which are tied together by a federal government run out of Addis Ababa, the system sowed the seeds of future discontent and ethnic conflict. While this paper does not focus on the political history of Tigray, it is necessary to provide at least a cursory overview of this history in order to understand the most salient conflict dynamics being impacted or multiplied by climate change related hazards. playing out today and the implications of these dynamics for a climate-sensitive conflict analysis.

The most recent bout of fighting began when Ethiopia's current Prime Minister, Abiy Ahmed, an ethnic Oromo who campaigned on national unity and who replaced the longstanding Tigrayan People's Liberation Front (TPLF)-led party at the helm of Ethiopia's government, sent federal troops into the Tigray region in November 2020, ostensibly in response to an attack by TPLF forces on a federal military base in Tigray.[lxxxi] However, the roots of the conflict extend further back to Mr. Abiy's attempts to drain the TPLF of its power and influence in Ethiopia and the latter's resistance to these efforts. This tension, in turn, stems from a history of quasi-authoritarian governance by TPLF leadership that dates back to the 1990s, which created resentment among many Ethiopians against Tigray leadership, as well as broad prejudice against Tigrayans. Furthermore, the Amharan ethnic group perceived the demarcation of federalist state borders in the 1990s to incorporate Amharan land within Tigray, and Ethiopia's Eritrean neighbors to the north have similarly engaged in border disputes in northern Ethiopia for decades.[lxxxii] These simmering tensions set the stage for the incursion of federal forces into Tigray in November 2020 to catalyze a rapid escalation of violence, which over a year later shows few signs of abatement and risks significant escalation.[lxxxiii] The history of ethnic tensions in the region and this recent escalation represent a failure by stakeholders inside and outside Ethiopia to use preventive diplomacy to mitigate the rising violence. Today, the conflict is an additional challenge for communities whose livelihoods depend on addressing climate shocks effectively.

Applying the IPCC Framework:

Hazards

> "The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or […] damage and loss to property, infrastructure, livelihoods, service provision and environmental resources" —IPCC Framework

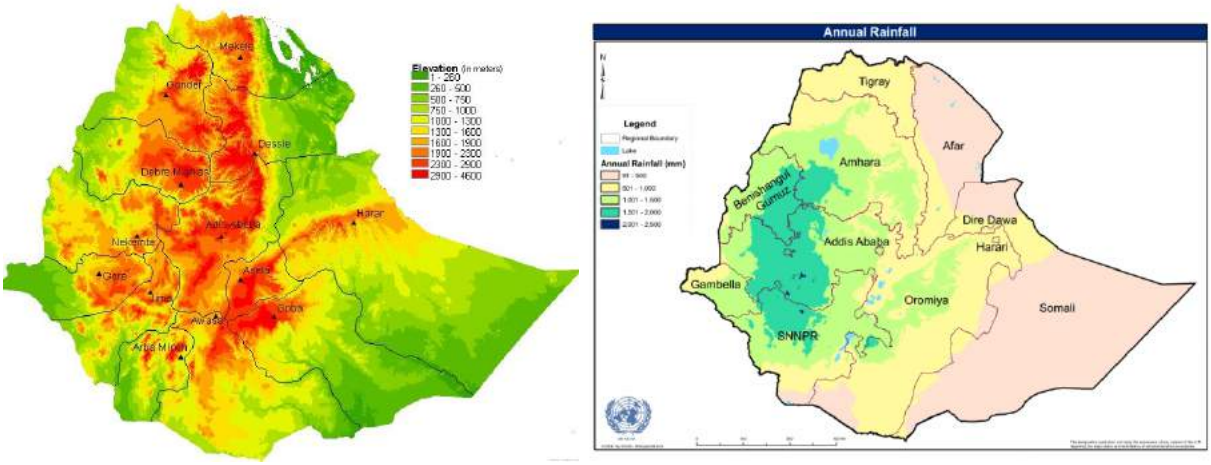


Photo source: OCHA 2006

The impacts of climate change vary across Ethiopia, with topography, season, proximity to water resources, and proximity to the Arabian Sea and Gulf of Aden all affecting the manifestation of climate change impacts in different parts of Ethiopia.[lxxxiv] As illustrated in these maps, rainfall variability closely mirrors topographic variability, with more precipitation caused by relief rainfall rising over these mountainous areas and slightly higher rainfall in the south due to convectional rainfall that occurs at latitudes closer to the equator.

As reported by the IPCC, climate change typically exacerbates or alters the oscillation of existing weather patterns.[lxxxv] The below diagram, which appears in the August 2021 IPCC report on the physical science basis for climate change, illustrates the ways in which heavy precipitation events and severe droughts will increase in frequency with global warming.[lxxxvi]

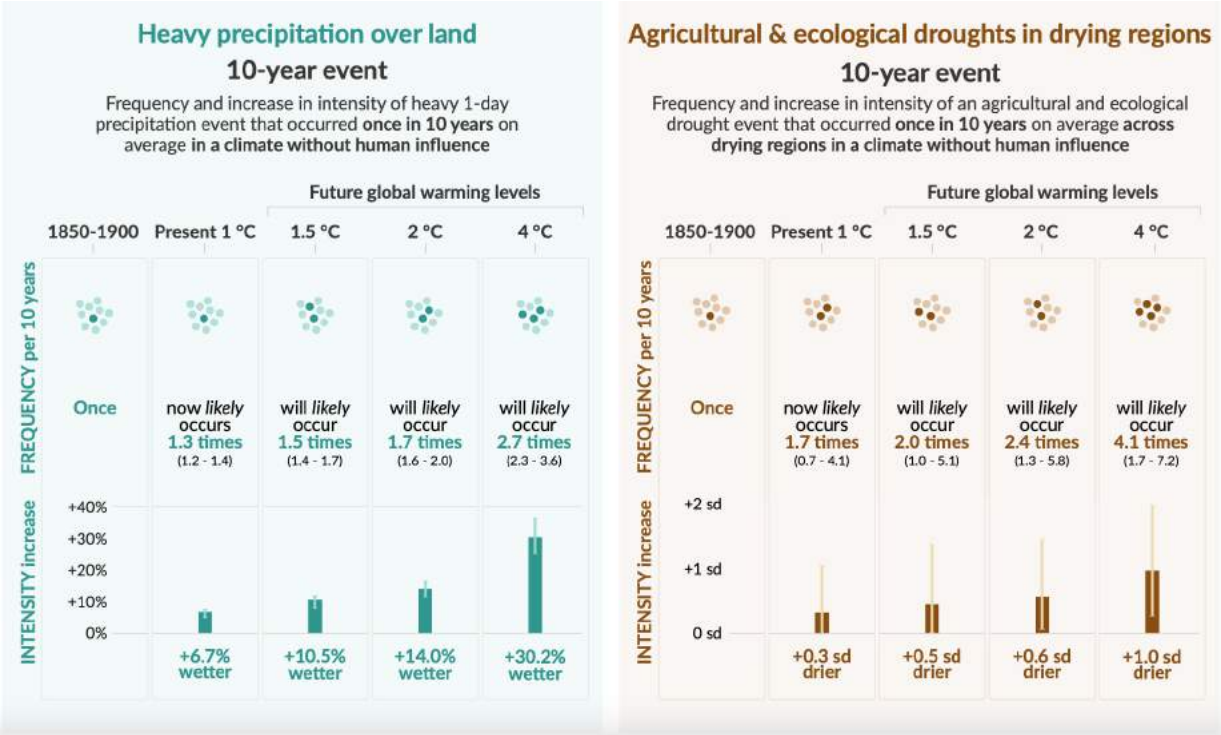


Photo source: IPCC Summary for policymakers. "Impacts, Adaptation, and Vulnerability," SPM-23.

Incidents of heavy precipitation and drought will become more prevalent in Tigray and neighboring states. First, Tigray is one of the most drought-prone regions in the country. Indeed, one study found that 44 percent of districts in Tigray have drought risk levels categorized as "high to very high."[lxxxvii] Furthermore, these droughts tend to be clustered in the western, eastern, and southern zones of Tigray, heightening risk in the regions facing the brunt of violence in the current conflict.[lxxxviii] As droughts increase in frequency, Tigray may be one of the hardest-hit areas. Indeed, the 2015 drought, induced by the *El Nino* and resulting in poor harvests over two consecutive rainy seasons, was one of the worst in decades.[lxxxix]

Second, Tigray will experience an increase in heavy precipitation events correlated with rising global temperatures, which in turn will bring more floods to the region. As illustrated in the map below, flooding during the rainy season occurs in pockets throughout Ethiopia, though some areas face higher rates of floods than others.[xc] For instance, heavy precipitation is projected to increase flooding in the Upper Blue Nile River Basin, which flows out of Lake Tana in the Amhara region and out of El Diem in Benishangul Gumuz.[xci] While not impacting Tigray directly, events in Amhara will have a direct impact on Tigray, and therefore it is necessary to know the impacts of climate hazards on the UBNRB and in Amhara broadly. To a lesser extent, Tigray is also exposed to heavy precipitation events that can lead to flooding, as illustrated in the map.

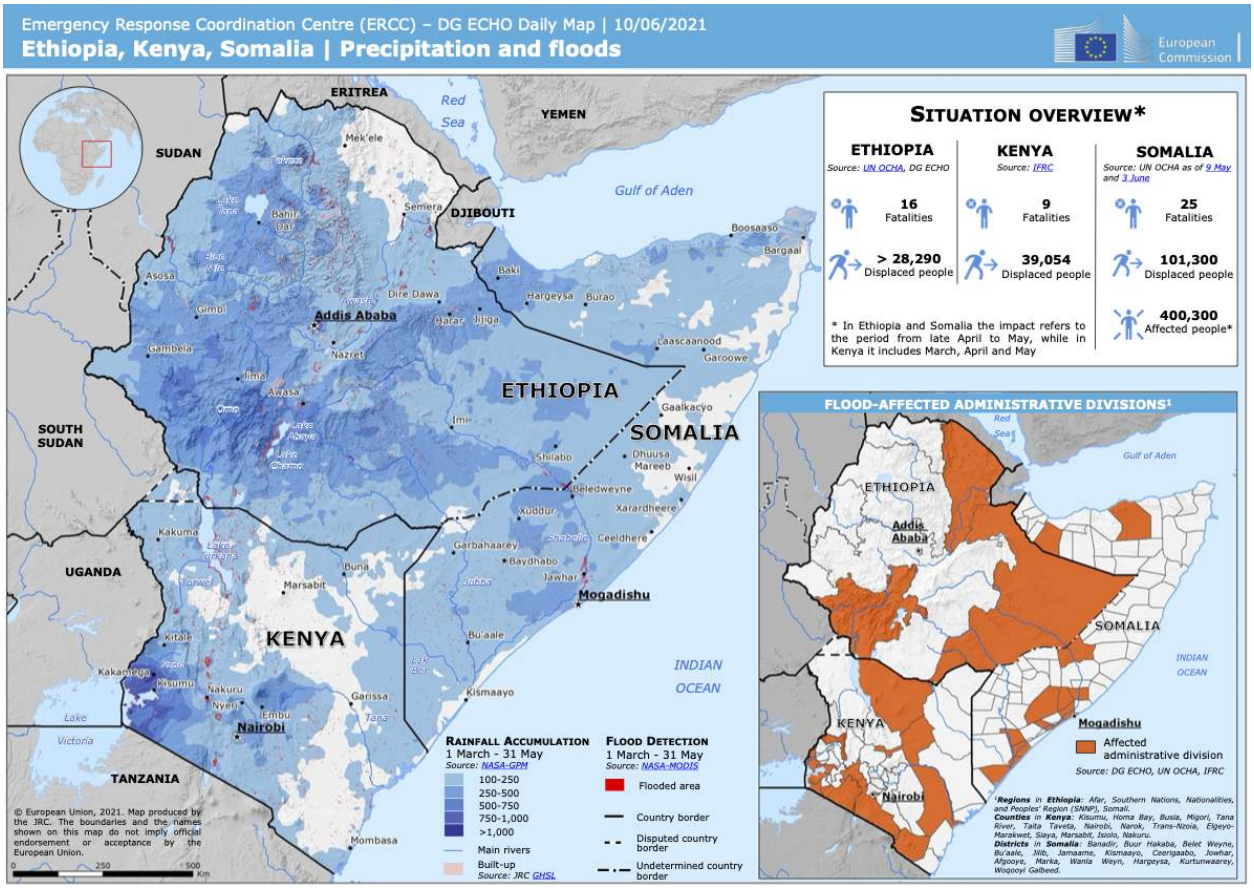


Photo source: ERCC 2021.

