



RESEARCH PAPER

COMMUNITY-DEVELOPED EARLY WARNING AND EARLY ACTION SYSTEMS: THE CASE OF SOUTH OMO COMMUNITIES IN ETHIOPIA



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Abstract

This research examines community-developed, otherwise indigenous, early warning systems among Ethiopia's South Omo communities. Data was gathered from March 4 – 17, 2024 among Karo and Daasanach communities, and from June 3 – 12 among Nyangatom. The study included three participants from each of the three communities and one official from the local administration representing each community. Besides, interviews were conducted with one zonal official in Dimeka from June 13 – 14 and with two federal government officials from July 1– 10 in Addis Ababa. Additionally, three focus group discussions were held in each of the study communities, with an average of six participants in each. A total of 72 individuals participated in this research as informants. A literature review was also conducted to integrate our field data with the available academic and policy studies. The findings show that hard-to-reach communities of South Omo are affected by natural disasters, particularly flooding, and still rely on their Indigenous mechanism of disaster risk reduction and emergency response. These communities have spiritual, ecological, and technical knowledge of prediction and response to hazards such as floods, drought, and large-scale conflicts. Focusing on flood disasters, this study discussed the strengths, weaknesses, and effectiveness of these mechanisms. The strengths include their cultural relevance, community ownership, holistic nature, rapid response, and social cohesion. Weaknesses include the subjective nature of the knowledge, limited scalability, reliance on specific individuals, lack of documentation, inadequate infrastructure, and lack of gender balance. The study suggested that it is important to acknowledge the strengths of these systems and integrate them with the formal system.

Keywords: community-developed, early warning systems, disaster, South Omo, Ethiopia

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1. Introduction

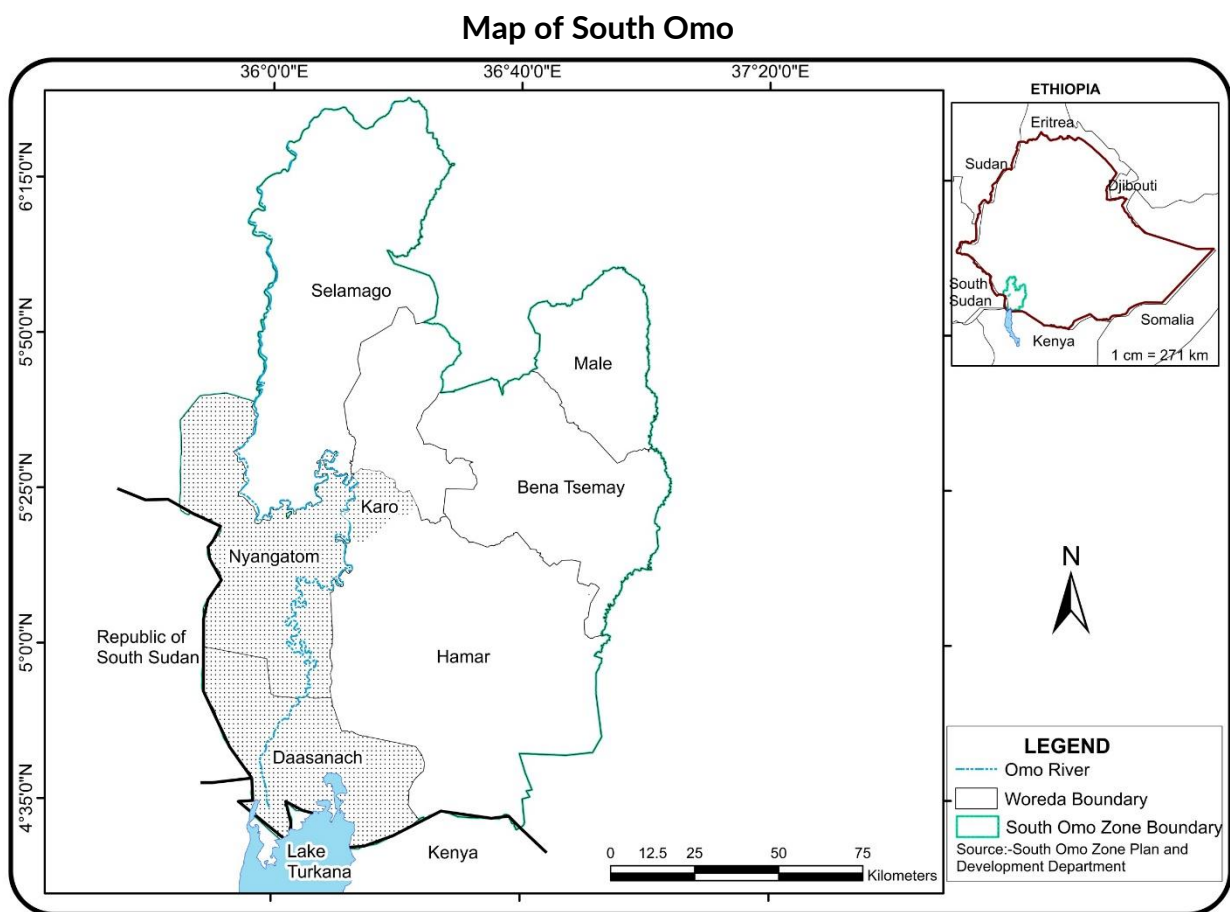
It is evident that, for millennia, Indigenous communities have relied on early warning systems (EWSs) that they have developed in response to various types of disasters (Lambert & Scott, 2019, p.1). This study examines the case of Indigenous EWSs among the communities of South Omo in Ethiopia. Among these remote communities where formal disaster EWSs are yet to be enhanced, community-developed early warning systems (CDESSs) play a significant role in mitigating disaster risks. This study delineates and describes these systems as well as inquires their strengths, weaknesses, and policy implications. We believe that the study not only enhances our understanding of indigenous EWSs, but its findings also offer policy makers with an opportunity to integrate effective indigenous practices into formal EWSs. And since the types of disasters are several and the knowledge and response mechanisms for each disaster slightly vary, we concentrate here on flood hazards.

South Omo is located in the southwestern extreme of Ethiopia bordering Kenya (see map below). Under the current administrative structure of the country, it constitutes a zonal-level administration that exists below the regional-level administration. Formerly, it had been part of Ethiopia's Southern Nations, Nationalities, and Peoples Region (SNNPR). However, after a successful referendum on 19 August 2023 (ENA 19 August 2023), it joined with other ethno-territorial communities to form the South Ethiopia Peoples Region split from SNNPR. The new restructuring divided the former South Omo Zone into two: Ari Zone, which is home to the sedentary agriculturalist Ari ethnic group, and the remaining fifteen agro-pastoralist communities retaining the name South Omo Zone. Based on latest national census conducted in 2007, the total population of the newly restructured South Omo Zone was 573,435 and has a total area of 21,055.92 km² with a population density of 27.23 (CSA, 2008). South Omo is perhaps the most culturally diverse and "authentic" place in Ethiopia where many ethnic groups live concentrated in a small area. There are at least fifteen "ingenious"¹ ethnic groups in the zone, speaking Cushitic, Omotic, or Nilo Saharan language families. The largest of them include Hamar (14.5%), Banna (8.02%), Tsamai (6.15%), and Nyangatom (5.35%) (CSA, 2008). The "indigenous" communities practice agro-pastoralism, which involves a combination of livestock rearing and flood-recession farming. South Omo Zone constituted about 56 percent of the defunct SNNPR and about 6 percent of the national goat population (CSA, 2021).

