

LASER PULSE

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Systems and Networks Approach to Examining Resilience in Ethiopian Communities Experiencing Violent Conflict and Interrelated Shocks: A Review of Literature

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AOR Name: Kevin Roberts

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PROJECT INFORMATION

This training manual is produced by the project *A Systems, Networks, and Human-Centered Design Approach to Assessing the Resilience of Ethiopian Communities Experiencing Recurring Violent Conflict Shocks*. This project has been supported by the United States Agency for International Development (USAID) via LASER PULSE. It has been implemented by Purdue University in partnership with Addis Ababa University, Aged and Children Pastoralists Association, and Search for Common Ground in selected agro-pastoral areas in the northwestern part of the Somali regional state, bordering the Oromia state, Ethiopia. One of the objectives of this project has been to co-design a framework for assessing community resilience with participating communities that are facing recurring and potentially compounding shocks. More information about the project is available on the project webpage [here](#).

ABOUT LASER PULSE

LASER (Long-term Assistance and Services for Research) PULSE (Partners for University-Led Solutions Engine) is a \$70M program funded through USAID's Innovation, Technology, and Research Hub, that delivers research-driven solutions to field-sourced development challenges in USAID partner countries.

A consortium led by Purdue University, with core partners Catholic Relief Services, Indiana University, Makerere University, and the University of Notre Dame, implements the LASER PULSE program through a growing network of 3,400+ researchers and development practitioners in 77 countries.

LASER PULSE collaborates with USAID missions, bureaus, and independent offices, and other local stakeholders to identify research needs for critical development challenges, and funds and strengthens the capacity of researcher-practitioner teams to co-design solutions that translate into policy and practice.

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Table of Contents

PROJECT INFORMATION	2
ABOUT LASER PULSE	2
ACKNOWLEDGEMENTS	2
SUGGESTED CITATION	2
1. Introduction	5
2. Existing Frameworks of Resilience in the Context of Violent Conflict Shocks	5
2.1. Frameworks of resilience and community resilience	5
2.2. Resilience in violent conflict contexts	7
3. Existing Resilience Programs and Research in Ethiopia Related to Violent Conflicts and Interrelated Shocks	9
3.1. Governmental, intergovernmental, and nongovernmental programs on resilience	9
3.2. Empirical research on resilience and conflicts in Ethiopia	13
4. Systems and Networks Approach to Resilience	14
4.1. Systems and networks perspectives in existing conceptualizations of community resilience	14
4.2. Systems and networks perspectives for understanding conflict shocks	15
4.3. Dimensions of interconnectivity and interactions in communities	16
4.4. Network structural indicators of resilience processes	20

List of Tables

Table 1: Summary of recent programs addressing conflict and resilience in Ethiopia	11
Table 2. A selection of network indicators at multiple levels which are relevant for system resilience	21

List of Figures

Figure 1: An illustration of the links between components in human and natural systems and violent conflict shocks, as shown in literature	7
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1. Introduction

Together with environmental and economic shocks induced by extremes in weather, violent conflicts pose challenges to the well-being of communities in Ethiopia. In this literature review, we first provide an overview of existing academic and practitioner literature on resilience frameworks that are applicable to communities facing violent conflict shocks. We then discuss existing governmental and nongovernmental efforts to improve resilience in Ethiopia as well as relevant empirical research. These programs and studies point to the interconnections among shocks and among social and environmental systems. The last section reviews key ideas derived from the field of systems and networks research which are relevant to assessing resilience against conflict and interrelated shocks.

2. Existing Frameworks of Resilience in the Context of Violent Conflict Shocks

2.1. Frameworks of resilience and community resilience

Resilience, broadly defined as the capacity to respond and adapt to adverse conditions, has emerged as a central concept for empowering individuals and communities in times of cumulative socio-environmental shocks. Early conceptualizations of resilience from the disciplines of psychology and child development primarily addressed individual's adaptation to adversity (e.g., Luthar et al. 2000). Over time, the notion of resilience has been widely applied to higher levels of social systems. The definition of resilience proposed by various agencies points to resilience at multiple levels (*italics added*):

- USAID: “the ability of *people, households, communities, countries, and systems* to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth” (Bujones et al., 2013, p.6)
- UNDP: “an inherent as well as acquired condition achieved by managing risks over time at *individual, household, community and societal levels* in ways that minimize costs, build capacity to manage and sustain development momentum, and maximize transformative potential.” (UNDP 2013, 34)
- The United Kingdom Department for International Development (DFID): “the ability of *countries, communities and households* to manage change, by maintaining or transforming living standards in the face of shocks or stresses - such as earthquakes, drought or violent conflict – without compromising their long-term prospects” (DFID 2011, 6)

There have been growing efforts to conceptualize community resilience and develop its indicators (see UNDP 2014 for a review). A community can be defined as a collection of individuals, households, and social organizations within a given boundary which hold communal natural and social resources (Béné 2018; Davis 2012). A community includes a combination of ethnicity, gender and age subgroups who are exposed to both common and differing shocks and stressors (Bujones et al. 2013). Communities are fluid rather than fixed since administrative

boundaries and jurisdiction, resources, population makeup, and ethnic identities of populations can all evolve over time.