These dual hazards of drought and heavy precipitation leading to flooding are both correlated with global temperature increase. Given projections of global temperature increase that could stretch to between 2.5° to 3° Celsius if extreme mitigation measures are not taken in the near term, incidents of severe flooding and drought are likely to further increase in frequency over the next century.[xcii]

Exposure

> "The presence of people, livelihoods, species or ecosystems, environmental functions and service and resources, infrastructure, or economic social or cultural assets in places and settings that could be adversely affected by climate hazards" —IPCC Framework

Ethiopia overall is highly susceptible to droughts, and Tigray is one of the most exposed areas given that it is already a water-deficient region.[xciii] The western, southern and eastern areas of the arid region of Tigray are even further prone to drought cycles.[xciv] Tigray is also exposed to

overall rainfall variability due to the phases of the El Niño,[1] which during its warm phases has resulted in lower rainfall in the region's usual wet seasons of July through September.[xcv]

Tigray is further exposed to rainfall variability due to the Indian Ocean Dipole, which is the oscillation in the sea surface temperatures between the opposite poles of the Indian Ocean, defined as either 'positive' or 'negative' Indian Ocean Dipole events.[xcvi] Most recently, positive Indian Ocean Dipole events have taken place as the warmer sea temperatures on the western pole of the Indian Ocean have resulted in much higher than usual rainfall in Tigray —as well as the broader Horn of Africa and the Arabian Peninsula adjacent to the Arabian Sea— since rainfall moves along the associated warmer waters in the Indian Ocean.[xcvii]

Vulnerability

> "The degree to which a system is susceptible to, or unable to cope with, adverse effects of. climate change, including climate variability and extremes" —IPCC Framework

Tigray is particularly vulnerable to the harms of climate change hazards due to the region's high proportion of small-scale subsistence farmers, landless population, and a significant dependency on rain-fed agriculture. Additional reasons for susceptibility to harm include dramatic population growth, deforestation, and soil erosion.[xcviii] The proportion of small-scale subsistence farmers paired with their significant dependency on rain-fed agriculture makes them more susceptible to harm due to the drastic fluctuation in crop yields that can occur with rainfall variability. This, in turn, has direct and serious impacts on their often sole source of income and livelihood. Additionally, the volume of landless people highlights the overall inequality in landholding throughout the region and lack of financial flexibility of the population in Tigray. This, therefore, heightens the Tigrayan population's vulnerability to the economic and social interruptions that result due to climate hazards.[xcix] Population growth, deforestation, and soil erosion also put further pressure on the agricultural ecosystem, increasing the chances of harming this system when climate change hazards occur.

As is the case across farming communities in the Horn of Africa, traditional coping mechanisms in Tigray have been insufficient and overstretched in the face of more frequent and powerful climate-change induced hazards.[c] Tigray's capacity to adapt and cope has been further reduced

[1] El Niño is a climate pattern in the Pacific ocean, which is when warm water is pushed to the western coast of the Americas as a result of weakened trade winds. This in turn impacts the Pacific jet stream, moving it south from its neutral position. This shifting of the jet stream has several implications on the weather around the world.

by low access to agricultural technologies, infrastructure (including roads and irrigation), institutions (such as veterinary and micro-finance), services, human capital[ci] in addition to a rigid cropping calendar, minimal choice in crop varieties, and a lack of a far-reaching and modern early warning system.[cii] However, it is important to note that this adaptive capacity does vary throughout Tigray. For example, three out of the 34 districts in the region (Adwa, Alamata and Enderta) are considered as having a high adaptive capacity due to better-developed infrastructure, institutions, and high literacy rates. Additionally, eleven other districts (Ofla, Adwa, Ganta Afeshum, Kilte Awelaelo, Saesie Tsaeda Emba, Alaje and Endamekoni) are considered as having a mid-range capacity to cope because they are closer to urban areas which means that farmers from these districts have greater access to agricultural inputs, infrastructure and institutions and have a higher literacy rate. Eight districts however (Asgede Tsimbla, Tsegede, Tselemti, Tanqua Abergelle, and Naeder Adet) are considered as having the lowest capacity to adapt.[ciii] This range throughout Tigray, although maintains the region's vulnerable status to adapting to climate change hazards, also highlights the possibility of establishing more adaptive capacity to build resilience to climate change.

Impacts

> "Effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific period and the vulnerability of an exposed society or system."
> —IPCC Framework

Some of the most critical impacts of rising temperatures and rainfall variability in Tigray have included locust swarms, food insecurity, shocks to livelihoods, competition over scarce resources, deterioration of health conditions, as well as the overall impact on social and environmental systems. These impacts all have significant effects on human security and on the overall fragility of the social fabric of the region.

Locust Swarms

In 2020, Tigrayan farmers lost almost half of their harvests to unprecedented Desert Locust swarms, leading to 43,000 individuals in Tigray being affected and in need of emergency food aid.[civ] These insects were mainly concentrated in the northwest and central Tigray, resulting in damaged crops, rangelands and pastures.[cv] The climate change hazard of rising temperatures has been associated with more devastating locust plagues. This is due to the fact that higher than average rainfall brought about by the Indian Ocean dipole has attracted more locusts as they follow periods of intense rainfall due to the resulting blooming of vegetation that occurs in usually arid environments, which the insects can feed off.[cvi] October through December of 2019 for example, brought about rainfall which was 400 percent above the normal rainfall levels during

that typical time period.[cvii] Additionally, the current conflict in Tigray has made locust breeding areas inaccessible and thus difficult to control and survey, which will likely lead to the development of new swarms in northern Ethiopia. This would have serious implications for Tigray as well as the surrounding regions and countries such as Eritrea, which have upcoming rains that could attract these newly forming locusts.[cviii] Therefore, a cyclical reinforcing relationship exists between climate change, locusts and conflict wherein climate change induced locust swarms have weakened the social fabric in Tigray through the threatening food security and livelihoods, which is further reinforced by the inability to control the locust situation due to the conflict.

Food insecurity

According to the World Bank, Tigray represents one of the five key hotspots of food insecurity in Ethiopia linked to climate change.[cix] In addition to the abovementioned locust swarms, rainfall variability has been an important driver contributing to food shortages and famine in Tigray's current and past history due to its high dependence on rainfed agriculture.[cx] This picture has been further complicated by the conflict-induced famine currently taking place in Tigray.[cxi] Although experts conclude that the famine has been brought about by the Tigrayan conflict, the baseline level of food insecurity which was worsened by climate change related shocks has likely intensified this situation.

High temperatures along with droughts have decreased agricultural productivity, given the stress put on the crop production process. Additionally, the unexpected spikes in above-average rainfall has contributed to severe environmental degradation and soil erosion, further putting pressure on crop yields.[cxii] This has resulted in significant shortfalls in the region's agricultural production and therefore a decrease in food availability. Additionally, it is important to note that food insecurity across Tigray impacts certain groups differently, with for example several studies indicating that food insecurity is higher in female-led households.[cxiii] This gendered reality may be due to women's overall limited access to services and resources which are critical for productive agricultural outputs, including equipment, land, better quality seeds, and labor. Societal factors also contribute to this disparity in food insecurity as Ethiopian tradition does not view women as being the primary producers for their households.[cxiv]

The relationship between food insecurity and conflict in Tigray is complex and non-linear, with climate-related hazards increasing the overall vulnerability of Tigrayans and multiplying the conflict-induced impacts on food supply in the region. As is common in the climate change - conflict nexus, this has likely multiplied the effects of the severe famine facing Tigray, where as of September 2021, 400,000 people in Tigray have been considered as facing famine conditions.[cxv]

Livelihoods

The abovementioned reduction in crop yields due to climate change hazards, has also had a direct impact on the livelihoods of Tigrayans due to the close relationship between agricultural

production and income in the region. This impacts a significant segment of the population since agriculture represents 45 percent of Tigray's GDP and that approximately 80 percent of the region's population's employment and livelihood is in the agricultural sector. The majority of the individuals who make up this sector are also small-scale farmers operating in rainfed agricultural systems with minimal adaptive capacity.[cxvi] Furthermore, the extremely limited financial resources and flexibility of small-scale farmers who often live harvest to harvest not only limits these farmers' adaptive capacities, but also increases the effect of the impacts of climate hazards on farmers and their families. This can make the real-life difference for farmers of being able to pay for school fees, have three versus one meal a day, and be able to provide for themselves and their families.[cxvii] Therefore, the destruction of livelihoods that has occurred due to climate-related factors threatens the overall well-being of this large majority of Tigray's population. This impact on well-being directly links to human security, contributing to the already fragile social fabric of Tigray.

Competition Over Resources

Climate change's impact on crop yields has also multiplied competition over resources in Tigray. For example, the Tigray and Amhara regions are currently engaged in an intense border dispute over a fertile part of Tigray, which is conducive for commercial farming and the cultivation of cash crops. Given the importance of cash crops in this border area, this dispute has therefore been exacerbated by competition over cash crops such as sesame.[cxviii] Although this is not the primary driving factor of the dispute, the lucrativeness of sesame combined with the strain that climate change variability has imposed on sesame yields[cxix] have likely multiplied tensions between these two regions. This eruption of tensions has been seen most concretely in the fact that fighters from Amhara have begun to mobilize directly against the Tigrayan forces in the context of the wider Tigrayan conflict.[cxx] The scarcity of this sesame resource has been further worsened by the Tigrayan conflict as 70 percent of Ethiopia's annual cultivation of sesame has skipped a harvesting season due to the eruption of violence in the region, further putting pressure on this resource.[cxxi]

Deterioration of Health

Food insecurity has also had a direct causal impact on undernutrition, with children under the age of five, women and growing girls being the most impacted. Studies have shown that if a child under five is born during a drought season in Ethiopia, they are 36 percent more likely to be undernourished which can permanently impact their brain development and immunity. Additionally, women are more impacted by food shortages given that trends have shown that women typically feed the rest of their family members before themselves, which has a compounding effect with the fact that households headed by females are more food insecure than male-led households. Also, as pregnant women are already predisposed to lacking micronutrients, this can be further exacerbated by a lack of available food. Lastly, growing girls have a heightened risk of undernutrition in poor families, which has potential impacts on their psychosocial, physical and sexual development.[cxxii]

Additionally, rising temperatures have contributed to the wider geographic distribution of mosquitos to higher altitude regions such as Tigray, which historically had too cool of a climate for these insects. This has therefore contributed to a rise in vector-borne diseases such as malaria, dengue, yellow fever, chikungunya and leishmaniasis. The spread of vector-borne diseases in Tigray has further been facilitated by periods of extreme rainfall, which has resulted in stagnant water and thus aided the breeding of mosquitoes. Finally, not only is the population in Tigray more exposed to vector-borne diseases, but the population also lacks immunity and the necessary coping mechanisms in comparison to areas in which such diseases have always been prevalent.[cxxiii] These health-related impacts are further factors contributing to the overall human insecurity in Tigray.