The climate in South Omo is predominantly arid the rainfall low and erratic (Pertaub, Tekle, & Stevenson, 2019, p.2). The highest peak in the territory of the newly

¹ Other than those who are believed to have expanded to the area such as Amhara, Oromo, or another who have come from other places according to *de facto* or *de jure* definition by the current ethnic politics.

restructured South Omo Zone is Asile Mountain, reaching 2,084 meters in Hammer Woreda, while the lowest point is 376 meters above sea level near Lake Turkana (also known as Lake Rudolf) at the southernmost point. The Omo River that originates from the central Ethiopian highland plateau and flows into Lake Turkana is the primary drainage system in the zone. Numerous rivers are tributaries of the Omo River, by far the largest total tributary being the Gibe River. Other river networks contributing to the Omo River include Mago River, Neri, Sara, Berso, and Maki. The Weito River, along with its tributaries Afa, Lemeto, and Merka, flows towards Chew Bahir (Lake Stefani) (Minalu, 2014). These water bodies hold immense potential for hydroelectric power, irrigation, and fishery development. Presently, the Omo River is utilized for the sugarcane plantations of the Omo-Kuraz sugar project.



Despite the area's wealth of river and lake water resources, it is afflicted by flooding. Ethiopia has experienced localized natural hazards such as flooding, droughts, and other disasters in different parts of the country, including South Omo. South Omo is susceptible to various natural and environmental hazards, but drought and flooding are the common natural hazards. Being a semi-arid region, it experiences periods of prolonged drought. For instance, in 2021/2022, the area encountered its most severe drought crisis in four decades, resulting in livestock deaths and economic instability (Global Communities, 2023). Conversely, heavy rainfall triggers river overflow,

damaging humans and livestock. For example, in June and August 2006, South Omo communities – mostly those affected by riverine flood, i.e., Karo, Daasanach and Nyangatom – experienced 620 fatalities, around 35,000 displaced individuals, and approximately 118,000 people affected by the end of July 2006 (OCHA, 2006). In October 2023, extensive flooding in parts of southeastern Ethiopia had a major impact on more than 1.5 million individuals, leading to the displacement of more than 760,000 people as of 15 November 2023 (OCHA, 2023). International Rescue Committee (IRC) reported the flood has displaced 16,648 households, or 79,828 people in Daasanach Woreda alone (Fisseha, 2023). Floods also occurred in March 2024. As per numerous reports from various media sources, a staggering 79,000 people were displaced in the Daasanach Woreda alone, making it the most severely impacted area by the disaster by August 20, 2024. The Omo River diverted from its usual path, leading to the overflow of its banks and the flooding of nearby areas. Informants observe that river flooding is becoming common in their region, often happening multiple times within a year. They admitted the difficulty in predicting these floods as they can occur unexpectedly.

Following this introductory section, the article provides the methodology employed to collect data. In the third section, the paper provides a brief analysis of the literature on community-developed, or otherwise indigenous, EWSs. Subsequently, the fourth section presents findings from case studies in South Omo which includes the indigenous mechanisms of EWS, their strengths and weaknesses, and available (lack of) state mechanisms. Finally, the paper gives a conclusion and some recommendations on the possible cooperation between the indigenous and the formal ones for a better EWS for the South Omo community.

2. Methodology

As hitherto mentioned, this study was carried out in the South Omo, focusing on pastoralist communities often affected by disasters, particularly flooding. The new administrative area of the South Omo Zone comprises six districts known as *woredas*, with this study specifically targeting districts with riverine floods of Omo River and Lake Turkana, namely Daasanach, Karo, and Nnyangatom. The paper was developed based on a qualitative research method. The research team collected field data from March 4 – 17, 2024 among Karo and Daasanach communities, and from June 3 – 12 among Nyangatom. The researchers conducted in-person interviews with three participants from each of the three communities and one official from the local administration representing each community. Besides, they conducted interviews from June 13 – 14 with one official from the zonal headquarters in Dimeka and from July 1– 10 with two federal government officials from the Disaster Risk Management

Commission (DRMC) in Addis Ababa. Additionally, three focus group discussions were held in each of the study communities, with an average of six participants in each. A total of 72 individuals participated in this research as informants until data saturation was reached. The researchers also used one guide for the fieldwork in each of the communities.

Community informants were selected using a snowball method due to their knowledge and experience regarding natural disasters, while officials were selected based on their role in handling such disasters. The former refers to senior members of respective communities recognized as leaders, such as clan leaders or simply respected elders without holding any specific designated role. Some or most of them are attributed to have a spiritual quality of communicating with the super natural. Office holders typically have some level of educational attainment, with one officer holding a BA degree as the most educated among this group of informants. In contrast, none of the community informants have ever attended school. With only 12 women interviewed, there exists a disproportionate representation of them within the study. This imbalance is attributed to the perception that men are more knowledgeable on matters of disaster. Those women whom we managed to interview tend to provide limited information, often deferring to men under the belief that they possess superior knowledge on the subject matter.

In addition to interviews, our data collection method also includes conducting a comprehensive literature review spanning academic and policy domains to seek out, identify, and utilize relevant materials. This process entailed exploring existing scholarly works, reports, and documents to gather insights and information that contribute to the depth and breadth of the study, ensuring a robust foundation for analysis and discussion.

The data was organized and analyzed thematically based on key patterns and topics. The research team made its best effort to uphold all necessary ethical standards. The Research Ethics Committee at Addis Ababa University's Institute of Ethiopian Studies, our host institution, has thoroughly reviewed our proposal and granted us clearance.

3. Literature review

3.1. Concepts

There is a loose usage of concepts in the area of research and policy related to the relationship between community role and EWS. Firstly, the term “early warning system” (EWS) is commonly used. The usage of the term encompasses the capabilities necessary to produce and distribute prompt and relevant alert messages that empower individuals, communities, and entities in danger to prepare and react suitably and with adequate time to minimize damage or losses. The United Nations Office for Disaster Risk Reduction (UNSDR) (2021) defines an EWS for natural hazards as “an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enable individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events”. Secondly, different terminologies are used to designate the relationship between the community and EWS. IFRC (2012, pp.13-14) identifies the difference between “community-based” and “community-driven” EWS and Jackson (2010) used “community managed” early EWS. These documents use the term without definition. As the name suggests, “community-based” refers to agencies working on and with the community where much control of the process is taken by the external actors while “community-driven” suggests that the community is the primary actor in the early warning. The difference in these concepts is the degree to which the community plays a role in a certain EWS.

In our paper, we use the term “community-developed” to refer to the fact that the community is not only the actor but also the originator of the knowledge and institutions of EWS. We believe that the difference among “community-based”, “community-driven”, and “community-developed” is significant, with the third one encompassing a deeper role, beyond participation, that includes institutions and the knowledge they generate. Community-based approaches typically focus on involving community members in decision-making processes and initiatives, while “community developed” encompasses a deeper framework that involves not only the community itself but also the institutions and knowledge systems that have been developed by it.