Community resilience impacts the well-being of community members (Quinn et al. 2020), which includes both objective community conditions and residents' subjective perceptions of their quality of life (Sung & Phillips 2018). The CoBRA framework (UNDP 2014) identifies characteristics of community resilience pertaining to five types of capital: financial, human, natural, physical, and social. Financial capital refers to cash in the form of savings or sources of income; human capital refers to people's skills, knowledge, labor, and health; natural capital refers to natural resources and related services; physical capital refers to basic infrastructure; and social capital refers to resources derived from networks, groups, and institutions (UNDP 2014). Norris et al. (2008) identified four sets of adaptive capacities—economic development, social capital, information and communication, and community competence—to be central to collective resilience. Houston et al. (2015) suggested a model which elaborates on communication systems and resources such as media, official information sources, and communication infrastructure. In addition, many studies (see Beccari, 2016 for a review) have developed composite indices to quantitatively measure resilience, risk, and vulnerability. These indices are composed of indicators and variables in the social, built, economic, natural, and disaster environments.

With resilience being increasingly adopted as a major assessment metric for sustainable development, much effort has been made to establish frameworks and indicators of resilience. A widely used framework proposes three dimensions of resilience capacities—absorptive, adaptive, and transformative capacities (e.g., Béné et al. 2012; USAID 2013).

- The absorptive dimension relates to resisting and reducing the impact of shocks, as derived from the traditional notion of engineering resilience.
- The adaptive dimension refers to recovering from and adjusting to shocks and continuing to function by identifying alternative ways, which is adopted from the notion of ecological resilience.
- The transformative dimension relates to proactively reconstituting and creating systems so that the community not only responds to shocks but overall reaches a higher level of functioning (Asmamaw et al. 2019; Kimhi & Shamaï 2004).

This three-capacities framework aligns with the conceptualization of three directions of resilience by Kimhi and Shamaï (2004): resistance, recovery, and creativity. In another review article, Schipper and Langston (2015) provide an overview of 17 sets of resilience indicators from existing frameworks. They propose that three concepts—learning (i.e., the ability to be aware of and understand risks, and share information with others), options (i.e., having diversity of choices to be able to modify behavior), and flexibility (i.e., the ability to function without interruption)—converge from existing definitions of resilience.

As individuals and households rely on shared socio-physical infrastructure and resources in a community, their well-being is largely shaped by the overall functioning of the community. At the same time, much of the grand challenges such as climate change facing communities can only be tackled through the collective capacity of multiple entities which make up the community. A notion derived from the fundamental concept of systems is that a collection of

resilient individuals does not necessarily sum up to a resilient community (Norris et al. 2008; Pfefferbaum et al. 2007; Rose 2004). Instead, community resilience requires interactions among entities such as households, social groups, and various organizations. To expand on this proposition, Section 3 explicates multiple dimensions of interconnectivity and interactions which can be assessed in relation to resilience.

2.2. Resilience in violent conflict contexts

Much work on developing the resilience capacities of communities focuses on addressing disturbances associated with climate change and economic disruptions such as natural hazards and food insecurity (see Schipper & Langston 2015 for a review of resilience frameworks). Similarly, most available composite indices of resilience which consider community aspects are developed in the context of natural disasters (e.g., Kusumastuti et al. 2014). Relatively less scholarly and practitioner work has been dedicated to understanding how communities can stay resilient in social disruptions that involve conflict and violence (Bosetti et al. 2016). Some of these conflicts are recurring shocks which could unfold in a chronic or an acute manner.

A recent article by Lordos and Hyslop (2021) provides a review of literature on conflict resilience. They discuss approaches to examining resilience along three dimensions:

- Stages of conflict (i.e., pre-conflict, ongoing conflict, and post-conflict)
- Unit of analysis (i.e., people, households, institutions and infrastructures)
- Methods of investigation (i.e., participatory case studies, quantitative or qualitative data collection)

For example, some studies focus on the post-conflict stage of resilience in war and terror, such as the ability of community leaders and programs and social relationships to help individual members cope with stress (Kimhi & Shamai 2004). In a study focusing on ongoing conflict, Eshel et al. (2020) examined civilians experiencing threats of terror and war on the northern Israeli border. The study showed that individuals' trust in their own as well as community institutes' capacity to deal with stress is a significant predictor of community resilience.

Recurrent political violence and conflict shocks unfold in a different manner than other types of shocks such as natural disasters (Norris et al. 2008). Violent conflicts are closely tied to human processes that are internal to social systems and often undermine the fabric of communities (Simpson et al. 2016). The root causes of violent conflicts are local- and context-specific and are influenced by historical contexts. In particular, cross-border pastoralism-related conflicts are deeply embedded in the social relationships between pastoralist ethnic groups as well as between pastoralist and farmer groups (Jobbins & McDonnell 2021). Both chronic and acute stressors interact with each other to create conflicts, such as in the case of ongoing chronic interethnic tensions being escalated by acute food shortage in the dry season (Endris et al. 2007).

While there are unique challenges associated with violent conflicts, resilience frameworks for violent conflict shocks cannot overlook the interrelated shocks to the overall socio-environmental system. Literature on fragility assessment has burgeoned but it largely focuses on examining political, social, and economic risks and is less sensitive to climate-related

risks. Further, fragility literature typically adopts a state-centric perspective, overlooking the role of non-state institutions and sub-systems within the states (Bosetti et al. 2016). Bujones et al. (2013) propose that examining resilience in conflict-affected states requires a consideration of five subsystems: economic (e.g., wealth and resources), environmental (e.g., natural resources, climate, flora and fauna), political (e.g., public administration and governance structures), security (e.g., law and state protection), and social (e.g., public services, public space) subsystems. Among these subsystems, the environmental system has been given significant attention in past decades. There are mixed findings regarding whether climate change events directly *cause* intergroup conflicts (e.g., Hsiang & Burke 2014). The ways in which conflict shocks and other climate or environmental shocks are interrelated with each other are highly specific to both spatial and temporal contexts (USAID 2020a). Rather than a simplified causal relationship, many studies show that these two are embedded in a web of interrelated factors. Figure 1 shows an example of how various components of human and natural systems are interrelated, as frequently described in literature. Yet, the figure is not a comprehensive representation of all factors in the broader complex systems surrounding conflict shocks.