Social and Environmental Systems

Historically speaking, several years of drought in Tigray played a key role in the region's settlement patterns, economic production and social formation, which are considered as being different from the rest of the country. For example, the drought in Tigray in 1973 contributed to the chaos of the region's social and environmental systems, therefore creating an avenue for the TPLF to set up and then prosper from 1975 onwards.[cxxiv] In fact, the severe drought and the subsequent suffering during the drought contributed to the civilian uprising which took place in 1974 where a dynamic combination of factors from dissatisfaction and anger across several classes such as the urban middle class, the peasant class, intellectuals and the military class led to a coup in February of 1974.[cxxv]

Overall, the abovementioned climate related impacts have significantly deteriorated human security in Tigray. Although climate change has not been a driver of conflict in the region, the Tigrayan conflict has been exacerbated by climate change induced hazards such as drought, floods and rainfall variability. This relationship to conflict is non-linear and at times cyclical, with climate-related factors making communities more vulnerable to conflict, multiplying the impact of conflict and then conflict further multiplying the impacts of climate change. This creates an overall detrimental causal loop, leaving Tigrayans to suffer the consequences in the process. Therefore, the wider conflict in Tigray should be analyzed through the context of immense suffering that was already occurring in the region due the climate hazards of drought and flash floods.

Risks

"The interaction of hazard, exposure, and vulnerability" —IPCC Framework

Droughts

The interaction between the drought hazard, exposure, and vulnerability is **moderate**. The Tigray region has a higher proportion of farmers than pastoralists than Gambella, making it less impacted by the lack of natural resources for cattle to graze. However, these droughts are harmful to crop production and income generation, leaving the most vulnerable without revenue nor produce. Tigray also has a very limited capacity to adapt, further exacerbating the region's vulnerability to climate hazards. Droughts can erode soil, lead to desertification and a decrease in agricultural productivity, further worsening malnutrition, food security, poverty and migration. While damage is reversible with high investments, it requires heavy investments to maintain the soil quality and moisture. Rather, adaptive solutions are plenty from drought-resistant plants, reforestation to improved management of water resources.

Risk Assessment Matrix			Droughts			
			Criteria Impact Level			
			Very High 4	High 3	Moderate 2	Undetectable 1
CRITERIA	I	Magnitude				
	II	Probability				
	III	Irreversibility of impacts				
	IV	Timing of Impacts				
	V	Persistent Vulnerability or Exposure Which Contribute to Risks				
	VI	Limited Potential to Reduce Risks				
Overall Risk Assessment 4 – Very High 3 – High **2 – Moderate** 1 – Undetectable						

Floods

The interaction between the flood hazard, exposure, and vulnerability is **high**. Floods have a more pernicious effect than droughts in that they are difficult to predict, take place very fast and can completely ruin a season's crops. Floods bring sediment and other contaminants to water, making that key resource undrinkable to populations, block roads, leaving women to take unsafe routes to other wells and destroy homes. Their magnitude is therefore considered to be stronger than droughts, and finally, solutions to address floods require higher investments in infrastructure. For example, the Gereb-Giba dam, a project aiming to provide drinking water and water supply to the capital of Tigray (Mekelle), was only started in 2019 because conflicts between Tigray and Amahara slowed down the negotiations and beginning of the project. The

Tekeze dam which supplies electricity to the region proves less and less reliable during the dry season as more water evaporates.

Risk Assessment Matrix			Floods			
			Criteria Impact Level			
			Very High 4	High 3	Moderate 2	Undetectable 1
CRITERIA	I	Magnitude				
	II	Probability				
	III	Irreversibility of impacts				
	IV	Timing of Impacts				
	V	Persistent Vulnerability or Exposure Which Contribute to Risks				
	VI	Limited Potential to Reduce Risks				
Overall Risk Assessment 4 – Very High **3 – High** 2 – Moderate 1 – Undetectable						

Photo: Mulugeta Ayene / WLE

Policy Recommendations

Policy Recommendations

Before providing policy recommendations for the Ethiopian context, which are based on the analyses of Gambella and Tigray, it is important to understand the most predominant policies currently underway in these two regions as well as at the national level. To begin, the Ethiopian government has designed and initiated the implementation of Ethiopia's National Adaptation Plan (NAP) to enhance the country's capacity to address the impact of climate change through a multi-sectoral long-term planning approach. Notably, the NAP's action items are in line with the Ethiopian government's obligations under the council of Adaptation Framework of the UN Framework Convention on Climate Change (UNFCCC).[cxxvi] Additionally, the NAP seeks to find synergies between climate centered adaptation policies and ongoing development initiatives to strengthen the capacity of government, local institutions, and local actors who are impacted by climate change. Some of the objectives of the NAP that are specific to Ethiopia include integrating sectoral and regional adaptation strategies to incorporate climate adaptation within Ethiopia's long term development objectives and establishing resilient systems that can withstand climate related shocks and disasters.[cxxvii]

The primary resilience-building program in Gambella is the Sustainable Land Management Program (SLMP2). Funded by the World Bank and the Kreditanstaltfür Wiederaufba, the SLMP2 is a multi donor flagship program that is implemented by agricultural offices at the *woreda*-level. The SLMP2 targets communities with degraded land.[cxxviii] In response to lack of energy in refugee hosting sites and the environmental impacts of using firewood, the UNHCR has partnered with GIZ on a programme in Gambella, entitled "Energy Solutions for Displacement Setting.".[cxxix] Where education and child protection needs of refugees are concerned, the Education Bureau has led efforts to provide textbooks and other supplies to schools for refugees. Still, local government officials have no detailed knowledge of the scale of child protection activities in Gambella.[cxxx] As a long term strategy, it will be necessary to strengthen integrated climate adaptation activities in the region.

In comparison to Gambella, the Tigray region has already benefited from national and regional initiatives to increase farmers' resilience. The government-led Productive Safety Net Program (PSNP) provides food assistance and other services to the poorest while food-for-work initiatives (FFW) implemented by the Bureau of Agriculture and Rural Development to address famine and provide food for families. Additionally, international NGOs like the World Food Programme provide nutritional meals to the most vulnerable. Beyond fulfilling essential needs, early warning systems and radio weather broadcasts have been implemented

to provide farmers with recommendations on what seeds and fertilizers to use based on upcoming rainfall or drought. Nevertheless, the 'last mile' dissemination of this information to remote villages needs to be strengthened. Finally irrigation systems have been piloted throughout the country, such as in the village of Lemlem in Tigray and showcased how this water management system allowed the village to subsist and continue growing and consuming their own produce until more help was available.

These ongoing policies are an essential starting point for Ethiopia. However, they have not gone far enough to shield the country from the overall impacts of climate change and specifically the impacts of climate change on Ethiopia's conflict dynamics. Therefore, the below mentioned recommendations offer a comprehensive set of policy solutions to address the impacts of climate change on conflict and increase Ethiopian resilience to climate change more broadly.

Given the abundance of literature on conflict resolution and peacemaking at the height of a crisis, our recommendations focus on mitigating the effects of climate change on conflict and acting before the destabilization of peace and escalation of a conflict (the Prevention stage of the Conflict Curve).

Recommendations on updating the climate change and security architecture:

Given the multiplying effect that climate change has on conflict drivers and the overall impact of conflict, it is critical that climate change and peacebuilding are addressed together. This means that overall climate change adaptation policies need to be implemented alongside intentional peacebuilding initiatives seeking to mitigate the impacts of climate change on conflict. However, in order to do this comprehensively, the overall climate change and security architecture needs to improve at the multilateral, national, non-governmental, and local level. Fundamental shifts need to be made within and across these spaces in order to improve the way in which the world confronts climate change and conflict together. Each of these four spaces has been chosen due to the need for a comprehensive and integrated approach to addressing the climate change-conflict nexus, and the unique potential that each level possesses to contribute to this approach. First, the multilateral level has the potential for coordination, funding, and the provision of technical expertise. Second, the national level can sustain and empower nationwide climate change and security programs. Third, the non-governmental space can provide specialized expertise. Finally, the local level has the potential to balance the top-down multilateral and national approaches with a bottom-up one, making peace more sustainable in the process. Although the policy recommendations have been delineated across these four specific spaces, it is important to note that they are highly interconnected and dependent upon one another, which is why an overall multiscalar approach is required.

➤ Multilateral Level

1. ***The international community must follow through with the new COP26 pledges of doubling the funding provided to developing countries for adaptation by 2025, taking the annual figure to approximately $40 billion.*** More specifically, climate finance needs to be unleashed and mobilized to curtail deforestation, invest in renewables, and accelerate action to tackle the climate crisis through collaboration among the public and private sector on local, national, and international levels. Beyond that, the ultimate goal should be to fulfill the pledges made in COP15 of providing $100 billion annually to developing countries for climate change adaptation.

2. ***The United Nations Security Council (UNSC) must work together to adopt a thematic UNSC resolution on climate change.*** A UN Security Council Resolution framing climate change as a threat to international security was vetoed by Russia and India on December 13, 2021, marking a major roadblock in establishing unified support for climate-related security issues at the multilateral level. Although, this is not indicative of the will of the majority, as twelve out of the fifteen UNSC members voted in favor of the resolution. Additionally, there are UN-wide initiatives like the Climate-Security Mechanism,[cxxxi] Group of Friends on Climate and Security,[cxxxii] and Informal Expert Group of Members of the Security Council on Climate and Security,[cxxxiii] which have facilitated effective multilateral collaboration in the climate change security nexus. However, the absence of a UNSC Resolution establishing a common approach to addressing climate-related security issues and signaling unified political commitment will continue to minimize the potential for coordinated, widespread and impactful interventions that are needed to transform the climate change-security space.

3. ***Multilateral institutions like the United Nations Secretariat should appoint either a special representative or establish an official institution focused on the climate change - security nexus to adequately coordinate and scale-up projects at the critical intersection of these two areas.*** In order to emphasize the linkages between security and climate change, the representative or official institution should invite relevant UN organs to intensify their efforts in addressing climate change, including its possible security implications and provide space for transparent and systematic discussions on the climate change - conflict nexus. However, it is important to note that the establishment of a coordinating institution or a special envoy will require funding and institutional backing from the wider UN community, which may be difficult to obtain. This further underlines the need for unified political commitment to the climate change - conflict nexus.

➤ National Government Level

4. ***Ethiopia's NAP should incorporate the climate change-conflict nexus by highlighting climate-related security risks and plans to adapt to these risks, given that there is no mention of conflict in Ethiopia's NAP.*** This would require support from specialists on climate change and conflict from the international community as those currently working on Ethiopia's NAP hold scientific expertise on climate change but appear to lack a nuanced understanding of this nexus.[cxxxiv] Such specialists could initially bridge this gap to provide input for the NAP currently in development, but they should also intentionally work to build Ethiopian capacity to specialize in the climate change conflict nexus. This could influence future National Adaptation Plans as well as potential future nationally-led program interventions seeking to address the impacts of climate change on conflict.