Following the insights provided by IFRC (2012, p.13), the term “community” within the context of this paper encapsulates a vibrant network of social interactions that are susceptible to a myriad of social and physical repercussions stemming from various hazards and threats. This community framework extends beyond mere geographical boundaries, encompassing shared spaces such as villages, neighborhoods, watersheds, and more. It signifies a dynamic ecosystem where individuals are interconnected by a web of relationships and mutual dependencies,

facing collective challenges and opportunities that transcend individual experiences. This interconnectedness underscores the importance of understanding communities not just as physical locations but as intricate webs of relationships, traditions, and resilience that shape their responses to risks and disasters.

3.2. State-of-the-art: academic and policy studies

The exploration of indigenous knowledge in relation to disaster risk management started in the 1970s (Yates & Anderson-Berry, 2004). However, it was since the Asian Tsunami of 2004 that scholars and the international community have shown increasing acknowledgement of Indigenous disaster early warning systems (Ali et al., 2021, p. 2). Scholars concur that, if harnessed appropriately, Indigenous mechanisms can contribute to early warning and recovery efforts in communities that otherwise have less access to formal mechanisms (Buergelt, 2017; Smith et al., 2017; Rai & Khawas, 2019; Bwambale et al., 2020). Apart from the research arena, international agencies have also called for increased use of Indigenous early warning systems and to embrace them in the policy formulation and implementation at local, national, and international scales (Rumbach, 2014; UN, 2013; Hewitt et al., 2012). The UN Yokohama Strategy and Plan of Action for a Safer World asked for all countries to “Aim at the application of traditional knowledge, practices, and values of local communities for disaster reduction” (DHA, 1994 p.14), and UNISDR (2015) underscored in item 24 the importance of “the use of traditional, Indigenous and local knowledge and practices, as appropriate, to complement scientific knowledge in disaster risk assessment and the development and implementation of policies, strategies, plans, and programs of specific sectors, with a cross-sectoral approach, which should be tailored to localities and the context”. The Sustainable Development Goals (SDGs) (UN, 2015, p.7) also contain comparable statements on the importance of local knowledge in disaster risk management (DRM).

Despite these advancements, there some prevalent observations that we can make respective to both academic study and policy implementation. Regarding the research arena, it is first important to highlight constraints in the existing body of literature. First, the studies that pay attention to the role of the community in formal EWSs are still limited. Most of the available works focus on community participation in schemes formally provided by national and international EWSs actors instead of indigenous approaches to early warning system as such. Besides, the majority of the community-based early warning systems documented in the literature are for floods and landslides (Gautam & Phaiju, 2013; Lassa & Sagala, 2013; Phaiju & Bhandari, 2012; & Vanloon, 2010).

Second, in terms of methodology, the studies predominantly relied on quantitative positivistic research approaches grounded in reductionist, anthropocentric, and secular viewpoints (Lambert & Scott, 2019). A considerable amount of Indigenous

DRM research is typically undertaken by non-Indigenous researchers (Ali et al., 2021, p. 2). Consequently, studies in this area have yet to investigate deeply the comprehensive aspects, such as the connections to cultural resilience, in mitigating, forecasting, responding to, recovering from, and adjusting to severe natural disasters (Lambert and Scott, 2019; UN, 2013) that beg for other research approaches. It is essential that the Indigenous knowledge, practices, and capacities required to support DRM planning for sustainable development, such as community-based approaches are articulated and their *modus operandi* understood (Paton, 2020; Phibbs, Kenny, Solomon, & Mowaho, 2015; Rumbach & Foley, 2014; Arunotai, 2008).

Third, there is a lack of balance in academic discussions between the merits and limitations of indigenous EW S. While discussing the latter, many studies focus on external factors that hinder the use of Indigenous systems for disaster risks and responses. They tend to attribute potential shortcomings to factors such as inadequate support by external agencies, lack of resources on the side of the locals, lack of trust between the local and external actors, and power dynamics, i.e., hierarchies of power in the two knowledge systems (Ali et al 2021, p.1; 2024, p.1137; Trogrlić & Homberg (undated, p.51); UNEP 2008, p.31). While these challenges are true, in essence, these and many other studies provide challenges towards the implementation of using or integrating indigenous systems rather than inherent substantive limitations. The studies tend to idealize the side of their importance. Besides, discussing the importance of the indigenous systems, the studies also make general assertions of their importance or a specific case study of contributions these institutions have made in tackling hazards. Focused discussions about which specific qualities of the systems can be used for DRM are scanty. As they explain away weaknesses, for the strengths, the studies also mention factors for using these institutions such as Macherera & Chimbari (2016, p.7) say “The major strengths of all the systems analyzed are that they are low cost, relevant to the communities and promote sustainability”. This obscures a genuine discussion about their actual strengths and limitations and masks strategies to leverage potential strengths and address limitations effectively. As this study will show below, the indigenous EWS in South Omo have inherent strengths and limitations.

In terms of integration, the proposal made by policy and academic circles alike is not seen practically implemented. Despite various frameworks and researchers advocating for the integration of indigenous and “western” knowledge systems in DRM (Hermans¹ 2022; Gagnon and Berteaux 2009; Ziervogel and Opere 2010; Plotz et al. 2017), there is in practice limited effort in implementation, that the authors of this paper have not come across any example of policy or academic document specifically figuring out how the two can be integrated.

In the context of Ethiopia where this case study is conducted, there are only a couple of academic studies we could find on the role of communities in EWS (Syum, 2019;

Ogato, 2013). Even these few studies have limited coverage of issues on the role of the community in disaster prevention as they pay attention to community participation with the framework of state policies and actions, rather than the utilization of community-developed solutions per se in DRM. Some other studies focus on formal institutional effectiveness and collaboration among the formal state structures (Gidyelew, 2019; Muluneh, 2013), histories, and trends in the development of the early warning system in Ethiopia (Birtukan, 2014; Abebe, 2009). Legese & Gumi (2021) conducted a systematic review of studies on DRM and response but provided studies merely focusing on scientific methods, attesting to a lack of studies on indigenous mechanisms of EWS. The studies on DRM in Ethiopia have notably overlooked the Indigenous early warning mechanisms deeply embedded in the country's communities. This oversight represents a significant gap in academic research, as it fails to explore the rich cultural traditions and ancestral wisdom that have long guided communities in response to disaster risks. On the policy level, the DRM policy of Ethiopia places significant emphasis on the involvement of communities in DRM, highlighting the need to enhance community institutions, mechanisms, and skills to systematically enhance resilience against hazards. However, there is less translation of policy into practice.

4. Results

4.1. Community-developed early action systems in South Omo

This section discusses the early warning and early action systems embedded in the indigenous knowledge of South Omo communities. They anticipate the onset of natural disasters by using several indicators which are discussed below. During times of heightened risk, the elders and cultural leaders are expected to remain vigilant, refraining from straying too far from their surroundings to ensure the safety of their families, their clan, and the broader community. These practices and methods are deeply embedded within their spiritual fabric.

4.1.1. Divinations

According to CSA (2008), 50.86% of the population in South Omo adhered to traditional beliefs, 30.44% identified themselves as Protestant, 12.23% Ethiopian Orthodox Christianity, and 1.33% were Muslim. In the region, the majority of indigenous communities uphold traditional belief systems intertwined with reverence for nature, spirits, and cultural rituals that serve as cornerstones of their identity. The growing influence of Ethiopian Orthodox Christianity and Protestant denominations,

introduced through historical connections and missionary endeavors respectively, is significantly reshaping the religious fabric of the region. Here, a unique blend of religious and cultural beliefs intertwines with practical knowledge to provide insights into the mysteries of nature through divination, commonly understood as “a technique to determine the future and to make authoritative pronouncements about it” (Grillo, 2009, p.921) or the “way of exploring the unknown” (Tedlock, 2001, p.1). Divination commonly encompasses techniques used to anticipate, foretell, or prophesy regarding future events.