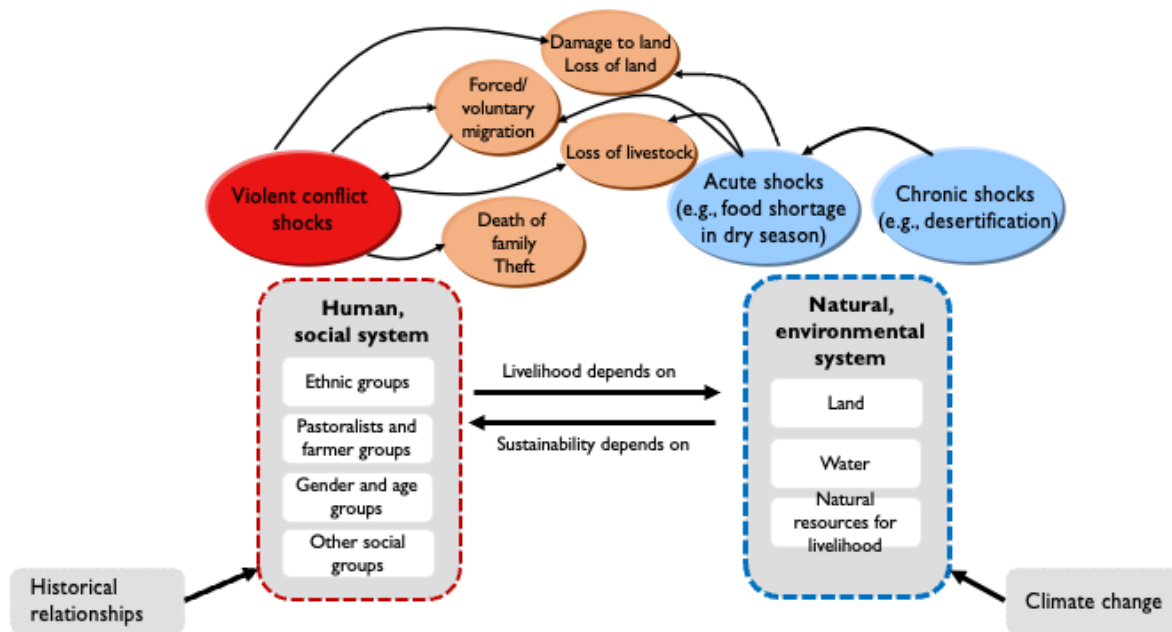


Figure 1: An illustration of the links between components in human and natural systems and violent conflict shocks, as shown in literature

Source: Authors

Examples from communities show that climate change factors can act as accelerators of conflict threats in pastoral communities which highly depend on natural resources for sustaining their livelihoods (USAID 2020b). Sociopolitical conflict shocks are often tied to resource scarcity and

involuntary migration which result from environmental disruptions such as drought and flood. Violent shocks in the drylands of Ethiopia were shown to have various related shocks including death of household members, theft of livestock or crops, theft or destruction of assets, destruction or damage of house, and loss of land (Feed the Future FEEDBACK 2015). Social aspects surrounding law enforcement and security also play a role. Cochrane and Hadis (2021) explain that arms trafficking in Ethiopia provides access to weapons to villagers' and farmers' increases insecurity and violent conflict. The feeling of uncertainty and the experience of instability have driven the purchasing of weapons by rural community members with the aim of defending themselves. The availability of weapons and their use in settling disputes can inflame tensions and lead to violent conflict particularly between ethnic groups.

In addition, violent conflict shocks incur cascading disruptions in the community, such as forced displacement, gender-based violence, destabilization of social groups, loss of productive labor including youth, women and men, and emotional distress and psychological trauma (Endris et al. 2017). According to the latest displacement report published in 2022, the primary cause of displacement in the Oromia region, the largest region in Ethiopia, was conflict and affected an estimated 61% of the displaced population (International Organization for Migration 2022).

There is existing work on resilience which considers conflict shocks as a part of multiple compounding and recurring shocks. USAID programs in the Horn of Africa show that peacebuilding and climate resilience need to be addressed together (USAID 2020a). Climate change can lead to instability, and addressing climate change and fragility together can create synergy in peacebuilding and resilience development outcomes. To address the complexities surrounding conflict shocks, processes and resources in both social and ecological systems need to be examined. Yet, Lordos and Hyslop (2021) suggest that there is a lack of concrete guidelines for assessing resilience capacities and processes for conflict-affected populations at multiple levels of the social system.

3. Existing Resilience Programs and Research in Ethiopia Related to Violent Conflicts and Interrelated Shocks

3.1. Governmental, intergovernmental, and nongovernmental programs on resilience

Extreme weather events including droughts and floods have frequently resulted in humanitarian crises in Ethiopia. Pastoral areas in the lowlands of Ethiopia are the most vulnerable to droughts (Bekele et al. 2020). Governmental as well as intergovernmental and nongovernmental organizations in Ethiopia have implemented major programs for building resilience.

Government level resilience building programs focusing on climate change and agricultural systems include Ethiopia's Program of Adaptation to Climate Change, the Productive Safety Net Programme (PSNP), and the Agricultural Growth Program (see Appendix 1&2 in Koo et al. 2019). The Sustainable Land Management Program (SLMP) is initiated by both the government and international donors (Bekele et al. 2020). Programs by intergovernmental and nongovernmental organizations include USAID's Livelihood for Resilience (L4R) program (U.S.