➤ Non-Governmental Organizations

5. ***NGOs should incorporate artificial intelligence (AI) into climate and natural disaster early warning systems to link research and modeling activities to multilateral organizations, international organizations, the federal government, and local communities.***[2][cxxxv] Internal early warning systems have significant limitations due to poor timeliness of information flow, poor data quality, low technical capacity, poor infrastructure, and limited financial resources, relying on organizations like the African Union (AU) and IGAD for early warning. Currently, the Continental Early Warning System (CEWS) and the Conflict Early Warning and Response Mechanism (CEWARN) are in place in the region but have significant constraints. Early warning should be strengthened to integrate the vast amounts of data from various sources and combine that data with sophisticated models and algorithms to accurately predict extreme climate events and conflicts to formulate options in an automated manner. This presents opportunities for NGOs, as they are better positioned to bridge the gaps between the various stakeholders. NGOs supported by the UN Funds and Programmes, International Financial Institutions (IFI), and bilateral donors could provide complementary technical, financial, administrative support, and expertise to link different platforms and data sources to share information.

   AI can augment early warning systems with analytics and pattern prediction capabilities to cover current gaps, especially with human limitations, through automation. Trouble spots can alert stakeholders in advance using algorithms that forecast risks, similar to those used to predict extreme climate events. For example, an early warning system developed by Lockheed Martin, the Integrated Crisis Early Warning System (ICEWS), integrates and analyzes more than 100 data sources and 250 news feeds in near real-time to forecast conflict with 80 percent accuracy.[cxxxvi] This level of accuracy is achieved by integrating quantitative data with social, cultural, political, economic, and other qualitative information and creating simulations with social science theories to forecast instability. This mixed model approach aggregates many models to improve forecasting

[2] AI is defined as "...a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments."

over what any single model could provide. This enhanced ability to anticipate climate and conflict events improves decision-making and allows stakeholders to develop responses driven by data. However, NGOs will still need to overcome interoperability challenges and link various data sources into a single early warning system and then link that early warning to preventative response. Also, securing funding for what will likely be a costly upgrade is a barrier to implementation. However, many NGOs have relationships with different sectors and organizations that they can leverage to encourage cooperation and acquire funding. Given the increasing cooperation and coordination between NGOs and the various stakeholders, along with the presence of NGOs in most conflict zones, NGO involvement matters, and getting their help to integrate AI into early warning systems is critical if this massive leap in technology is to be achieved.

➤ Local Level

6. ***Raise awareness on the impacts of climate change and human (in)security.*** Local government officials, national NGOs, and civil society organizations in Gambella and Tigray should raise public awareness of the impacts of climatic shocks, vulnerability, and human (in)security to ensure that citizens are aware of climate-related risks such as floods and droughts. This can increase acceptance from community members on climate adaptation policies such as resettlement programs for people who live in flood-prone zones and no-build zones. Awareness raising campaigns can build trust in the state's decision-making process, challenge perceptions that climate adaptation policies favor certain groups over others, enhance social cohesion, and thus reduce social conflict. This could be supported by NGOs and supported by international-level funding.

7. ***Strengthen local dispute resolution mechanisms.*** The overarching local peacebuilding infrastructure needs to be strengthened and empowered with the support of the international community and NGOs. More specifically, a network of local committees that serve to mediate disputes relating to resource management and the overall socioeconomic tensions exacerbated by climate change should be funded throughout Ethiopia. It is important that these local committees take into account and identify Ethiopia's existing and extensive indigenous conflict resolution mechanisms,[cxxxvii] that they are locally led, equitably distributed and designed and inclusive of a broad subset of the population. NGOs can support this by providing non-partisan and pro-community expertise on preventing conflict before escalation. Moreover NGOs can help *woredas* with conflict prevention by helping them identify key human security indicators in order to identify rising tensions and violence. Additionally, the UN Secretary-General's Peacebuilding Fund for example could be leveraged for this initiative as it regularly funds projects that are aimed at establishing or enhancing local peace committees to facilitate community dialogue and mediation.[cxxxviii] However, in order to support these local committees in an extensive, systematic, and therefore more impactful way, this will

require a heightened commitment of resources to mechanisms such as the Peacebuilding Fund.

8. ***Prioritize programming that mitigates tensions between refugees, IDPs, and host communities.*** In regions such as Gambella, inter-communal tensions have led to insecurity and deterred the successful economic inclusion of displaced populations. Local organizations should prioritize efforts to reduce tensions between host communities and displaced populations through community-building programmes that address the sources of tension, such as deforestation.[cxxxix] By facilitating knowledge exchange sessions on climate adaptation strategies through both formal and informal channels, local organizations can increase cooperation between groups.

9. ***Focus on conflict mitigation between smallholder farmers and pastoralists.*** Additionally, the Ethiopian Pastoralist Affairs standing committee should consider, with the support from international donors, establishing locally-led migration committees which would work to identify migration routes and serve as the body to address grievances that occur between farmers and pastoralists. This would be much more targeted and tailored to farmer–herder conflicts compared to the abovementioned local committee dispute mechanisms. This has for example worked successfully in South Sudan with the support of the United Nations Mission in South Sudan.

➤ Multi-level

10. ***Leverage climate change in political dialogue and environmental peacebuilding.*** Environmental peacebuilding is a niche in the peacebuilding field wherein non-zero-sum environmental issues requiring collaboration across dividing lines become entry points for bringing members of groups in conflict together to discuss issues of joint concern and problem solve joint solutions.[cxl] The Arava Institute of Environmental Studies in Southern Israel provides a robust example of this approach.[cxli] Environmental peacebuilding also recognizes the central role of environmental and resource issues in driving conflict. Additionally, international mediators can leverage environmental issues exacerbated by climate change, for instance flooding and drought impacts, to bring political stakeholders to the table to address these issues of common concern. Reaching agreements on these issues, and verifying the implementation of these agreements, can build confidence and trust between conflict parties that could provide traction for dialogue on more intractable political issues. For instance, TPLF leadership and representatives of Mr. Abiy's Government have shown limited desire to negotiate on political issues at the time of this report's writing. However, both sides have a likely interest in preventing widespread destruction due to flooding throughout the country, as well as preventing locust swarms that could devastate crop production for the whole country. If progress can be made on these issues and environmental peacebuilding is effectively leveraged, it could provide

traction and trust to tackle more intractable issues such as regional borders, political leadership, and security reform.

Climate Adaptation Recommendations:

Given the increasing intensity and frequency of climatic shocks and their devastating impacts on vulnerable groups it is essential to design climate adaptation policies that enhance the resilience of communities, relieve the socioeconomic pressures of climate related hazards, and mitigate the multiplying effects of climate change on conflict through relieving the socio-economic pressures worsened by climate hazards. Progress needs to be made sustainably, comprehensively, and fairly. First, hazard response needs to be prioritized through mitigating climatic impacts in the short term, and building up climate resilience in the long term. Second, programs should focus more on vulnerable groups like women and children disproportionately affected by climatic shocks by providing them with stable access to resources to improve their level of human security. Third, advanced technologies stabilized market mechanisms, and affordable crop insurance should be developed and implemented on farmers who face yield instability, food insecurity, and intensified resource competition. Finally, It is crucial to ensure that one group is not adversely affected or enriched at the expense of the other through the implementation of these climate adaptation recommendations. Diversification in communication channels and incorporation of community engagement should be promoted to enhance accessibility and equity. Although the policy recommendations have been delineated across these four categorizations, it is important to note that the below recommendations require coordination between stakeholders at all levels of governance to design and implement climate adaptation policies that can decrease pressure on economic and political systems.

➤ Human Security

1. ***Increase resilience to climate-related shocks in the long term.*** As mentioned above, the majority of Tigray and Gambella's population is employed in the agricultural sector and therefore affected by climate change. There is already a large migration taking place from rural areas to urban ones in search of better economic opportunities, which can affect food production and food security given that consumption relies on local produce. Therefore, strengthening agricultural productivity by using the recommendations made in the section Farming Resilience (below) is essential to maintain food security and avoid malnutrition or famine. In the long run, promoting other high-value sectors (e.g. manufacturing, services) while maintaining food security can allow these two regions to increase their resilience in a more volatile climate. This can be achieved with the reinforcement of basic education in remote rural areas but also by offering vocational training in areas such as mechanics or textile. Upskilling and reskilling vulnerable populations ultimately is an important investment that will bear fruits gradually but will increase resilience and adaptability for those experiencing the highest risk of climate

shocks. As a federal system, states would be the best actors to look at ways to transition labor to high-value industries and implement those in accordance with local culture, language, and customs. NGOs and woredas are great partners to share knowledge and expertise and could therefore support the implementation of such an initiative.

2. ***Prioritize the needs of the most vulnerable to widen the impact of climate change adaptation.*** In the face of climate shocks, the lack of local produce affects the most vulnerable first and can lead to malnutrition and in extreme cases famine. Cash transfers allow households to efficiently collect the right items based on their specific needs. Alternatively, subsidies from grain and good imports provide a temporary relief for regions in need. Some of the challenges to providing support to these vulnerable groups include poor infrastructure that hinders nonprofit or government access to grains and essentials. Investing in better roads and leveraging other supply systems such as river transport could improve access to aid. A gender sensitive approach should also be incorporated into livelihoods programming given that women refugees face a unique set of challenges and climate related vulnerabilities. For example, in hosting sites, women tend to have higher rates of unemployment. Thus programs should aim to strengthen women's economic participation and provide additional support for host and refugee women.

➤ Farming Resilience

3. ***Strengthen agricultural productivity and resilience with smart agriculture.*** Using an adaptive approach that incorporates weather variability through innovations such as drought-resistant plants, fertilizers, and seeds that bring produce in a shorter cycle to avoid the dry/rainy seasons are some proven solutions that allow farmers to adapt to their environment. Innovations in the areas of management of natural resources to reduce inefficiencies and optimize the use of resources are incredibly valuable. This can take the form of renewable energy sources, clean stoves, and investments in reforestation. In addition, international organizations and academic institutions could promote accessibility and availability of sustainable farming practices. With the incorporation of intensification to mitigate the yield gap, smallholder farmers could have high crop productivity and climate resilience without unsustainably clear forest lands for agriculture usage. Implementing double/multi-cropping, smallholder farmers could minimize the risks of crop disease and pests' resilience in chemicals. Moreover, practicing contour cropping, smallholder farmers could reduce their on-farm runoff which would contaminate the precious water resource. Most importantly, considering the unavoidable increase in frequency and intensity of climatic hazards, international organizations could collaborate with local NGOs to provide smallholder farmers with capital and knowledge of practicing flood recession farming, growing short maturing crop varieties, and changing farming calendars to implement strategic long-term adaptation plans.

4. ***Utilize technologies and build infrastructure to help smallholder farmers and pastoralists adapt to climate change.*** By leveraging remote sensing technologies, local government officials can identify the most optimal migratory and grazing areas for pastoralists, to eliminate encroachments onto farmlands and thus reduce conflicts between farmers and pastoralists. Local governments collaborating with donors and providing incentives to investors could develop more extensive infrastructure projects such as rainwater harvesting ponds that could be used for irrigation and to provide water for livestock. Studies in the Alaba woreda have proved that optimizing usage of water as irrigation and rain storage in the form of dams or water tanks leads to higher agricultural productivity and an increase in household income[cxlii]. Besides that, investments should also be injected into establishing road networks along with community based planning to provide basic services, including health, education and alternative energy systems.