Among the communities in South Omo with whom this study was conducted, a significant aspect of hazard prediction involves belief systems. They use techniques such as dreams and their interpretation experienced by elders and revered cultural leaders. Some individuals in these communities are believed to possess a heightened connection with the spiritual world, enabling them to receive premonitions and divine messages that offer glimpses into the future. Cultural and spiritual authorities claim to glean crucial information through dreams about impending natural events, such as the expected water levels in the rivers and the likelihood of droughts, floods, or manmade hazards commonly inter-ethnic or inter-clan conflicts. The following is a witness of a Daasanach informant who shared with us a dream that he claimed to have seen in September 2023, in the wake of the October 2023 floods in their area:

In the quiet hours of the night, as the embers of the fire danced and the stars whispered secrets to the sleeping village, I, an elder, found myself drifting into a dream unlike any other night. In this vision, the heavens rumbled with a fierce intensity, and dark clouds gathered ominously on the horizon. A turbulent river surged with primal energy, its waters roaring with a voice that seemed to echo through my very soul. The wind crackled my house and carried the scent of impending change—a change that spoke of danger and disruption.²

According to this informant, this dream gave him a feeling of the raw power of nature coursing through him, and once he was awake, he was convinced that this was no ordinary dream. It was a message from the super natural, a warning etched in the fabric of the night, urging him to heed the signs and prepare his people for the deluge that loomed on the horizon. He said, “The dream lingered like a shadow upon my waking thoughts, guiding me to share its wisdom with the community, to rally them in unity against the coming flood, and to safeguard our lives and livelihoods against the relentless fury of nature’s wrath”. With a heart heavy with purpose and a spirit fortified by a super natural guidance, he embarked on a journey to translate the dream’s cryptic language into tangible actions that would protect his people and preserve their way of life in the face of adversity. As per the informant, the flood of October 2006 had a profound impact on numerous villages, their livelihoods, and

² Yerporech Nakabel, M, 63, Daasanach elder

their livestock such as the Daasanach villages of Nakiya, Agolsia, and Selegn. However, he believes the severity of the situation was somewhat alleviated by their prayers, which mitigated the potential extent of the damage.

In the face of potential flood threats, the community members do not merely wait until they see dreams. Instead, a proactive spirit emerges within them, prompting action in the form of collective prayers. Sensing the impending danger through subtle cues in their environment, a sense of urgency pervades their interactions, driving them to seek solace and protection through the power of prayer. This communal act of supplication serves as a unifying force, binding them together in faith and hope, as they beseech the divine forces to intercede and safeguard their homes and loved ones from the looming specter of inundation. Through their shared rituals of reverence and petition, they forge a spiritual shield against the encroaching threat of floodwaters, finding strength and resilience in their collective belief and the bonds that unite them in times of adversity. An informant from Nyngatom says:

Dreaming does not always occur despite hazards seeming to be coming. Dreaming also happens when we pray first to our Creator with a clear mind. To organize our mass prayers, we say to each other "Let's start by praying for the safety of the animals and then we wish and pray for the health of our family, our people, our environment and our country". We do this at home and in groups. When we pray to our God like this, we hear a message in our dreams at night saying, "The Omo River is overflowing."³

Dreams possess a profound ability to not only unveil potential adversities but also to illuminate the spiritual solutions that can guide dreamers through challenging times. In the realm of dreams, symbolism often intertwines with subconscious desires, presenting a unique canvas where the mind can grapple with both the problems at hand and the pathways to solution. These nocturnal narratives act as mirrors reflecting not just fears or uncertainties, but also the inner strengths and wisdom that individuals may possess. The following story demonstrates a practical case.

In the wake of the 2006 flood adversity, a Daasanach informant who told us the story saw in dreams floods so powerful that they could bring devastation to both humans and animals alike. He saw the signs of impending rain manifested in his dream's slumber. He also saw what measures he should take in response to the unfolding adversity. Based on what he had been instructed in his dreams, he ordered a solemn decree to the villagers. He ordered community members to slaughter a goat. The color of a goat, whether red, white, or black, would determine the sacrifice needed to appease the forces of nature. Accordingly, he

³ Aleper Echom, 60, M, Nyngatom.

*ordered a chosen individual to select the sacrificial goat, its skin to be worn by selected members of the community as a shield against the impending deluge. As the appointed hour approached, the village stirred with a sense of solemn anticipation. At 11:00-12:00 pm, the designated water sprinklers, esteemed elders from each clan, would commence the sacred ritual of spraying water upon the people and their animals as they entered the village gates. The skins of the sacrificed goat, imbued with protective power, were sometimes affixed to the entrance as a symbolic ward against the destructive rains. In this way, the Daasanach community honored the ancient pact between dreams and reality, weaving a tapestry of reverence and resilience in the face of nature's unpredictable wrath.*⁴

In many communities, the credibility of spiritual revelations varies significantly, often depending on the status and track record of the individual experiencing them. Among indigenous belief systems, dreams and divinations from esteemed figures like senior elders, clan leaders, and individuals with a proven history of accurate predictions hold substantial weight and are trusted implicitly. However, a recent trend has emerged where some protestant pastors are asserting the ability to prophesy future adversities, a departure from traditional practices. This shift suggests the evolving landscape of spiritual authority and the intersections between indigenous beliefs and newer religious influences, leading to a complex tapestry of spiritual guidance and interpretation within these communities.

Any form of insight, whether from their ecological knowledge or indigenous spiritual messages, is not taken lightly within the community. They are often shared during communal gatherings or special ceremonies where the interpretations are discussed, debated, and integrated into the collective understanding of the impending natural events. As the above informant said, "If adults have a dream, they will share it with us the next morning when we gather under the tree. We exchange information and cautionary messages. Every village has respect for dreamers and dream solvers. Some adults persist in understanding and solving their dreams."⁵ The guidance these mechanisms provide is considered a valuable complement to the more tangible flood forecasting method, enriching the community's overall preparedness and response strategies.

These disaster response mechanisms also serve, beyond the spiritual aspect, a practical purpose by fostering a sense of solidarity and cooperation among community members. Through these institutions, the community not only seeks divine protection but also strengthens its social bonds and collective resilience. This shared experience of facing and addressing the threat of natural disasters through

⁴ Komoro Nakabel, M, 61, Daasanech elder

⁵ Komoro Nakabel, M, 61, Daasanach elder

prayer and ritual creates a sense of empowerment and unity that transcends individual concerns and fosters a shared sense of responsibility for each other's well-being. In essence, the organization of community prayers and rituals in South Omo represents a holistic approach to flood preparedness that combines indigenous knowledge, spirituality, and community solidarity.