Embassy Ethiopia 2017). The Pastoralist Areas Resilience Improvement and Market Expansion (PRIME) project in the drylands of Ethiopia was funded by the U.S. Government's Feed the Future initiative. The project aimed at enhancing the resilience of households to climate-related shocks.

Some regions in Ethiopia have been experiencing social tensions and violent conflicts. Cross-border clashes have been intensifying across Ethiopia's Oromia and Somali regions. A field survey in the Eastern Hararghe Zone of Oromia regional state shows that households ranked conflict shocks, including territorial and tribal conflict, as the most frequently occurring shocks in the past five years (Endris et al. 2017). To foster growth amid these challenges, much effort has been made to enhance the resilience of individuals and communities. Some initiatives emphasize that social and environmental disruptions can be better addressed when they are considered simultaneously.

Peace Centers for Climate and Social Resilience (PCCSR) project in the Borana Zone of Ethiopia since 2014 aimed to address communities' capacities regarding both climate change and conflict prevention, mitigation, and resolution (USAID 2020a). The zone has experienced ethnic tensions along the border between Oromia and Somali regions, and the project attempted to enhance conflict resilience by encouraging collaborative action across communities for addressing climate crisis. The project showed evidence of the interrelated nature of preventing shocks – climate change adaptation in fact served as an “external threat” against which ethnic and clan groups strengthened their dialogue and collaboration (USAID 2020a, 15). Another project, PEACE III, addressed conflict along the borders between Kenya and its Eastern African neighbors (USAID 2020a). These areas have experienced conflicts among pastoralists and agropastoralists communities around issues of access to natural resources. The program emphasized strengthening both horizontal networks (across communities) and vertical networks (with national and regional peace actors) to reduce and mitigate conflict. As part of these efforts, networks of peace committees, women's and youth groups, and traditional leaders were facilitated. The program also supported better communication across pastoralists and agropastoralists communities in the borderlands (Stark et al. 2019).

A recent project, the Inclusive Governance and Conflict Management Support to Ethiopia project, aimed to strengthen peacebuilding and conflict management system in three regional states of Ethiopia (Okul & Bayene 2021). Key implementations included training on conflict resolution, forming and revitalizing local peace committees, and increasing inter-community dialogues, and establishing Conflict Early Warning and Response Mechanism (CEWARN). Taking a national level approach, certain interventions (Ahmed 2021) were also directed at strengthening the Ethiopian National Peace Architecture, which includes the Ministry of Peace (MOP) and its regional and woreda-level offices responsible for the prevention of conflict and promotion of peace and security.

Given Ethiopia's rapidly evolving political and security environment, there has also been an increased need to better understand and measure peace, especially taking into account the perceptions of local communities. One example is the Peace Index (PI) project (Ahmed 2021),

which seeks to generate evidence-based data and analysis to inform peacebuilding efforts at national and local levels in Ethiopia. The two main objectives are to provide a comprehensive understanding of the drivers of peace and conflict in Ethiopia and to enhance the capacity of local actors to promote peace through close engagement of local partners, including civil society organizations, government agencies, media outlets and policymakers.

There are also increasing efforts at strengthening regional and cross-national collaboration and improving evidence-based resilience programming. For instance, learning hubs like the Horn of Africa Resilience Network (HoRN) connect program implementers, academic, research and government institutions across the region to share global best practices that could be applied locally to enhance resilience programming in the HoA (HoRN Learning Hub 2020). Table 1 provides a summary of programs in Ethiopia which emphasize conflict and resilience.

Table 1: Summary of recent programs addressing conflict and resilience in Ethiopia

Program	Organization	Region	Years	Key focus areas
Conflict				
Peace Centers for Climate and Social Resilience (PCCSR)	USAID (Funding); College of Lau at Haramaya University (Implementation)	Borana Zone of Ethiopia	2014-2017	Conflict resilience, Climate resilience
Peace in East and Central Africa project (PEACE III)	USAID (Funding); Pact, Mercy Corps (Implementation)	The borders between Kenya and its Eastern African neighbors	2014-2019	Conflict resilience
Inclusive Governance and Conflict Management Support to Ethiopia	Peacebuilding Fund (Funding)	Oromia, SNNPR, and Somali Regional States of Ethiopia	2019-2021	Conflict management support
Strengthening Institutions for Peace and Development (SIPED) II	USAID (Funding), Pact (Implementation)	Conflict-prone “clusters” of Afar-Issa, Amhara-Tigray, Benishangul-Oromia, Dire Dawa, Gambella,	2016-2020	Conflict management, Accountable governance

		Gedeo-Guji, Hawassa, Oromia-Somali, and the national level.		
The Peace Index (PI) project	Swiss Government (Funding); Interpeace (Implementation) in cooperation with local partners.	Multiple locations across the country	ongoing since 2018	Framework for measuring peace based on the perceptions of local communities
Resilience				
Resilience Building in Ethiopia (RESET)	European Union (Funding), a consortium of international and national NGOs (Implementation)	5 Regions of Ethiopia, namely Afar, Amhara, Oromia, SNNPR and Somali	2017-2021	Address the root causes of displacement and irregular migration through the creation of economic opportunities and the strengthening of the resilience capacity
Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED)	UK Department for International Development (Funding), a consortium of NGOs in Ethiopia (implementation)	Several regions of Ethiopia, including Afar, Amhara, Oromia, Somali, and SNNPR	2015-2020	Resilience of communities to climate change and disasters
The Horn of Africa Resilience Network (HoRN)	USAID (funding), regional institutions such as the Intergovernmental Authority on Development (IGAD),	Horn of Africa region, including Ethiopia, Somalia, and Kenya	ongoing since 2016	Resilience of communities to withstand and recover from shocks and stresses such as conflict, drought, and other disasters

	development partners and other donors (Users)			
Building Resilience in Ethiopia – Technical Assistance (BRE-TA) facility	UK’s Foreign and Commonwealth Development Office and United States Agency for International Development (Funding), Oxford Policy Management (Implementation)	Across all sectors and regions in Ethiopia.	2019-2024	Strengthening government responses to reduce the effects of climatic and humanitarian shocks