5. ***Establish a functional market for agricultural insurance.*** Resource poor and food insecure households are ill-equipped to manage the risks they face due to erratic weather patterns. Agricultural index insurance programs can serve as social protection and risk management mechanisms to reduce vulnerability to shocks, by providing financial relief to farmers at times when their agricultural productivity is low. The Ethiopian government and its partner organizations, including the World Food Programme (WFP), should scale up such initiatives to include hard to reach communities. International organizations, local NGOs, and insurance companies should consider the limitations and recommendations of such initiatives as discussed in the WFP's Evaluation report of Satellite Index Insurance for Pastoralism in Ethiopia (SIIPE). More specifically, the International Livestock Research Institute (ILRI) and the WFP should convene to share the lessons learned from SIIPE Pilot with the general public sector. The Oromia Insurance Company should encourage the participation of actors from the private sector so that insurance products can be offered to underserved markets.

Index-based Insurance

The WFP has been leading the development of index-based insurance programs in countries such as Senegal and Ethiopia. This type of program generally targets the agricultural sector. The compensation payment is linked to an index that correlates to climatic data (i.e. drought, rainfall, and temperature). Often collected by meteorological images or satellite data.

6. ***Strengthen representation of farming and pastoral communities to incorporate their interests in legislation and policy.*** Advocacy, lobbying, and attention by the media are critical to promote a bottom-up approach to policies and projects affecting the natural resources, particularly infrastructure (e.g. dam development), resource-based commerce (e.g. logging, fishing).

➤ Deliberative Processes

7. ***Improve communication strategies to ensure that all decision-makers receive information on climate adaptation policies.*** Several innovative early warning systems and programs such as WFP and ILRI's index insurance project have been implemented in Ethiopia. However, the information gathered through these programs may not always reach the targeted audience. In some cases, households and communities rely on face to face communication to relay information on the occurrence of natural disasters, which means that evacuation orders may be received too late to adequately prepare. In sharing information, stakeholders should consider what channels local actors have access to, what channels offer the greatest opportunity to build awareness, and what channels encourage two-way engagement.

8. ***Strengthen communication infrastructures and services so that local actors can receive timely and accurate information.*** Private IT companies and INGOs should increase access to essential resources like cell phones, radios, and low-cost wireless internet while also investing in long-term infrastructure development projects to install radio masts and stations, as feasible. The ability of relevant stakeholders to achieve such initiatives will largely depend on the impacts of the conflict and insecurity in Ethiopia. NGOs should function as the ground facilitators to promote the usage of communication channels, as necessary, and offer training to enhance technological literacy.

9. ***Engage local actors, including at-risk individuals and vulnerable groups, in the design, implementation, and evaluation of programs to strengthen local ownership.*** The Ethiopian government and INGOs need to work collaboratively with households and communities whose physical environment, economic interests, and well-being will be impacted by climate adaptation policies. Policymakers should ensure that there are avenues for real dialogue between various stakeholders, including youth groups, women's groups, religious groups, and refugee-led organizations.

Conclusion

The well-being of Ethiopians and climate change are intrinsically connected. Extreme weather disproportionately impacts conflict-affected communities through the loss of life, disease, economic setbacks, worsening living conditions, and jeopardized livelihoods. Ethiopians have long dealt with droughts and floods. However, the increasing frequency and magnitude of such climate hazards have posed a serious challenge to regions such as Gambella and Tigray, as well as Ethiopia as a whole. The country, for example, faces unprecedented heatwaves and rainfall, intensifying existing challenges of communicable diseases, food insecurity, and poverty. Moreover, these climate hazards severely affect the health and livelihoods of Ethiopians unequipped to deal with their constant threat.

The Ethiopian government, NGOs, IGOs, and multilateral institutions have a role and responsibility to help local communities strengthen their resilience to extreme climate events, especially when conflict occurs. Unfortunately, current adaptation measures are falling short, increasing the chances of conflict over scarce resources, heightening the vulnerability of communities to climate change, displacing communities, and even driving or exacerbating the impacts of conflict in the process. Additionally, the overall global climate change security architecture needs to undergo significant shifts in order to make a real impact in the climate change - conflict nexus. Interconnectivity between the multilateral, national, non-governmental and local levels must improve to collectively overcome obstacles and find ways to consistently and predictably help local communities adapt to a changing and increasingly volatile climate. Urgent and ambitious measures are essential to mitigate the impact of climate change on conflict, as adaptation alone will not sufficiently avert disastrous consequences for Ethiopians and their environments.

The findings in this report suggest climate change exacerbates the traditional causes of conflict in Ethiopia and worsens the impact of conflict on communities. The Gambella and Tigray case studies evince the varied effects of climate change on Ethiopia. Additionally, there are linkages to other regions such as South Sudan, where Nuer refugees migrate to Gambella to escape poverty and conflict. The case studies demonstrate opportunities for adaptation measures and adjustments to the overall climate change and security architecture necessary to make a lasting contribution to environmental peacebuilding. These challenges point to the need for innovative people-focused policy recommendations to build resilience, strengthen infrastructure, and mitigate conflict.

Bibliography:

Abaya, S., Nicodemus Mandere, and Göran Ewald. "Floods and health in Gambella region, Ethiopia: a qualitative assessment of the strengths and weaknesses of coping mechanisms," *Global Health Action* 2, no. 1, (2009). https://doi.org/10.3402/gha.v2i0.2019

Alcayna, Tilly, Tima Munthali, Vivian Njogu, Mizan Michael, and Laura Stewart. "Climate Change Impacts on Health: Ethiopia Assessment." Climate Centre. April, 2021. https://www.climatecentre.org/wp-content/uploads/RCRC_IFRC-Country-assessments-ETHIOPIA.pdf

Alemie, Ajanaw and Hone Mandefro. "Roles of Indigenous Conflict Resolution Mechanisms for Maintaining Social Solidarity and Strengthening Communities in Alefa District, North West of Ethiopia." *Journal of Inidgenous Social Development.* Vol. 7. No. 2. (2018). https://umanitoba.ca/faculties/social_work/media/V7i2-01_alemie_mandefro.pdf

Bryan, Elizabeth, Temesgen Deressa, Glwadys Gbetibouo, and Claudia Ringler. "Adaptation to Climate Change in Ethiopia and South Africa: Options and Constraints." *Environmental Science & Policy.* Vol. 12. No. 4 (June 2009): 413-426.

Carver, F., F. Gebresenbet, and D. Naish. (2020). Gambella regional report: 2018–2019 refugee and host community context analysis.

Cascão, Ana Elisa. "Resource-based conflict in South Sudan and Gambella (Ethiopia): when water, land and oil mix with politics". 2013.

"Climate Change Risk Profile Ethiopia." Climatelinks.org. July 2016. https://www.climatelinks.org/sites/default/files/asset/document/2016%20CRM%20Factsheet%20-%20Ethiopia_use%20this.pdf

"Conflict compounded by Covid-19 and climate change pushes millions in Tigray to the brink – Oxfam." Oxfam International. January 22, 2021.https://www.oxfam.org/en/press-releases/conflict-compounded-covid-19-and-climate-change-pushes-millions-tigray-brink-oxfam

Degife, A., Florian Zabel, and Wolfram Mauser. "Climate change impacts on potential maize yields in Gambella Region, Ethiopia," *Regional Environmental Change* 21, no. 60: (May 2021), https://doi.org/10.1007/10113-021-01773-3

"Desert Locust Situation Update: November 2021." Food and Agriculture Organization of the United Nations. November 2021. https://www.fao.org/ag/locusts/en/info/info/index.html

Dika, Galgalo. "Impacts of climate variability and households adaptation strategies in lare district of Gambella region, South Western Ethiopia." *Journal of Earth Science & Climatic Change* 9, no. 2 (2018): 7.

Endale, Ashenafi. "Ethiopia: War Leaves Two Thirds of Sesame Farm Uncultivated." All Africa. October 30, 2021.https://allafrica.com/stories/202110300033.html

"Ethiopia: Desert Locusts drive one million to food insecurity." Food and Agriculture Organization of the United Nations. April 13, 2020.https://www.fao.org/ethiopia/news/detail-events/en/c/1270924/

Federal Democratic Republic of Ethiopia. "Ethiopia's Climate Resilient Green Economy National Adaptation Plan" (2019).

Fick, Maggie and Dawit Endeshaw. "Young men in Ethiopia's Amhara start to mobilise against Tigray forces." Reuters. July 26, 2021. https://www.reuters.com/world/africa/young-men-ethiopias-amhara-start-mobilise-against-tigray-forces-2021-07-26/

Graham, Jimmy, and Sarah Miller. "From displacement to development: how Ethiopia can create shared growth by facilitating economic inclusion for refugees." (2021).

Gebre, G.G., H. Isoda, Y. Amekawa, *et al.* "What Explains Gender Gaps in Household Food Security? Evidence from Maize Farm Households in Southern Ethiopia." *Social Indicators Research* Vol. 155, 281–314 (2021). https://doi.org/10.1007/s11205-020-02600-8

Gebeyehu, Temesgen. "Ethnic Conflict, Interaction and Cohabitation in Africa: The Case of Nuer and Anuak," *Eastern Africa Social Science Research Review* 29, no. 2 (June 2013), https://doi.org/10.1353/eas.2013.0008

Gebrehiwot, Tagel and Anne Van der Veen. "Climate change vulnerability in Ethiopia: disaggregation of Tigray Region." Journal of Eastern African Studies, Vol. 7, No. 4, (August 2013): 607-629, DOI: 10.1080/17531055.2013.817162

Getahun, A., Desalegn Yayeh Ayal, Kassahun Ture, and Tadesse Terefe Zeleke, "Determinants of climate variability adaptation strategies: A case of Itang Special District, Gambella Region, Ethiopia," *Climate Services* 23, (2021), https://doi.org/10.1016/j.cliser.2021.100245

Gezie, Melese. "Farmer's response to climate change and variability in Ethiopia: A review." Cogent Food & Agriculture 5, no. 1 (2019): 1613770.

Hagos, Samuel Zewdie. "Refugees and local power dynamics: The case of the Gambella Region of Ethiopia." No. 25/2021. Discussion Paper, 2021.

Lie, J., and A. Borchgrevink. "Layer upon Layer: Understanding the Gambella Conflict Formation," International Journal of Ethiopian Studies 6, no. 1/2, (2012), http://www.jstor.org/stable/41756938

Haslund, E. and R. Riek. (2021, August 31). South Sudanese refugees make safer, better, Greener Stoves in Ethiopia. UNHCR. Retrieved November 16,

2021, from https://www.unhcr.org/afr/news/stories/2021/8/612cafd14/south-sudanese-refugees-make-safer-better-greener-stoves-in-ethiopia.html.

Hirvonen, Kalle, Thomas Pave Sohnesen, and Tom Bundervoet. "Impact of Ethiopia's 2015 drought on child undernutrition." World Development Volume, 131. 2020. https://doi.org/10.1016/j.worlddev.2020.104964.

Hussona, Jake. "How is climate change driving conflict in Africa?" Action on Armed Violence. March 10, 2021. https://aoav.org.uk/2021/how-is-climate-change-driving-conflict-in-africa/

"'I Just Cry': Dying of Hunger In Ethiopia's Blockaded Tigray Region." NPR. September 20, 2021. https://www.npr.org/2021/09/20/1038858345/i-just-cry-dying-of-hunger-in-ethiopias-blockaded-tigray-region

Ide, Tobias, Anders Kristensen, and Henrikas Bartusevičius. "First Comes the River, Then Comes the Conflict? A Qualitative Comparative Analysis of Flood-Related Political Unrest." Journal of Peace Research 58, no. 1 (January 2021): 83–97. https://doi.org/10.1177/0022343320966783.