Sources abound on the role of supernatural powers such as dreams in relation to the communities' relationship with ecology (Robin et al., 2022; Agrawal, 1995). However, there is limited information in the literature about the role of those eco-spiritual mechanisms of vigilance against disasters. One example of information briefly mentioned is the case of the Karamoja. In Karamoja, local communities employed diverse signs to anticipate weather patterns. They monitored plant growth stages, animal actions, star positions, sun movements, and wind directions. Skilled individuals also relied on dreams and the interpretation of various objects like intestines, shoes, and gourds to predict future events, such as weather conditions and other occurrences. These signs fall into four primary categories: meteorological cues, biological indicators (from plants and animals), astrological signals, and supernatural or animistic signs (USAID, 2024). Among the South Omo communities of South Omo also, agricultural endeavors commence only after receiving the Gudii's blessing, who appeals to God for the rain to initiate cropping activities. The Donzas, as community elders, offer counsel regarding calamities. Additionally, traditional prognosticators and seers, such as Met'eed who interprets star movements, Moorah who predicts using thrown shoes, and Koymo who reads animal entrails, advise the community on life matters. The Hamar community places deep trust in these customary establishments and adheres to their directives (Jackson, 2010, p.15).

Divinations represent a marginalized facet of indigenous knowledge concerning EWSs, often overshadowed by the emphasis placed on the technical dimensions of this traditional wisdom. Regrettably, they are frequently dismissed as mere superstitions or mystical beliefs devoid of tangible relevance. Exploring deeper into these practices shows a profound interconnectedness with the environment and a nuanced understanding of subtle signs and patterns that could potentially offer valuable insights into impending disasters.

4.1.1. Ecological indicators

The prediction of disaster risks transcends the boundaries of the spiritual realm, encompassing a multifaceted approach that involves environmental factors. Members of the community venture forth on ecological observation and insight. As an informant stated during the fieldwork, "We know what happens to each plant, each animal, and the environment at large as seasons change throughout the year",⁶ thus,

⁶Lopiding Lokuwa, M, Nyangatom

reading among them certain indicators of potential disaster. Drawing from a wellspring of technical knowledge, they navigate the terrain with a keen eye and a knowing heart, attuned to the subtle cues and murmurs of the environment that portend the arrival of natural calamities.

Some repository of signs of impending changes lie within the flora. Certain plant species lining the shores of the Omo River and Lake Turkana exhibit rapid growth and sudden blossoming, a phenomenon closely observed by local informants. Informants mentioned the local names of several such plants: *etumse*, *eperuu*, *echoke*, *etiir*, *ejerro*, *ekalale*, *elakas*, *elmamae*, and *ekabkuru*. This botanical response is not viewed as an auspicious occurrence; rather, it is interpreted as a precursor to less favorable events. The flowering of these specific plants is intricately linked to the anticipation of floods, serving as an early warning system that the waters may soon rise.

The rivers serve as another indicator. With vigilant eyes fixed on the mesmerizing spectacle before them, members of the community witness the gradual rise of the river's levels, a silent yet profound prelude to nature's impending display of strength. An informant stated, "We observe each small increase in the water's height which serves as a poignant reminder of the potential floods"⁷. The prediction of water level increases in South Omo is not solely based on local rainfall. Water systems are interconnected, where downstream rainfall can trigger swelling rivers despite the absence of precipitation in the immediate vicinity. However, sudden floods, though sporadic in their occurrence, can swiftly engulf landscapes and communities, leaving a trail of destruction and chaos in their wake. An informant added, "In the blink of an eye, tranquil rivers swell into raging torrents, breaching their banks and inundating everything in their path with a relentless surge of water."⁸ The abruptness of these deluges defies prediction, catching individuals and authorities off guard, necessitating rapid responses to mitigate the ensuing crisis. This indigenous system for monitoring water levels serves the community in the absence of official records maintained by local government or non-governmental organizations regarding water levels.

The wind also acts as a vital harbinger in the realm of prediction, with local communities attributing mystical qualities to its whispers, which seemingly carry omens of distant storms and imminent downpours. Through generations of observation and folklore, community members have come to understand that not only the direction but also the nature of the wind can foretell impending weather patterns, particularly in anticipating heavy rainfall and potential flooding. When the wind sweeps to the Southwest, which geographically means originating from the Indian Ocean, a common belief emerges that substantial rainfall is on the horizon.

⁷ Aja Lepel, M, 49. Karo.

⁸ Akiru Ekeno, F, 58, Nyangatom.

Additionally, the presence of robust, chill-laden breezes is often interpreted as a prelude to intense downpours, further cementing the wind's role as a reliable soothsayer of impending precipitation and then flooding. The following table shows the Hamar elders' charting of early EWS for drought and animal diseases.

Regrettably, as highlighted in the literature review section, this invaluable knowledge remains largely undocumented, not just within Ethiopia but also in other regions globally. The scarcity of comprehensive documentation poses a significant challenge in preserving and understanding the intricate systems of indigenous forecasting methods. Within this context, a glimpse into the drought prediction wisdom of the Hamar community, as briefly outlined by Jackson (2010, p 24), offers a rare insight into the depth and complexity of traditional forecasting practices that are at risk of being lost or overlooked due to insufficient documentation and recognition.

Drought	Animal disease
Intensely gusting winds	Intense blowing
Two consecutive rainy seasons without precipitation	Change in livestock behavior
Acacia trees turning yellow	Heavy rainfall extended the dry season
Diminished physical condition of pets and other animals	Variation in rainfall of its typical season
Decreased livestock price	Presence of uncommon insects
Lack of palatable grass & water	A typical foggy weather condition
Foliage of deciduous plants casting shade	
Lack of libido in animals	
The presence of sleet and small, slow-moving clouds	
Drop in water levels at existing water sources	
Rise in the scale of migration to border areas	

4.1.2. Building fences

Once the occurrence of flood is predicted by spiritual and ecological methods and in addition to spiritual actions such as prayers taken to prevent it, the community also implements physical measures against such hazards. Informants indicated that they also engage in technical works to prevent flooding. They built check dams, terracing, bunds, percolation tanks, and storage tanks at various locations across the watershed as effective landscape-based flood risk mitigation strategies. This practice has been honed over generations and is deeply ingrained in the cultural and practical strategies for flood resilience. These mechanisms act as physical barriers that help divert or

contain the flow of floodwaters, preventing them from inundating homes, farmlands, and other vital infrastructure. A Daasanach informant stated:

In September 2023, a tangible urgency of flooding gripped the villagers who had been sensitized to the imminent danger. Acting upon the guidance of our community leaders, a resolute group convened at the banks of the Omo River. In a strategic response to the threat, we built three protective walls constructed in the most vulnerable villages. The construction varied in scale and design based on the topography of the locations, with each dam tailored to the specific risk factors present. For low-lying areas susceptible to extensive flooding, larger terraces were engineered to mitigate the potential damage, while elevated regions necessitated less elaborate fortifications due to their naturally advantageous position on higher ground.⁹

Comparable defensive structures comprising terraces are systematically erected along the perimeters of the Omo River and Lake Turkana, and encompassing villages to mitigate the recurring threat of floods. Despite the proactive measures taken, the efficacy of these fortifications is contingent upon the scale of the inundation, with the potential for comprehensive flooding to overwhelm these safeguards, rendering them partially effective or viable for a limited duration, often lasting only a year. Notably, the terraces in the villages necessitate recurrent reconstruction on an annual or semi-annual basis, contingent upon the forecasted risks of imminent disasters. This cyclical reconstruction process indicates the dynamic nature of disaster preparedness in these regions, emphasizing the imperative of continual adaptation and maintenance of these protective structures to safeguard against the unpredictable forces of nature.