3.2. Empirical research on resilience and conflicts in Ethiopia

Several efforts identified factors which contribute to resilience in Ethiopia. Focusing on north central highlands of Ethiopia which are predominantly agrarian communities, Asmamaw et al. (2019) examined factors predicting the three capacities—absorptive, adaptive, and transformative—of households’ resilience to climate change-induced shocks. Through household surveys, focus group discussions, and key informant interviews, they found that absorptive capacity was the most important for resilience, followed by adaptive and transformative capacities. In addition, use of livelihood resources, diversity of income sources, infrastructure, and social capital were some of the key determinants of household resilience. Being exposed to recurrent shocks, underdeveloped public services, and poor livelihood diversification were among factors which resulted in low resilience capacity.

Bekele et al. (2020) introduce existing strategies to build resilience to climate shocks in Ethiopia. Households in agricultural, pastoral, and agropastoral communities relied on different coping strategies depending on their geographic locations and local contexts. Some of the coping strategies such as selling off assets tend to have negative long-term effects. Households’ resilience is influenced by their level of adaptive capacity which relates to the ability to access resources and social support. The PRIME project in Ethiopia showed that the three dimensions of households’ pre-drought resilience capacities – absorptive, adaptive, and transformative – differently helped them from employing certain negative coping strategies such as reducing food consumption and depleting productive assets (Feed the Future FEEDBACK 2015).

In a study which employed participant observations and interviews at an orphanage in Addis Ababa, Lothe and Heggen (2003) examine young people’s resilience from childhood adversities including drought and famine. The study focuses on social and cultural aspects of resilience,

showing that bonding among peers, perception of hope, and religious attachment were important sources of resilience.

Education is another sector that is considered important for resilience. High quality, inclusive and accessible education strengthens social capital, improves community knowledge of risks and hazards, enhances gender equality, strengthens human capital, and builds internal dispositions to adapt (Shah 2019). Diwakar's (2021) study from several countries including Ethiopia suggested that better-quality education combined with other resilience capacities such as livelihood diversification and shift in gender norms contributed to escape from poverty.

A few projects examine resilience in the context of conflict shocks. A previous project on resilience in Ethiopia found that the presence of community elders and traditional, indigenous institutions which encouraged hospitality among communities contributed to reducing conflicts across communities (Feed the Future FEEDBACK 2015). Through interviews and observations, Endris et al. (2017) examined how households in the Eastern Hararghe zone used strategies to buffer against conflict, climate, and health related shocks. Households utilized various mutual support practices that are established among community members who share kinship, residence, tribal origin, neighborhood, and mutual acquaintances. In addition, a number of studies link communal violence to low or unequal access to socio-economic resources and political exclusion (e.g., Fjelde & Østby 2014), which in Ethiopia is observed as ethnic autonomy realized at the local level. The institutional set-up of local-level governments affects local horizontal inequalities (Fessha & Beken 2013), thus weakening resilience to violent conflict (Juon & Rohrbach 2022).

4. Systems and Networks Approach to Resilience

4.1. Systems and networks perspectives in existing conceptualizations of community resilience

Resilience is influenced by the ways in which resources are utilized and modified in response to uncertainty and surprise in the system (Adger 2000). A systems perspective to resilience emphasizes how the absence or presence of resources may function as vulnerability factors or protective factors. Vulnerability exists in conditions in which resources are not sufficiently robust, redundant, or rapid to be able to create resistance (Norris et al. 2008), and these conditions magnify the impact of stressors on dysfunctional outcomes.

Adger (2000) explains community resilience in terms of resource dependency: resilience depends on the quantity and quality of resources on which a community relies for livelihood systems and the extent to which these resources can be modified or diversified. The interaction between social and natural/ecological systems is important from this perspective, since the resilience of social systems is related to the resilience of ecological systems which social systems depend on (Adger 2000). The resilience of the ecological system simultaneously depends on the resilience of the social system (Janssen et al. 2006). For example, resources in the ecological system such as rainfall influence the grazing land necessary for livestock, which in turn influence the livelihood of pastoralists. At the same time, if pastoralists can make agistment arrangements

in which they temporarily move cattle between properties in response to rainfall variations, they can reduce the grazing pressure on their land (Janssen et al. 2006).

Several indicators of resilience developed in previous frameworks (e.g., robustness, flexibility, diversification) have implications for the absorptive, adaptive, and transformative capacities of communities. Norris et al. (2008) define community resilience as “a process linking a network of adaptive capacities (resources with dynamic attributes) to adaptation after a disturbance or adversity” (127). Two of the four sets of capacities in their model of community resilience—social capital and information and communication—highlight the networks perspective. As communities have structural inequalities along characteristics such as race, religion, and socioeconomic status, creating diverse and equitable connections is also important for resilience (Houston 2018).

The notion of interrelated systems underlies how community resilience is understood in previous studies. While relational properties such as social cohesion, cooperation, emotional connections, and social capital are considered in resilience, these properties are typically measured based on individuals’ perceptions of connectedness on a scale rather than structural indicators. The field of Social Network Analysis (SNA) focuses on examining structural patterns of relations among social entities (e.g., Wasserman & Faust 1994). SNA approach distinguishes itself from other conventional approaches in its explicit focus on analyzing social network data, which is structured along two main components: nodes and links. Employing SNA tools and methods allows us to move beyond aggregated perceptual measures and pay attention to the structure and patterns of connections.