International Panel for Climate Change, 2014: Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 5

International Panel for Climate Change. September 04, 2020. The Concept of Risk in the IPCC Sixth Assessment Report: a Summary of Cross-Working Group Discussion. [Field, A. Reisinger, M. Garschagen, K.J. Mach, M. Pathak, E. Poloczanska, M.V. Aalst, A.C. Ruane, M. Howden, M. Hurlbert, and M.R. Corradi (eds.)]. UNEP, pp. 1-15.

International Peace Institute. "Preventing Conflicts in Africa: Early Warning and Response", 4, (2012), 4, https://www.ipinst.org/wp-content/uploads/publications/ipi_e_pub_preventing_conflicts.pdf.

"Indian Ocean Dipole: What is it and why is it linked to floods and bushfires?" BBC News. December 7, 2019. https://www.bbc.com/news/science-environment-50602971

Internal Displacement Monitoring Centre. "Mid-Year Figures: Internal Displacement in 2018." Relief Web. September 12, 2018. https://reliefweb.int/sites/reliefweb.int/files/resources/201809-mid-year-figures.pdf

Jal, G. R. (2014). The Root Causes of Cross Border Conflict in Gambella Regional State between Jikany-Nuer and Lou-Nuer. J. Public Policy Adm. Res, 4(8).

Kloos, Julia, Niklas Gebert, Therese Rosenfeld, and Fabrice Renaud. "Climate change, water conflicts and human security." *Regional assessment and policy guidelines for the Mediterranean, Middle East and Sahel. CLICO final report. UNited Nations University–Institute for Environment and Human Security (Report, 10), updated on* 8, no. 27 (2013): 2013.

Koo, J., J. Thurlow, H. ElDidi, C. Ringler, and !. De Pinto. (2019). Building resilience to climate shocks in Ethiopia. Washington, DC: IFPRI.

Kray, Holger and Shobha Shetty. "The locust plague: Fighting a crisis within a crisis." World Bank. April 14, 2020. https://blogs.worldbank.org/voices/locust-plague-fighting-crisis-within-crisis

Lansford, T. "Ethiopia," *Political Handbook of the World 2020-2021 Vol. 1*, (CQ Press, 2021), http://dx.doi.org/

Lanz, Tobias J. "Environmental Degradation and Social Conflict in the Northern Highlands of Ethiopia: The Case of Tigray and Wollo Provinces." Africa Today 43, no. 2 (1996): 157–82. http://www.jstor.org/stable/4187094.

Lederer, Edith. "UN: Over 400,000 people in Ethiopia's Tigray face famine now." AP News. July 2, 2021. https://apnews.com/article/united-nations-africa-ethiopia-famine-016864947ec243e27cc3d97d58bed8f0

McSweeney, C., M. New, and G. Lizcano, "UNDP Climate Change Country Profiles: Ethiopia" UNDP Climate Change Country Profiles. https://www.geog.ox.ac.uk/research/climate/projects/undp-cp/UNDP_reports/Ethiopia/Ethiopia.hires.report.pdf

Mekonnen, G., Bezatu Mengistie Alemu, Worku Mulat, Geremew Sahilu, and Helmut Kloos, "Risk factors for acute childhood diarrhea: A cross-sectional study comparing refugee camps and host communities in Gambella Region, Ethiopia," *Travel Medicine and Infectious Disease* 31, (September 2019), https://doi.org/10.1016/j.tmaid.2019.02.003

Mengistu, Dejene. "Farmers' perception and knowledge on climate change and their coping strategies to the related hazards: case study from Adiha, central Tigray, Ethiopia." *Agricultural Sciences*, Vol. 2, No. 2, 2011. DOI: 10.4236/as.2011.22020

Milman, Anita, and Yacob Arsano. "Climate adaptation and development: Contradictions for human security in Gambella, Ethiopia." *Global environmental change* 29 (2014): 349-359.

Niguse, Awetahegn and Araya Aleme. "Modeling the Impact of Climate Change on Production of Sesame in Western Zone of Tigray, Northern Ethiopia." Journal of Climatology & Weather Forecasting. Vol. 3, No. 3. DOI: 10.4172/2332-2594.1000150

Negash Wagesho, "Temporal and spatial variability of annual and seasonal rainfall over

Ethiopia" Hydrological Science Journals, Volume 58, 2013 - Issue 2, (February 2013): https://www.tandfonline.com/doi/full/10.1080/02626667.2012.754543.

O'Brien, Sean P. "Crisis Early Warning and Decision Support: Contemporary Approaches and Thoughts on Future Research." International Studies Review 12, no. 1 (2010): 87–104. http://www.jstor.org/stable/40730711.

Rajkumar, A., Christopher Gaukler, and Jessica Tilahun, "Introduction," Combating Malnutrition in Ethiopia : An Evidence-Based Approach for Sustained Results, (Washington, DC: The Work Bank, 2012).

Simane, B., Hunachew Beyene, Wakgari Deressa, Abera Kumie, Kiros Berhane, and Jonathan Samet. "Review of Climate Change and Health in Ethiopia: Status and Gap Analysis." The Ethiopian journal of health development. U.S. National Library of Medicine, 2016. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5578710/

Stone, Madeleine. "A plague of locusts has descended on East Africa. Climate change may be to blame." National Geographic. February 14, 2020. https://www.nationalgeographic.com/science/article/locust-plague-climate-science-east-africa?loggedin=true

Tadesse, D., V.S Karuturi, and D. Nedaw. (2021). GIS-Based Flood Hazard Mapping in Itang District of the Gambella Region, Ethiopia.

Tesso, Gutu. "Climate Change, Natural Disaster and Rural Poverty in Ethiopia." UN.org. https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2019/03/Climate-Change-Natural-Disaster-and-Rural-Poverty-in-Ethiopia-by-Gutu.pdf

"The Indian Ocean Dipole." Australian Government Bureau of Meteorology. 2021. http://www.bom.gov.au/climate/enso/history/ln-2010-12/IOD-what.shtml

UNICEF Ethiopia. "Situation Analysis of Children and Women: Gambella Region," 2019. https://www.unicef.org/ethiopia/media/2311/file/Gambella%20.pdf.

UNHCR, and FAO. "UNHCR - FAO Collaboration Framework: Agriculture and Livestock Sector Development in Refugee Hosting Areas of Ethiopia - April 2020 - Ethiopia." ReliefWeb, April 2020. https://reliefweb.int/report/ethiopia/unhcr-fao-collaboration-framework-agriculture-and-livestock-sector-development.

Von Uexkul N., M. Croicu, H Fjelde, and H Buhaug. "Civil conflict sensitivity to growing-season drought." *Proceedings of the National Academy of Sciences of the United States of America* vol. 113,44 (2016): 12393. doi:10.1073/pnas.1607542113

Walelign, S., Susan L. Cutter, and Päivi Lujala, "Resettlement capacity assessments for climate induced displacements: Evidence from Ethiopia," Climate Risk Management 33, (2021), 3, https://doi.org/10.1016/j.crm.2021.100347

Weldearegay, S.K. and D.G. Tedla. "Impact of climate variability on household food availability in Tigray, Ethiopia." *Agriculture & Food Security* Vol. 7, No. 6 (2018). https://doi.org/10.1186/s40066-017-0154-0

Weldegebriel, Zerihun Berhan and Esayas Amphune. "Livelihood resilience in the face of recurring floods: an empirical evidence from Northwest Ethiopia." *Geoenvironmental Disasters.* Vol. 4. No. 10 (2017) 4:10 DOI 10.1186/s40677-017-0074-0

Winthrop, Michelle, Tracy Kajumba, and Sarah McIvor." Ethiopia Country Climate Risk Assessment Report." Climate Learning Platform. February, 2018. https://www.climatelearningplatform.org/sites/default/files/resources/ethiopia_country_climate_risk_assessment_report_-final.pdf

Yishak, Milen. "Ethiopia's climate fragility and security linkage too serious to ignore."

Website Climate Diplomacy. November 25, 2019.https://climate-diplomacy.org/magazine/conflict/ethiopias-climate-fragility-and-security-linkage-too-serious-ignore

[i] Belay Simane, Hunachew Beyene, Wakgari Deressa, Abera Kumie, Kiros Berhane, and Jonathan Samet. "Review of Climate Change and Health in Ethiopia: Status and Gap Analysis." The Ethiopian journal of health development. U.S. National Library of Medicine, 2016, 4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5578710/.

[ii] "Climate Change Risk Profile Ethiopia." Climatelinks.org, July 2016. https://www.climatelinks.org/sites/default/files/asset/document/2016%20CRM%20Factsheet%20-%20Ethiopia_use%20this.pdf

[iii] C. McSweeney, M. New and G. Lizcano. "UNDP Climate Change Country Profiles: Ethiopia." UNDP Climate Change Country Profiles, 2-4. https://www.geog.ox.ac.uk/research/climate/projects/undp-cp/UNDP_reports/Ethiopia/Ethiopia.hires.report.pdf

[iv] Gutu Tesso."Climate Change, Natural Disaster and Rural Poverty in Ethiopia." UN.org. 2019. https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2019/03/Climate-Change-Natural-Disaster-and-Rural-Poverty-in-Ethiopia-by-Gutu.pdf, 1.

[v] Zerihun Berhan Weldegebriel and Esayas Amphune. "Livelihood resilience in the face of recurring floods: an empirical evidence from Northwest Ethiopia." *Geoenvironmental Disasters.* Vol. 4. No. 10 (2017) 4:10.

[vi] V. Aich, S. Liersch, T. Vetter, S. Huang, J. Tecklenburg, P. Hoffmann, H. Koch, et al. "Comparing Impacts of Climate Change on Streamflow in Four Large African River Basins." *Hydrology and Earth System Sciences*. Vol. 18, (2014). https://doi.org/10.5194/hess-18-1305-2014.

[vii] Elizabeth Bryan, Temesgen Deressa, Glwadys Gbetibouo and Claudia Ringler. "Adaptation to Climate Change in Ethiopia and South Africa: Options and Constraints." *Environmental Science & Policy*. Vol. 12. No. 4 (June 2009): 414.

[viii] Tom Lansford. "Ethiopia," Political Handbook of the World 2020-2021 Vol. 1, (CQ Press, 2021): 538.

[ix] Simane et al. "Climate Change and Health," 2-4, 16.

[x] Internal Displacement Monitoring Centre. "Mid-Year Figures: Internal Displacement in 2018." Relief Web. September 12, 2018. https://reliefweb.int/sites/reliefweb.int/files/resources/201809-mid-year-figures.pdf.

[xi] Milen Yishak. "Ethiopia's climate fragility and security linkage too serious to ignore." Website Climate Diplomacy. November 25, 2019. https://climate-diplomacy.org/magazine/conflict/ethiopias-climate-fragility-and-security-linkage-too-serious-ignore.

[xii] Patrick Bolton, Morgan Despres, Luiz Awazu, Pereira Da, Frédéric Samama, and Romain Svartzman. "The Green Swan: Central Banking and Financial Stability in the Age of Climate Change." 2020; Romanello, Marina, Alice McGushin, Claudia Di Napoli, Paul Drummond, Nick Hughes, Louis Jamart, Harry Kennard, et al. "The 2021 Report of the Lancet Countdown on Health and Climate Change: Code Red for a Healthy Future." *The Lancet,* Vol. 398, No. 10311 (2021): 1619–62; "Summary and Recommendations by the Standing Committee on Finance on the 2018 Biennial Assessment and Overview of Climate Finance Flows." *UNFCCC Standing Committee on Finance*. Bonn, 2020.