4.2. Emergency responses

Apart from the above preventive measures, the community members take a set of actions if the flood is imminent. They will determine to take emergency actions, discussed below, when they receive a flood warning from designated individuals from the government offices or their community members or both. . Such action points can vary, but once the flood has begun to overflow river banks or has begun to affect nearby villages, they need to evacuate .

The communities use different mechanisms to communicate messages during an emergency. One of those methods is gunshots. The usage of gunshots as a warning mechanism to signal impending floods in South Omo has been noted, but this method presents significant challenges due to the frequency of gunshots being heard for various reasons such as often being the result of incursions from different tribes in an

⁹ Komoro Nakabel, M, 50, Daasanach

attempt to steal cattle or the result of armed conflict between tribes. Gunfire is a common means of communication for diverse alerts, such as warning about cattle raids from other tribes or signaling armed conflicts between different ethnic groups. The pervasive nature of gunshots in the region makes it difficult for communities to distinguish flood warnings from other contexts, contributing to a sense of uncertainty and potentially reducing the effectiveness of this signaling method.

The communities also employ traditional loudspeakers as an integral component of their disaster response mechanisms. These traditional amplification devices are sourced either from local administrative offices or acquired through personal means, often stored within the residences of community elders for accessibility during emergencies. Informants have also highlighted instances where external entities, such as non-governmental organizations (NGOs), have supplied these communities with loudspeakers.

According to informants, there are dedicated individuals tasked with disseminating emergency information throughout the various hubs within their settlements. These individual warning tellers harness existing social frameworks and communication channels to bridge the information gap within their community, recognizing the constraints posed by the scarcity of modern communication technologies. The social network's approach not only ensures wider reach and engagement among the populace but also fosters a sense of unity and cohesion as information flows seamlessly through the familiar channels that have long served as the lifeblood of their interconnected society.

Moreover, while state and local TV and radio stations serve as additional channels for information dissemination, the agro-pastoralist community of South Omo remains largely disconnected from technological advancements since most of them do not have access and even those who have, face frequent outages of electricity. Similarly, the use of phones is limited or constrained by similar problems. In this remote enclave, where the rhythms of life are attuned to the land and sky, access to modern communication tools is limited, rendering these external platforms less effective in reaching the community's core. Compounding this challenge is the prevalent use of Amharic, the official language of communication, which may present a difficulty for residents who have had minimal exposure to formal education or interactions with external cultures. For those whose world revolves around the cycles of nature and the traditions of their ancestors, the nuances of a language they don't sufficiently understand pose a significant obstacle in the reception of crucial information that could impact their lives and livelihoods.

Once the floods are forthcoming, the community members prioritize going to their usual gathering place first, followed by securing their grain and ensuring the safety of their animals. However, when asked about a designated safe zone for evacuation,

respondents mentioned that although there is a place to go during flood situations, it is not considered entirely safe because the flood may suddenly catch them in their new place of relocation. For the Nyangatom, for example, the safe zone is located approximately 3.5-4 km away from their homes, a place known as Napuzumeriya. There are also designated evacuation zones identified for the Karo; people have been evacuated to the Labuk Kebele¹⁰ during past flood events. However, these evacuation sites often lack the necessary infrastructure and facilities, such as adequate food, water, and sanitation and are therefore unable to properly support the displaced populations. Where food or clothing is provided, this is often dependent on international aid. Once they are evacuated, there is often little follow-up by the local authorities. Often international aid is “intercepted” before it can reach them. Some food and malaria nets are provided but little else. In recent floods in March 2024, the schools and government administrative buildings were damaged. Socio-religious institutions, such as churches mosques, and *idirs* (self-help associations with a religious component) are used to assist in the provision of flood warnings.

In traditional societies, women are often limited by their societal roles, primarily focused on managing households and caring for children. Furthermore, they are more likely to have restricted educational opportunities and proficiency in languages like Amharic or English. These limitations result in a range of difficulties: (i) women and girls are at higher risk following natural disasters due to their constrained ability to speak out and act independently; (ii) women frequently lack the financial resources and tools to effectively respond to disasters and reduce their vulnerability, impacting their capacity to deal with future challenges; and (iii) women often do not have access to early warning systems, as these are typically communicated in public areas, while women spend most of their time at home looking after children and managing household tasks.

4.3. Strengths, challenges, and effectiveness

In evaluating Indigenous EWSs in South Omo, it is important to assess their strengths, weaknesses, and effectiveness so that whatever works well can be developed and integrated into the formal system. It is also equally important to acknowledge the weaknesses, including limitations in scalability, dependencies on individuals, lack of formal documentation, and inadequate infrastructure, which can pose challenges to the reliability, sustainability, and broader applicability of these indigenous early warning systems.

4.3.1. Strengths

¹⁰ Kebele is the lowest administrative unit in the government structure.

The first strength of indigenous EWSs is their cultural relevance. They are deeply ingrained in the spiritual, cultural, and historical fabric of the community, embodying traditions passed down through generations. These practices, rooted in a spiritual connection to the environment, hold significant cultural value as they bridge the past with the present and offer a unique perspective on disaster risk reduction that resonates with the beliefs and values of community members. These honored traditions not only strengthen their resilience to floods but also preserve their rich cultural heritage and identity.

Secondly, community ownership stands as a cornerstone of the indigenous EWSs in South Omo, which fosters a sense of empowerment and resilience within the local population. This ownership is not merely about implementing prescribed solutions but involves active participation and engagement from community members at every stage of the process. Through communal decision-making, shared responsibilities, and collective action, individuals become stewards of their safety and well-being. This sense of ownership instills a commitment to preparedness and response efforts, as community members recognize the importance of their contributions to safeguarding lives and livelihoods. Moreover, by taking ownership of these mechanisms, communities cultivate a sense of self-reliance and agency, enabling them to adapt and respond effectively to the dynamic challenges posed by floods.

The holistic approach of Indigenous EWSs in South Omo represents a fusion of spiritual, environmental, and practical wisdom, intertwining traditional knowledge with modern scientific insights to address flood risk comprehensively. These mechanisms embrace the interconnectedness of various factors influencing disaster preparedness beyond conventional forecasting methods to encompass a multifaceted strategy that not only predicts floods but also incorporates cultural beliefs, community practices, and environmental indicators into a cohesive framework. This holistic perspective not only enhances the effectiveness of early warning systems but also strengthens community resilience by recognizing and addressing the diverse aspects of flood risk mitigation in a unified and integrated manner.

The concept of rapid response within the Indigenous EWSs in South Omo reflects the community's ability to swiftly and effectively react to imminent flood threats based on timely alerts and traditional knowledge. This proactive approach enables community members to mobilize resources, implement preparedness measures, and evacuate vulnerable areas promptly, reducing the potential impact of flooding on lives and property. They leverage local insights and spiritual foresight and facilitate quick decision-making processes that are grounded in a deep understanding of the environment and historical patterns of flooding. This rapid response capability not only minimizes the loss and damage caused by floods but also underscores the agility and resilience of the community in adapting to dynamic and unpredictable natural hazards.