Utilization of SNA in resilience research has been limited yet brings innovative potential for assessing community level resilience capacities (Sagara 2018). A study on food security in rural Nepal (Dahal et al. 2018) examines the web of economic transactions—labor, cash, or goods—in Maulali in Far West region. The capital flows they capture include “labor contracts and padimu labor sharing, wages and other cash transfers, land, livestock, loans, sharecropping and matey (i.e., a landowner allowing another farmer to cultivate their land in exchange for a loan) value, and gifts” (16). The results show that the measures of a household’s position in the network as well as strength of connections (i.e., the volume of capital flow through the household) are associated with household food security. As to network positions, closeness centrality (i.e., the number of steps it takes to access other households) had the largest explanatory power, followed by degree centrality (i.e., the number of families a household engages in transactions with) and betweenness centrality (i.e., the extent to which a household serves as a bridge in the capital flow network).

4.2. Systems and networks perspectives for understanding conflict shocks

In the social-ecological research tradition, systems theory helps understand the stressors involving multiple stakeholders which trigger conflict (Lordos & Hyslop 2021). Simpson et al. (2016) argue that to examine resilience for addressing conflict-driven adversities, we need to consider the relationships between various components of the social organization including individuals and groups.

Violent conflicts are grounded in complex interconnections among social-institutional-ecological factors and may lead to compounding and competing needs for resources. Multiple elements in the social (e.g., social norms, gender roles, community-based networks), institutional (e.g., public services, governance systems for conflict management, nonstate actors' role), and ecological (e.g., availability of livelihood resources) systems are contributing factors to resilience (Asmamaw et al. 2019; Bekele et al. 2020; Koo et al. 2019). In agro-pastoral communities, a large part of violent conflict shocks surrounds issues of resource scarcity. Programs which neglect to consider these interdependencies may lead to unintended consequences. For example, certain livelihood strategies may yield escalated cross-border conflicts, and certain communication channels or organizing for youth may increase the risk of radicalization or violent extremism. Political and institutional contexts which have the effect of politicizing and rigidizing conflicts are important to consider as well.

Examination of resilience against violent conflicts can be built on existing work on conflict prevention and post-conflict reconciliation. A resilience framework informed by systems and network perspectives can not only address post-conflict adaptations but also help enhance the long-term relational capacity of communities to reduce violent conflicts. Several aspects of resilience capacities and processes which can be interpreted from systems and networks approach are discussed below.

4.3. Dimensions of interconnectivity and interactions in communities

4.3.1. Interrelated shocks, risks, and vulnerability factors

Analysis of vulnerabilities is a fundamental step in understanding communities' conditions which impact their capacity to prepare for, withstand, or cope with adversities (e.g., Turvill & Turnbull 2012). With growing attention to compounding conflict and environmental risks, new methodologies are needed to identify how multiple risks interact with each other (USAID 2020a). There is also a need to assess the interdependencies among varying types of shocks and stresses (Sagara 2018). A recent USAID report (2020a) suggests that there is a lack of a comprehensive review of evidence and practice regarding interrelated conflict-climate shocks. Empirical studies show that the impact of climate change on conflict dynamics is inconsistent and varies across contexts (USAID 2020b). Therefore, identifying the specific patterns in which multiple shocks across social and ecological systems interact with each other in each community context is the primary step. Further, community members may perceive the interrelatedness among multiple shocks differently depending on their gender, age, and other social roles or groups they are associated with.

For example, in the Ethiopia context, Endris et al.'s (2017) study examined collective risk-sharing strategies which buffer households from adverse livelihood shocks. This study addressed interrelated shocks by asking study participants about pairwise ranking of community-wide shocks that frequently took place. Participants from Eastern Hararghe Zone of Oromia regional state identified that territorial conflict or tribal conflict shocks were the most frequently occurring type of shock at the community level, followed by drought and hunger. Jointly considering resilience to conflict and interrelated shocks is important because reduced

food and livelihood security leads to 1) competition over scarce resources such as water and land and 2) migration, which can lead to tensions across community borders and between ethnic groups (USAID 2020a). Pastoralism involves a system of entities including herders, farmers, and businesses as an essential component of the livelihood chain (Jobbins & McDonnell 2021). Pastoralists and farmers are interdependent in terms of sharing animal products, grains, and produce, and thus develop relationships that can be both cooperative and conflict-prone (Jobbins & McDonnell 2021). Violent conflicts and subsequent interruptions such as forced displacement can disrupt these relationships.

Questions which can be examined regarding this dimension include:

- In what way are violent conflict shocks interwoven with other acute/chronic shocks in the community?
- Which type of shocks and vulnerability factors play a central role in the interconnections, potentially leading to cascading disruptions?
- Which factors are involved in positive feedback (e.g., the impact of a risk worsening over time)? For example, a positive feedback effect exists if violent conflict shocks lead to displacement and increase in displaced populations lead to violent conflicts.
- Which factors are involved in negative feedback (e.g., a condition which acts as a mitigating mechanism)? For example, a negative feedback effect exists if local communities have capacities of mediating conflicts which will lead to the reduced violent conflicts.
- How are these shocks and interdependencies perceived and experienced differently by different gender and demographic groups in the community?

4.3.2. Mapping relations in communities

SNA is useful for identifying the key nodes as well as relationships among those nodes in a community. More than one type of relations can be mapped among the nodes. For example, competitive relationships over key resources (i.e., whether multiple groups are dependent on an identical set of resources in a given geographical location) can be mapped on to conflict or adversarial relationships among people, groups, or clans. Similarly, resource exchange ties among members of a community can be compared with positive ties such as trust and intimacy. Theories of embeddedness (e.g., Granovetter 1985) and methods for analyzing multiplex networks (i.e., networks consisting of multiple types of ties) can be utilized for examining overlapping relations.