[xiii] Malin Mobjörk, Maria-therese Gustafsson, Hannes Sonnsjö, Sebastian Van Baalen, Lisa Maria Dellmuth, and Niklas Bremberg. "Climate-Related Security Risks: Towards an Integrated Approach."

Solna, 2016; Adam Day and Jessica Caus. "Conflict Prevention in an Era of Climate Change." New York: United Nations University Centre for Policy Research, 2019; Adam Day. "Climate Change and Security: Perspectives from the Field." New York: United Nations University Centre for Policy Research, 2020.

[xiv]The IPCC framework defines hazards as a potentially destructive physical phenomenon.

[xv] Day and Caus. "Conflict Prevention"; Janani Vivekananda, Martin Wall, Florence Sylvestre, and Chitra Nagarajan. "Shoring Up Stability: Addressing Climate and Fragility Risks in the Lake Chad Region." Berlin, 2019; Farah Hegazi, Florian Krampe, and Elizabeth Seymour Smith. "Climate-Related Security Risks and Peacebuilding in Mali." *SIPRI Policy Paper*. Solna, 2021.

[xvi] NUPI. "Conflict-Related Peace and Security Risks (CPSR)." 2020–2023. https://www.nupi.no/nupi_eng/About-NUPI/Projects-centers/Climate-related-Peace-and-Security-Risks.

[xvii] Vivekananda et al. "Shoring Up."

[xviii] Jared Diamond. *Collapse: How Societies Choose to Fail or Succeed*. New York: Penguin Books, 2011.

[xix] Day and Caus. "Conflict Prevention."

[xx] UNEP, UNDPPA, and UNDP. "Climate Security Mechanism Toolbox: Briefing Note." New York, 2020.

[xxi] UNEP, UNDPPA, and UNDP. "Climate Security Mechanism Toolbox: Conceptual Approach." New York, 2020.

[xxii] IPCC, 2014: Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

[xxiii] IPCC Summary for policymakers. "Impacts, Adaptation, and Vulnerability."

[xxiv] IPCC Summary for policymakers. "Impacts, Adaptation, and Vulnerability."

[xxv] International Panel for Climate Change. September 04, 2020. The Concept of Risk in the IPCC Sixth Assessment Report: a Summary of Cross-Working Group Discussion. [Field, A. Reisinger, M. Garschagen, K.J. Mach, M. Pathak, E. Poloczanska, M.V. Aalst, A.C. Ruane, M. Howden, M. Hurlbert, and M.R. Corradi (eds.)]. UNEP, pp. 1-15.

[xxvi] IPCC, 2020. The Concept of Risk in the IPCC Sixth Assessment Report: a Summary of Cross-Working Group Discussion. [Field, A. Reisinger, M. Garschagen, K.J. Mach, M. Pathak, E. Poloczanska, M.V. Aalst, A.C. Ruane, M. Howden, M. Hurlbert, and M.R. Corradi (eds.)]. UNEP, pp. 1-15.

[xxvii] G. Dika. "Impacts of climate variability and households adaptation strategies in large district of Gambella region, South Western Ethiopia." *Journal of Earth Science & Climatic Change* 9, No. 2 (2018): 7.

[xxviii] UNHCR and FAO. "UNHCR - FAO Collaboration Framework: Agriculture and Livestock Sector Development in Refugee Hosting Areas of Ethiopia - April 2020 - Ethiopia." ReliefWeb, April 2020. https://reliefweb.int/report/ethiopia/unhcr-fao-collaboration-framework-agriculture-and-livestock-sector-development.

[xxix] Anita Milman, and Yacob Arsano. "Climate adaptation and development: Contradictions for human security in Gambella, Ethiopia." *Global environmental change* 29 (2014): 349-359.

[xxx] UNICEF Ethiopia. "Situation Analysis of Children and Women: Gambella Region," 2019. https://www.unicef.org/ethiopia/media/2311/file/Gambella%20.pdf.

[xxxi] UNHCR and FAO. "Collaboration Framework."

[xxxii] Samuel Z. Hagos, *Refugees and Local Power Dynamics: The Case of the Gambella Region of Ethiopia*, 25/2021, Bonn, Germany: German Development Institute. 5-19, https://doi.org/10.23661/dp25/2021.
[xxxiii] UNICEF Ethiopia. "Situation Analysis."
[xxxiv] UNICEF Ethiopia. "Situation Analysis."
[xxxv] G. Dika. "Impacts of climate variability."
[xxxvi] Julia Kloos and Niklas Gebert, Therese Rosenfeld, and Fabrice Renaud. "Climate change, water conflicts and human security." *Regional assessment and policy guidelines for the Mediterranean, Middle East and Sahel. CLICO final report. United Nations University–Institute for Environment and Human Security (Report, 10), updated on* 8, no. 27 (2013): 2013.
[xxxvii] UNICEF Ethiopia. "Situation Analysis."
[xxxviii] UNICEF Ethiopia. "Situation Analysis."
[xxxix] Milman and Arsano "Climate adaptation and development."
[xl] Milman and Arsano "Climate adaptation and development."
[xli] Milman and Arsano "Climate adaptation and development."
[xlii] Kloos et al. "Climate change."
[xliii] Kloos and Gebert. "Climate change, water conflicts."
[xliv] Milman and Arsano "Climate adaptation and development."
[xlv] Milman and Arsano "Climate adaptation and development."
[xlvi] Hagos. "Refugees and local power dynamics."
[xlvii] Ana Elisa Cascão. *Resource-based conflict in South Sudan and Gambella (Ethiopia): when water, land and oil mix with politics*. 2013.
[xlviii] Milman and Arsano "Climate adaptation and development."
[xlix] Milman and Arsano "Climate adaptation and development."
[l] Kloos et al. "Climate change."
[li] Melese Gezie. "Farmer's response to climate change and variability in Ethiopia: A review." Cogent Food & Agriculture 5, no. 1 (2019): 1613770.
[lii] Dame Tadesse, V.S. Karuturi, and Dessie Nedaw. "GIS-Based Flood Hazard Mapping in Itang District of the Gambella Region, Ethiopia." (2021).
[liii] Milman and Arsano "Climate adaptation and development."
[liv] Tadesse et al. "GIS-Based Flood Hazard Mapping."
[lv] Samson Wakuma Abaya, Nicodemus Mandere, and Goran Ewald. "Floods and Health in Gambella Region, Ethiopia: a qualitative assessment of the strengths and weaknesses of coping mechanisms." Glob Health Action, 2009; 2: https://doi.org/10.3402/gha.v2i0.2019
[lvi] Tadesse et al. "GIS-Based Flood Hazard Mapping."
[lvii] Tadesse et al. "GIS-Based Flood Hazard Mapping." Fluvisols is defined as "... genetically young soil in alluvial deposits."
[lviii] Tadesse et al. "GIS-Based Flood Hazard Mapping."
[lix] UNICEF, Livelihoods & Vulnerabilities Study Gambella Region of Ethiopia, http://www.genocide-watch.com/images/Ethiopia_Feb_06_Livelihoods_and_Vulnerabilities_Study,_Gambella_Region_of_Ethiopia.pdf.
[lx] UNICEF, Situation Analysis of Children and Women: Gambella Region, 5, https://www.unicef.org/ethiopia/media/2311/file/Gambella%20.pdf.
[lxi] Azeb W. Degife, Florian Zabel, and Wolfram Mauser, "Land Use Scenarios and Their Effect on Potential Crop Production: The Case of Gambella Region, Ethiopia," MDPI Agriculture 2019, 9(5), 105; https://doi.org/10.3390/agriculture9050105.

[lxii] Abaya et al. "Floods and health."
[lxiii] Negash Wagesho, "Temporal and spatial variability of annual and seasonal rainfall over Ethiopia" Hydrological Science Journals, Volume 58, 2013 - Issue 2, (February 2013): https://www.tandfonline.com/doi/full/10.1080/02626667.2012.754543.
[lxiv] Wagesho. "Temporal and spatial variability."
[lxv] UNICEF. "Situation Analysis."
[lxvi] Hagos. "Refugees and local power dynamics."
[lxvii] Azeb W. Degife, Florian Zabel, and Wolfram Mauser, "Climate change impacts on potential maize yields in Gambella Region, Ethiopia," *Regional Environmental Change* 21, no. 60 (May 2021): 9, https://doi.org/10.1007/10113-021-01773-3.
[lxviii] Tobias Ide, Anders Kristensen, and Henrikas Bartusevičius. "First Comes the River, Then Comes the Conflict? A Qualitative Comparative Analysis of Flood-Related Political Unrest." *Journal of Peace Research* 58, no. 1 (January 2021): 85. https://doi.org/10.1177/0022343320966783; N. Von Uexkul, M. Croicu, H Fjelde, H Buhaug. "Civil conflict sensitivity to growing-season drought." *Proceedings of the National Academy of Sciences of the United States of America* vol. 113,44 (2016): 12393. doi:10.1073/pnas.1607542113.
[lxix] Temesgen Gebeyehu. "Ethnic Conflict, Interaction and Cohabitation in Africa: The Case of Nuer and Anuak," *Eastern Africa Social Science Research Review* 29, no. 2 (June 2013): 108, https://doi.org/10.1353/eas.2013.0008.
[lxx] Jon Harald Sande Lie and Axel Borchgrevink. "Layer upon Layer: Understanding the Gambella Conflict Formation," *International Journal of Ethiopian Studies* 6, no. 1/2, (2012): 150, http://www.jstor.org/stable/41756938.
[lxxi] Getachew Kabew Mekonnen, Bezatu Mengistie Alemu, Worku Mulat, Geremew Sahilu, and Helmut Kloos. "Risk factors for acute childhood diarrhea: A cross-sectional study comparing refugee camps and host communities in Gambella Region, Ethiopia." *Travel Medicine and Infectious Disease* 31, (September 2019): 4, https://doi.org/10.1016/j.tmaid.2019.02.003.
[lxxii] Andrew Sunil Rajkumar, Christopher Gaukler, and Jessica Tilahun. "Introduction," *Combating Malnutrition in Ethiopia: An Evidence-Based Approach for Sustained Results*, (Washington, DC: The Work Bank, 2012), 13-22.
[lxxiii] Abaya et al. "Floods and health."
[lxxiv] Solomon Zena Walelign, Susan L. Cutter, and Päivi Lujala. "Resettlement capacity assessments for climate induced displacements: Evidence from Ethiopia," Climate Risk Management 33, (2021), 3, https://doi.org/10.1016/j.crm.2021.100347.
[lxxv] Gebeyehu. "Ethnic Conflict."
[lxxvi] Azemir Berhanu Getahun, Desalegn Yayeh Ayal, Kassahun Ture, and Tadesse Terefe Zeleke, "Determinants of climate variability adaptation strategies: A case of Itang Special District, Gambella Region, Ethiopia," *Climate Services* 23, (2021), 6, https://doi.org/10.1016/j.cliser.2021.100245.
[lxxvii] Scott Neuman. "9 Things To Know About The Unfolding Crisis In Ethiopia's Tigray Region." NPR, 2021. https://www.npr.org/2021/03/05/973624991/9-things-to-know-about-the-unfolding-crisis-in-ethiopias-tigray-region.
[lxxviii] Jan Nyssen, Emnet Negash, and Sofie Annys. "How Ethiopia's Conflict Has Affected Farming in Tigray." Down To Earth, 2021. https://www.downtoearth.org.in/blog/africa/how-ethiopia-s-conflict-has-affected-farming-in-tigray-7859.
[lxxix] UNICEF. "Situation Analysis of Children And Women: Tigray Region," 2019.
[lxxx] International Crisis Group. "Keeping Ethiopia's Transition on the Rails," No. 283 (2019): 1–26.