Social cohesion plays a pivotal role within the Indigenous EWSs in South Omo, fostering unity, collaboration, and collective resilience within the community in the face of flood risks. These mechanisms not only serve as tools for disaster preparedness but also as catalysts for strengthening the social fabric and bonds among community members. Participation in communal rituals shared decision-making processes, and joint efforts to implement response measures create a sense of solidarity and mutual support that transcends individual interests. Engaging in collective actions to address flood threats, community members build trust, empathy, and a shared sense of responsibility towards one another, reinforcing a culture of cooperation and reciprocity. This social cohesion not only enhances the effectiveness of early warning systems but also builds a foundation of resilience that enables the community to weather challenges and bounce back stronger in the aftermath of floods.

4.3.2. Challenges

Examining the limitations of Indigenous EWSs in South Omo indicates significant areas that can hinder their efficiency and sustainability. These weaknesses, ranging from scalability issues to dependencies on individuals and infrastructural limitations, underline the challenges faced in ensuring the reliability and effectiveness of these traditional systems in the face of evolving environmental threats.

The limitation of reliability and accuracy within Indigenous EWSs in South Omo stems from the subjective nature of spiritual aspect of forecasting methods, which may lead to potential misinterpretation or false alarms. The point of accuracy of spiritual predictions is contentious. These methods are believed to be accurate from the community's point of view. Community informants argued that all hazards that have occurred before have been accurately predicted. If a predicted hazard does not occur, it should not be seen as a failed prediction by the elders. Instead, it should be attributed to the collective prayers of the community. From the perspective of expert informants, visions, dreams, and signs interpreted by spiritual leaders or elders, although significant within the community, may not always align with scientific meteorological data or provide consistent and verifiable predictions. In either case, the reliance on individual interpretations for early warnings introduces a level of uncertainty and ambiguity that could impact the overall preparedness and response efforts, highlighting the need for a balanced integration of traditional and modern approaches to enhance the reliability and accuracy of flood forecasting in the region.

One of the limitation of Indigenous EWSs in South Omo is their limited scalability, stemming from their specificity to local contexts and challenges in integration with broader or modern forecasting systems. These traditional mechanisms, deeply rooted in cultural practices and community knowledge, may lack the adaptability and standardized protocols necessary for wider application across larger regions or

diverse communities. As a result, the effectiveness of these mechanisms in addressing flood risks may be constrained to specific areas or groups, limiting their reach and impact on a broader scale. Moreover, the lack of standardized procedures and data-sharing mechanisms could impede collaboration with external agencies or organizations involved in disaster management, hindering efforts to coordinate responses and share best practices across different regions.

A significant limitation within Indigenous EWSs in South Omo is the dependency on specific individuals, such as spiritual leaders, elders, or key community members, for visions, dreams, or interpretations that inform the early warning process. Reliance on individual insights or intuitions for forecasting floods can create vulnerabilities within the system, particularly if these individuals are unavailable, incapacitated, or if their interpretations are inconsistent or unreliable. The absence of a structured and collective approach to early warning generation and dissemination may lead to delays in response efforts, misinterpretations of signals, or a lack of continuity in the transmission of critical information across generations. This dependency on individuals not only introduces risks of miscommunication and errors but also underscores the need to establish mechanisms that promote the sharing of knowledge, diversification of expertise, and the cultivation of a more decentralized and resilient early warning system that is less reliant on specific individuals for its effectiveness.

The lack of formal documentation within Indigenous EWSs in South Omo presents a critical limitation, as the absence of written records and systematic documentation hinders the preservation and transmission of valuable traditional knowledge essential for anticipating and responding to flood events. Without formal records, the risk of losing key insights, predictive indicators, and response strategies increases, limiting the ability of communities to integrate indigenous practices with modern scientific approaches or establish standardized frameworks for disaster risk reduction. Documenting and cataloging Indigenous knowledge and EWSs enables communities to safeguard their cultural heritage and enhance the resilience of their traditional practices in the face of environmental challenges, bridging intergenerational gaps and fostering credibility in disaster management collaborations.

A critical limitation within Indigenous EWSs in South Omo is also the presence of inadequate infrastructure to support effective communication, data collection, and response coordination during flood events. Limited access to reliable communication networks, such as telephone lines or internet connectivity, impedes the timely dissemination of early warnings to at-risk communities, hindering their ability to prepare and respond proactively. Additionally, the lack of robust data collection systems and monitoring equipment in remote areas may compromise the accuracy and reliability of flood forecasts, diminishing the effectiveness of early warning systems. Insufficient physical infrastructure, such as flood shelters, evacuation routes,

or emergency supplies, further exacerbates the vulnerability of communities to the impacts of flooding, limiting their capacity to mitigate risks and ensure the safety of residents during emergencies.

All informants agree that there is a significant gender disparity in terms of participation in predicting or responding to hazards and disproportionate impacts of hazards on different genders, which can be considered as another limitation of Indigenous EWSs. The spiritual and ecological aspects of prediction are prerogatives of men, often knowledge and authority associated with male roles. Informants have however argued that women and children are given priority in evacuations and any aid should consider such vulnerable sections of the community. Yet, in case of disasters happening, it is also these sections of the community who are primary victim. Yet, informants argued that women and children are often disproportionately affected by disasters due to biological factors. For example, children and pregnant women have unique vulnerabilities and nutritional needs, and elderly individuals have age-related concerns.

Securing adequate funding presents a significant obstacle. Ideally, the implementation of Indigenous EWSs should be contingent upon the availability of local emergency funds, whether in the village or immediate area. However, frequently these funds are centralized at the district or regional levels, complicating the distribution and management processes. Moreover, resources and capabilities at the grassroots level are often scarce, necessitating robust connections with intermediary administrative tiers (Jackson, 2010; Isaak & Yusuf, 2010). Additionally, a recurring issue is the cessation of EWS initiatives once associated projects conclude, highlighting a lack of integration within formal government structures and the absence of a dedicated institutional and legal framework for sustained operation (Tekle & Adamu, 2009).

4.3.3. Opportunities

Informants agree that the flooding is not without opportunity. A Karo informant elaborated on the positive aspects of the recurrent floods, emphasizing that while the flooding presents challenges, it also brings forth opportunities, especially in the realm of recession farming. He acknowledged the fertile soil deposits left behind by the receding waters, and the informant highlighted the potential for utilizing these enriched lands for agriculture during the post-flood period.¹¹ Several studies have also assessed the challenges and opportunities of river recession farming in South Om (Desta, Legesse, Ahmed, Muluneh, & Birhanu4 2024; Yazew, Mezgebu, Embaye, Teka, Alemu, (2015).

¹¹ Demo Lale, M, 56, Karo

4.3.4. Effectiveness

Indigenous EWSs have been extensively documented and put into practice in various regions, notably in Asia (Gautum & Phaiju, 2013; Lassa & Sagala, 2013; Perez, Espinueva & Hernando, 2007). These studies have provided noteworthy successes that have been achieved with non-disease-specific community-based early warning systems (Macherera & Chimbari, 2016, p.1). Valuable insights have been gleaned from their effectiveness in regions susceptible to sudden-onset disasters, particularly in Asia and urban settings (Mercy Corps and Practical Action, 2010). However, there remains a dearth of information regarding their implementation within pastoralist communities in the Horn of Africa. According to Jackson (2010, p. 9), the efficacy of traditional coping mechanisms has diminished, with pastoralists facing constraints on their traditional practices. Factors such as land privatization and restricted access to water sources have restricted their mobility and livelihood options. Consequently, the disaster risks confronting pastoralists and agro-pastoralists have evolved into complex, interconnected challenges.