4.3.2.1. Networks of resource and support exchange

In addition to the role of strong formal institutions emphasized in many resilience and fragility frameworks, the role of informal institutions is also significant (Bosetti et al. 2016). In conflict-affected settings, informal and sub-national institutions have an even more important role if formal authorities do not have the capacity to facilitate interventions (Bosetti et al. 2016). Social cohesion between and within groups is one of the key capacities for strengthening

resilience against conflict- and climate-related shocks and stresses, as such relations allow jointly using natural resources (USAID 2020a).

Existing studies show that nurturing relationships among households can help resilience. Endris et al. (2017) adopted a network approach by asking whom people rely on for support, and which indigenous mutual support groups they are a member of or receive support from. Results show that kin and relative based support networks are the most important support sources, followed by neighbor networks. Mutual support groups and borrowing/lending networks are also important. Bekele et al. (2020) also point to the role of informal networks and risk sharing mechanisms. For example, farming communities can better adjust to climate induced shocks by establishing market networks and facilitating pooling among communities (Asmamaw et al. 2019). Lordos and Hyslop (2021) suggest that designing ways for resource stakeholders to cultivate networks with each other to collaboratively use community resources can enhance resilience to conflict. Mercy Corps' research in Somalia found that households who had better social and economic interactions across clan groups were able to better deal with 2010/11 famine (Mercy Corps 2013; as cited in USAID 2020b).

As violent conflicts disrupt the social fabric of communities such as belonging and social cohesion, Simpson et al. (2016) identify trust as a key agenda for resilient processes in violent conflicts. Several forms of networks have significance in the context of pastoralism-related conflict shocks. To better address conflicts involving pastoralist groups, understanding the relationships between mobile pastoralists and local sedentary farmer groups is important (Jobbins & McDonnell 2021). In addition, examining the relationship between displaced populations and host communities can help understand community dynamics. Beyene (2009) explains that poorly defined property rights build tensions for conflict and that there is a lack of legal backing to address insecure property rights. For instance, customary institutions have historically settled or prevented conflict between agro-pastoralists and pastoralists over traditional grazing land. However, current government policies favor agro-pastoralists through the provisioning of agricultural technologies, extension services and training (Beyene 2009).

Questions which can be examined regarding this dimension include:

- How do violent conflict shocks influence the functioning of resource and support exchange network?
- Which nodes are central in the resource and support exchange network?
- Which nodes are excluded from the resource and support exchange network?
- To what extent do households and social groups have multiple exchange partners so that they have alternatives if they cannot receive needed support or resources from one partner? (*redundancy*)
- To what extent are communities dependent on multiple types of resources in multiple geographical locations? (*distributed dependence*)

4.3.2.2. Networks of communication and information sharing

To establish long-term resilience against recurrent shocks, communication networks are important. The transformative capacity dimension of resilience involves making system-level

changes, and the flow of communication is critical in those change processes (Asmamaw et al. 2019). Identifying the communication ties among stakeholders helps locate central actors, brokers, and marginalized groups in the network (Jasny et al. 2021).

Research on violent extremism in Sudan by Search for Common Ground (2020) suggests that youth are at the risk of being recruited to violent extremist organizations. Communication channels including social media platforms, television, and radio as well as face-to-face conversations played a significant role in information diffusion. Utilizing a network survey, the study showed collaboration and information sharing networks among civil society organizations in three different regions of Sudan. Information sharing network was sparse and centralized, leaving the potential for better connecting the organizations so that stronger collaboration and dialogue among them could be formed. Another research program (Search for Common Ground 2017) adopted a similar approach to examining communication networks and influencers. At-risk individuals of violent extremism in Kenya and Tanzania reported that they most frequently sought friends and peers for advice, followed by family members and religious leaders. People turned to those who are immediately accessible rather than respected community leaders such as religious and political leaders.

Patterns of marginalization and exclusion can exist in communication networks. Several social groups are marginalized due to gender, age, social status, ethnicity, or religion. Involving these marginalized groups in decision-making processes regarding resource use and allocation is important (USAID 2020a). In pastoralist contexts, population groups including women, youth, minority ethnic groups, or poorer herders are frequently overlooked in their ability to voice their perspectives and contribute to conflict resolution (Jobbins & McDonnell 2021). Women play a particularly important relational role in pastoralist communities: they build social and economic connections with farmers in the community by engaging in trades of animal products. They also maintain relationships with women in sedentary communities (Jobbins & McDonnell 2021). As women also tend to stay in villages during livestock migration, they have a better potential to address intercommunal conflicts than men do (Jobbins & McDonnell 2021). Yet, their voice is rarely represented in governance and peacebuilding. Multilingualism may also be a factor which influences communication and information sharing ties. Language is closely associated to ethnic identity, and multilingualism in Sub-Saharan Africa in general and in Ethiopia exacerbates differences between ethnic groups thereby inhibiting political integration and social cohesion (Shewadeg 2020).

Questions which can be examined regarding this dimension include:

- Which nodes are central in the information sharing network? Which nodes participate in decision-making?
- Which subpopulations or social groups are peripheral in the networks of information sharing?
- Which nodes are trusted sources of communication?
- How are these networks of communication perceived and experienced differently by different gender and demographic groups in the community?