[lxxxi] Declan Walsh and Abdi Latif Dahir. "Why Is Ethiopia at War With Itself?" *New York Times*, November 16, 2021.
[lxxxii] Kjetil Tronvoll. "Ethiopia's Tigray War Is Fueling Amhara Expansionism." Foreign Policy, 2021. https://foreignpolicy.com/2021/04/28/ethiopia-tigray-war-amhara-abiy-ahmed-expansionism/.
[lxxxiii] International Crisis Group. "Ethiopia's Tigray War: A Deadly, Dangerous Stalemate," no. 171 (2021): 1–14.
[lxxxiv] Abera, Wuletawu, Luca Brocca, and Riccardo Rigon. "Comparative Evaluation of Different Satellite Rainfall Estimation Products and Bias Correction in the Upper Blue Nile (UBN) Basin." *Atmospheric Research* 178–179 (2016): 471–83. https://doi.org/10.1016/j.atmosres.2016.04.017.
[lxxxv] IPCC Summary for policymakers. "Impacts, Adaptation, and Vulnerability."
[lxxxvi] "IPCC 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change." [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.
[lxxxvii]A.S. Tefera, J.O. Ayoade, and N.J. Bello. "Analysis of the Spatial Pattern of Drought Risk in Tigray Region, Northern Ethiopia." *Journal of Applied Sciences and Environmental Management* 23, no. 7 (2019): 1265–1272.
[lxxxviii] Tefera et al. "Spatial Pattern of Drought Risk."
[lxxxix] Kalle Hirvonen, Pave Sohnesen, Thomas, Bundervoet, Tom. "Impact of Ethiopia's 2015 drought on child undernutrition." World Development Volume, 131. 2020.
[xc] JRC. "Ethiopia, Kenya, Somalia: Precipitation and Floods Map." European Union. 2021
[xci] Aich et al. "Comparing Impacts of Climate Change."
[xcii] UNEP. "Emissions Gap Report: The Heat Is On: A World of Climate Promises Not Yet Delivered," 2021.
[xciii] Tilly Alcayna, Tima Munthali, Vivian Njogu, Mizan Michael, and Laura Stewart. "Climate Change Impacts on Health: Ethiopia Assessment." Climate Centre. April, 2021. https://www.climatecentre.org/wp-content/uploads/RCRC_IFRC-Country-assessments-ETHIOPIA.pdf, 9.
[xciv]A.S. Tefera, J.O. Ayoade, and N.J. Bello. "Analyses of the Spatial Pattern of Drought Risk in Tigray Region, Northern Ethiopia." Journal of Applied Sciences and Environmental Management 23, no. 7 (2019), 1269.
[xcv] Michelle Winthrop, Tracy Kajumba, and Sarah McIvor. "Ethiopia Country Climate Risk Assessment Report." Climate Learning Platform. February, 2018. https://www.climatelearningplatform.org/sites/default/files/resources/ethiopia_country_climate_risk_assessment_report_-final.pdf, 9.
[xcvi] "The Indian Ocean Dipole." Australian Government Bureau of Meteorology. 2021. http://www.bom.gov.au/climate/enso/history/ln-2010-12/IOD-what.shtml
[xcvii] "Indian Ocean Dipole: What is it and why is it linked to floods and bushfires?" BBC News. December 7, 2019. https://www.bbc.com/news/science-environment-50602971
[xcviii] Tagel Gebrehiwot and Anne Van der Veen. "Climate change vulnerability in Ethiopia: disaggregation of Tigray Region." Journal of Eastern African Studies, 7:4, (August 2013).
[xcix] Gebrehiwot and Van der Veen. "Climate change vulnerability."
[c] Holger Kray, and Shobha Shetty. "The locust plague: Fighting a crisis within a crisis." World Bank. April 14, 2020. https://blogs.worldbank.org/voices/locust-plague-fighting-crisis-within-crisis
[ci] Gebrehiwot and Van der Veen. "Climate change vulnerability."

[cii] Dejene Mengistu. "Farmers' perception and knowledge on climate change and their coping strategies to the related hazards: case study from Adiha, central Tigray, Ethiopia." *Agricultural Sciences*, Vol. 2, No. 2, 2011. DOI: 10.4236/as.2011.22020, 143.
[ciii] Gebrehiwot and Van der Veen. "Climate change vulnerability."
[civ] "Ethiopia: Desert Locusts drive one million to food insecurity." Food and Agriculture Organization of the United Nations. April 13, 2020.https://www.fao.org/ethiopia/news/detail-events/en/c/1270924/
[cv]"Conflict compounded by Covid-19 and climate change pushes millions in Tigray to the brink – Oxfam." Oxfam International. January 22, 2021. https://www.oxfam.org/en/press-releases/conflict-compounded-covid-19-and-climate-change-pushes-millions-tigray-brink-oxfam
[cvi] Madeleine Stone. "A plague of locusts has descended on East Africa. Climate change may be to blame." National Geographic. February 14, 2020. https://www.nationalgeographic.com/science/article/locust-plague-climate-science-east-africa?loggedin=true
[cvii] Richard Munang. "Locust swarms and climate change." United Nations Environment Program. February 6, 2020. https://www.unep.org/news-and-stories/story/locust-swarms-and-climate-change
[cviii] "Desert Locust Situation Update: November 2021." Food and Agriculture Organization of the United Nations. November 2021. https://www.fao.org/ag/locusts/en/info/info/index.html
[cix] Alcayna et al. "Climate Change Impacts on Health."
[cx] Gebrehiwot and Van der Veen. "Climate change vulnerability."
[cxi] Edith Lederer. "UN: Over 400,000 people in Ethiopia's Tigray face famine now." AP News. July 2, 2021.https://apnews.com/article/united-nations-africa-ethiopia-famine-016864947ec243e27cc3d97d58bed8f0
[cxii] S.K. Weldearegay and D.G. Tedla. "Impact of climate variability on household food availability in Tigray, Ethiopia." *Agriculture & Food Security* Vol. 7, No. 6 (2018). https://doi.org/10.1186/s40066-017-0154-0, 7.
[cxiii] Weldearegay and Tedla. "Impact of climate variability."
[cxiv] G.G. Gebre, H. Isoda, Y. Amekawa, *et al.* "What Explains Gender Gaps in Household Food Security? Evidence from Maize Farm Households in Southern Ethiopia." *Social Indicators Research* Vol. 155, 281–314 (2021). https://doi.org/10.1007/s11205-020-02600-8, 282.
[cxv] "I Just Cry': Dying of Hunger In Ethiopia's Blockaded Tigray Region." NPR. September 20, 2021. https://www.npr.org/2021/09/20/1038858345/i-just-cry-dying-of-hunger-in-ethiopias-blockaded-tigray-region
[cxvi] Gebrehiwot and Van der Veen. "Climate change vulnerability."
[cxvii] Interview with a non-governmental representative, interview by Margaux L'Herbette and Yishuang Xu, virtual November 23, 2021.
[cxviii] Interview with a former Ethiopian government official, interview by Margaux L'Herbette, virtual, November 23, 2021.
[cxix] "Western Zone of Tigray, Northern Ethiopia." *Journal of Climatology & Weather Forecasting*. Vol. 3, No. 3.
[cxx] Maggi Fick and Dawit Endewshaw. "Young men in Ethiopia's Amhara start to mobilise against Tigray forces." *Reuters*. July 26, 2021. https://www.reuters.com/world/africa/young-men-ethiopias-amhara-start-mobilise-against-tigray-forces-2021-07-26/
[cxxi] Ashenafi Endale. "Ethiopia: War Leaves Two Thirds of Sesame Farm Uncultivated." All Africa. October 30, 2021.https://allafrica.com/stories/202110300033.html.
[cxxii] Alcayna et al. "Climate Change Impacts on Health."
[cxxiii] Alcayna et al. "Climate Change Impacts on Health."

[cxxiv] Jake Hussona. "How is climate change driving conflict in Africa?" Action on Armed Violence. March 10, 2021. https://aoav.org.uk/2021/how-is-climate-change-driving-conflict-in-africa/
[cxxv] Tobias J. Lanz. "Environmental Degradation and Social Conflict in the Northern Highlands of Ethiopia: The Case of Tigray and Wollo Provinces." Africa Today 43, no. 2 (1996). http://www.jstor.org/stable/4187094, 166.
[cxxvi] Federal Democratic Republic of Ethiopia. "Ethiopia's Climate Resilient Green Economy National Adaptation Plan" (2019).
[cxxvii] Republic of Ethiopia. "Ethiopia's Climate Resilient Green Economy."
[cxxviii] Jawoo Koo, James Thurlow, ElDidi Hagar, Claudia Ringler, and Alessandro De Pinto. (2019). "Building resilience to climate shocks in Ethiopia." Washington, DC: IFPRI.
[cxxix] E. Haslund and R. Riek. (August 2021). "South Sudanese refugees make safer, better, Greener Stoves in Ethiopia." UNHCR. https://www.unhcr.org/afr/news/stories/2021/8/612cafd14/south-sudanese-refugees-make-safer-better-greener-stoves-in-ethiopia.html.
[cxxx] F. Carver, F. Gebresenbet, and D. Naish (2020). "Gambella regional report: 2018–2019 refugee and host community context analysis."
[cxxxi] UN Security Council. "The UN Security Council and Climate Change." (2021)
[cxxxii] UNSC "Climate Change."
[cxxxiii] UNSC "Climate Change."
[cxxxiv] Interview with a former Ethiopian government official, interview by Margaux L'Herbette, virtual, November 23, 2021.
[cxxxv] National Artificial Intelligence Initiative Act of 2020, H.R. 6395, 1210 (2020). https://www.congress.gov/116/crpt/hrpt617/CRPT-116hrpt617.pdf.
[cxxxvi] Sean P. O'Brien. "Crisis Early Warning and Decision Support: Contemporary Approaches and Thoughts on Future Research." *International Studies Review.* Vol. 12, No. 1 (2010): 87–104. http://www.jstor.org/stable/40730711.
[cxxxvii] Ajanaw Alemie and Hone Mandefro. "Roles of Indigenous Conflict Resolution Mechanisms for Maintaining Social Solidarity and Strengthening Communities in Alefa District, North West of Ethiopia." *Journal of Inidgenous Social Development.* Vol. 7. No. 2. (2018), 2. https://umanitoba.ca/faculties/social_work/media/V7i2-01_alemie_mandefro.pdf.
[cxxxviii] Nigina Khaitova, Peacebuilding Fund, interview by Margaux L'Herbette, virtual, December 3, 2021.
[cxxxix] Jimmy Graham and Sarah Miller. "From displacement to development: how Ethiopia can create shared growth by facilitating economic inclusion for refugees." (2021).
[cxl] Tobias Ide, Carl Bruch, Alexander Carius, Ken Conca, Geoffrey D. Dabelko, Richard Matthew, and Erika Weinthal. "The Past and Future(s) of Environmental Peacebuilding." *International Affairs.* Vol. 97, No. 1 (2021): 1–16.
[cxli] "About the Arava Institute." *The Arava Institute of Environmental Studies*. https://arava.org/about-our-community/about-arava/.
[cxlii] Rebeka Amha. "Impact Assessment of Rainwater Harvesting Ponds: The Case of Alaba Woreda, Ethiopia". (2008).