4.3.3. *Competing or contradicting needs and outcomes*

The social and environmental systems often involve dilemmas (Jasny et al. 2021). Lordos and Hyslop (2021) call for systems thinking to better understand violent social conflicts, which has been considered a wicked problem. Wicked problems are “difficult or impossible to solve because of incomplete, contradictory, or changing requirements that are often difficult to recognize” (Lordos & Hyslop 2021, 419; see McCandless 2013). Wicked problems tend to emerge in highly interconnected, complex, and dynamic social systems. In addition, multiple stakeholders who are involved in the problem may have different interpretations of the problem and pursue differing solutions. A given strategy for resilience can result in both positive and negative consequences. For example, migration of pastoralists to sedentary farming communities may have both positive and negative impact on outcomes in areas such as agricultural production, food security, health, climate, and education. Migration is a strategy to spread risk at the household level to diversity resources but can lead to vulnerability and decrease in social resilience when communities face external stress (Adger 2000). Vulnerability and protective factors are not static features but processes that operate differently in certain circumstances to yield different outcomes (Rutter 1993). For instance, a strong community bond or attachment may have opposing impacts on communal conflicts. It may explain enhanced mutual support within communities but at the same time, result in strong ingroup-outgroup dynamics which might intensify tensions.

Resilience itself often requires two contrasting characteristics: sturdiness/robustness and flexibility (Schipper and Langston 2015). Nelson et al. (2007) suggest that managing systems for flexibility rather than for stability is important, since the system will experience varying types and magnitudes of change which are often unpredictable. Indicators of network structures such as redundancy can provide insights on system resilience. For example, if a social tie breaks down, there need to be alternative ties which can prevent the system from falling apart. In the other words, the system needs to be flexible in responding to shocks by mobilizing resources that are needed.

Questions which can be examined regarding this dimension include:

- In what way do compounding shocks require competing or contradicting resources and strategies?
- Which tensions exist in a community’s effort to strengthen resilience?
- Which tensions exist in a community’s effort for peacebuilding and conflict resolution?
- In what way might resources and strategies pursued by different gender and demographic groups in the community create conflicts or contradictions?

4.4. **Network structural indicators of resilience processes**

Table 2 summarizes indicators of network connectivity which have implications for resilience. It is important to note that the indicators do not have a consistent positive or negative impact on resilience (Janssen et al. 2006). Therefore, studies of resilience need to consider these indicators in relation to the specific socio-physical context of the community as well as the patterns of

interrelated risks. The question of which dimensions of network connectivity should be prioritized will also depend on the specific community and conflict contexts.

Table 2. A selection of network indicators at multiple levels which are relevant for system resilience

Level of network	Network/systems indicator	Examples from literature	Implications for system resilience
Node level	Centrality of nodes	<ul style="list-style-type: none"> Degree, closeness, and betweenness centrality in capital flow network (Dahal et al. 2018) 	<ul style="list-style-type: none"> Facilitates the role of leaders and decision-making entities; nodes are able to self-organize into grassroots networks and institutions (Choptiany et al. 2021)
	Network composition –diversity of connected nodes	<ul style="list-style-type: none"> Composition of support networks: kin, relative, neighbor, mutual support groups, borrowing/lending networks in measuring household asset for resilience (Endris et al. 2017) 	<ul style="list-style-type: none"> Facilitates sharing of information and knowledge across cultures and scales (Simonsen et al. 2015) Facilitates the involvement of systemically excluded groups (Choptiany et al. 2021)
	Ties to external entities	<ul style="list-style-type: none"> Households having extended networks outside of the community (Endris et al. 2017) 	<ul style="list-style-type: none"> Facilitates broadened participation (Simonsen et al. 2015)
	Redundancy of nodes	<ul style="list-style-type: none"> Planting multiple varieties of crops or keeping equipment for various crops (Choptiany et al. 2021) 	<ul style="list-style-type: none"> Multiple nodes which perform the same function buffer the failure of each other (Simonsen et al., 2015) Multiple nodes have response diversity, i.e., respond to disturbances in a heterogenous manner (Simonsen et al. 2015)
Dyad level	Redundancy of links	<ul style="list-style-type: none"> A radio station having back-up systems and functioning as an emergency communication channel (Da Silva et al. 2014) 	<ul style="list-style-type: none"> Links substitute each other in case of failures of links (Da Silva et al. 2014; Janssen et al. 2006) Facilitates recovery from disruption without a large

		<ul style="list-style-type: none"> Alternative transportation routes functioning for evacuation when roads are flooded (Berkes 2007) 	cost (Schipper & Langston 2015)
	Reciprocity of links	<ul style="list-style-type: none"> Mutual support ties and risk-sharing practices among family, kin, and neighbors (Endris et al. 2017) 	<ul style="list-style-type: none"> Facilitates trust and bonding social capital (Endris et al. 2017)
Overall network level	Network size	<ul style="list-style-type: none"> Polycentric governance (Simonsen et al. 2015) Inclusive approach in which a broad set of communities and sectors including vulnerable groups are involved in resilience strategies (Da Silva et al. 2014) 	<ul style="list-style-type: none"> Facilitates broadened participation (Simonsen et al. 2015) Contributes to a sense of shared ownership and joint vision (Da Silva et al. 2014)
	Density	<ul style="list-style-type: none"> Dense collaborative networks for addressing high-risk cooperation problems (Bodin 2017) 	<ul style="list-style-type: none"> Facilitates information sharing (Janssen et al. 2006) Facilitates cohesion and trust (Simonsen et al. 2015; Bodin 2017) Reduce resilience by spreading and increasing simultaneous exposure to disturbances (Simonsen et al. 2015)
	Reachability	<ul style="list-style-type: none"> Households in a community being accessible to each other (Dahal et al. 2018) 	<ul style="list-style-type: none"> Access to distant information and resources (Janssen et al. 2006) Spread of disturbances across large distances (Janssen et al. 2006)

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