While quantifying “effectiveness” remains challenging, insights from informants in South Omo shed light on the efficacy of these institutions. According to the informants' opinion, indigenous methods excel in accurately predicting flood occurrences by leveraging traditional wisdom and local cues. Notably, communication effectiveness emerges as a standout feature, with the community efficiently relaying early warnings through local networks, ensuring widespread and timely dissemination of alerts. Furthermore, active community participation in decision-making, preparedness initiatives, and response strategies stands as a linchpin for the efficacy of these early warning systems. Regular monitoring and evaluation are deemed essential to pinpoint deficiencies, gauge performance, and iteratively enhance the early warning mechanisms over time.

4.4. Relationship with formal structures

The Disaster Risk Management Commission (DRMC), previously known as the National Disaster Risk Management Commission, is a pivotal governmental body tasked with overseeing and coordinating disaster preparedness, response, and recovery efforts across Ethiopia. In its current structure, it is directly accountable to the office of Ethiopia's Prime Minister. It is the office established to address the country's risks to various natural and man-made hazards. The DRMC also plays a crucial role in formulating policies, strategies, and action plans aimed at mitigating the impact of disasters on communities and infrastructure (DRMC, 2024). At the level of Ethiopia's regional governments, this office is structured under the Bureau of Agriculture. The office also exists in zonal and woreda levels, Ethiopia's government structures in descending order. DRMC works closely with regional and local

authorities, as well as national and international partners, and it strives to enhance resilience, promote EWSs, and facilitate effective disaster response mechanisms to safeguard lives, property, and livelihoods in the face of emergencies (DRMC, 2024).

Another relevant institution is the Ethiopian Metrological Institute (EMI), previously known as the National Meteorological Agency. It is tasked with weather forecasts (EMI, 2024). According to an expert interview at DRMC, in the event of disasters, various levels of government, including district, zonal, regional, and federal entities, participate in the early warning processes. All administrative and management structures, along with agricultural structures, are likely involved in the dissemination of early flood warnings. In terms of administrative and institutional chains, various levels of government are involved in the EWS processes.

Based on the information provided during the interview in South Omo, the formal mechanisms are not as effective as they ought to be. It was found that the community does not typically receive flood warnings in advance from the government structure. Community members are not aware of any government warning system in place, which the respondents acknowledged would have been valuable. Informants argued that any form of warning or communication regarding floods usually occurs after the incident has already taken place. In such cases, either a person is sent to inform the community or a letter is sent. The messaging of flood warnings is not consistently accessible to all segments of society, lacking consideration for social and cultural practices. Informants from the local government offices also admitted that there are no regular and structured EWSs communicated to the communities.¹²

During the devastating 2006 floods in South Omo, a concrete example of a delayed and ineffective state response can be exemplified by the scenario in which a remote village, located along the riverbanks, faced imminent danger as floodwaters surged. Despite the village leaders alerting the regional authorities about the rising water levels and the potential for a catastrophic flood, the state response was sluggish and disorganized. Due to bureaucratic delays and a lack of preparedness, the warning was not escalated swiftly to higher levels of government for necessary action. As a result, essential resources such as emergency aid, evacuation assistance, and medical support did not reach the village in time. The delayed response exacerbated the situation, leading to preventable loss of lives, displacement of families, and destruction of property. In this example, the inefficacy of the state response during the 2006 floods in South Omo underscores the critical need for timely and coordinated actions to mitigate the impact of natural disasters on vulnerable communities. According to an informant:

¹² Mesay Leben, M, Daasanach, Woreda Prosperity Party (ruling party) Head

Consistent shortcomings arise whenever emergencies occur. We visit local offices and express our concerns, warning them about potential weather-related disasters like floods. Regrettably, the response often seems nonchalant, with authorities reassuring us that there's no cause for alarm. However, when the inevitable crisis strikes, state officials intervene only after the damage is done: homes are already submerged, livelihoods devastated, and possessions lost. Subsequently, we are relocated to designated areas, but crucial aid arrives belatedly, leaving us grappling with hunger and deprivation. This cyclic pattern of response remains distressingly familiar and dishearteningly predictable.¹³

There are some instances of collaboration between what they call community-based EWS and the formal system initiated by NGOs such as Save the Children UK Ethiopia, USAID, and Farm Africa. These collaborations contain some examples of leveraging community-developed EWSs. According to Save the Children Ethiopia (2011) which ran a project the main objective of the project includes transforming at-risk communities into prepared disaster-resilient communities. They used community-based EWSs to complement the national EWS. This is because communities do not have the resources to respond to all types of disasters at the local level but can inform the national EWS (Macherera & Chimbari, 2016, p.6). The 2014 Ethiopia policy and strategy on disaster risk management (FDRE, 2014) underscores the significance of decentralized and community-centered approaches in tackling disaster risks, highlighting the importance of local engagement and empowerment. While this focus is pivotal for effective disaster preparedness and response, a critical gap exists in the policy's neglect of indigenous knowledge systems that could significantly enhance these efforts.

5. Conclusion and recommendations

5.1. Conclusion

The Indigenous communities of South Omo have rich EWSs blending spiritual, ecological, and technical knowledge. These intricate systems, honed over millennia, have been a lifeline for the community, including in contemporary times where formal early warning infrastructure is scarce. While it is imperative to acknowledge the limitations inherent in these traditional methods, it is equally crucial to appreciate their strengths. It is useful to tap into these age-old practices and integrate them with modern technologies and knowledge. This synergy not only fortifies the resilience of the community but also opens doors to a more effective and sustainable early

¹³ Summary of FGD participants, Karo

warning framework. Embracing the complexities and nuances of these indigenous systems, it is possible to pave the way for a more inclusive and adaptive approach to disaster risk reduction. Leveraging the strengths of these traditional mechanisms alongside contemporary tools and methodologies can forge a path towards a more robust, community-centered early warning system that is deeply rooted in the wisdom of the past and poised to meet the challenges of the future.

5.2. Recommendations

This research joins the academic and policy literature that widely acknowledges the integration of indigenous and modern early warning and disaster prevention systems (Vasileiou, Barnett & Fraser 2022). However, there is no one way of doing such integration. But, it is imperative to acknowledge the limitations inherent in these traditional methods, it is equally important to appreciate their strengths. These systems, rooted in the deep understanding of the land, its rhythms, and the interconnectedness of all living beings, offer a holistic approach to forecasting and responding to potential threats. It is useful to tap into these age-old practices and integrate them with modern technologies and knowledge. This synergy not only fortifies the resilience of the community but also opens doors to a more effective and sustainable early warning framework. In embracing the complexities and nuances of these indigenous systems, it is possible to pave the way for a more inclusive and adaptive approach to disaster risk reduction. In light of this general recommendation, the following more specific recommendations can be made.

- a) To enhance the reliability and accuracy of EWSs in South Omo, it is important to address the inherent limitations stemming from the subjective nature of spiritual or traditional forecasting methods. While these methods hold cultural significance, their potential for misinterpretation or false alarms may pose a challenge in predicting floods with precision. To overcome this, it may be possible to implement a hybrid approach that integrates indigenous knowledge with scientific meteorological data. This integration will not only enhance the credibility of early warnings but also foster greater trust among external stakeholders and facilitate more effective communication regarding impending flood events. Moreover, by supplementing individual interpretations with empirical data, it is possible to reduce uncertainty and ambiguity, ultimately improving overall preparedness and response efforts in the face of natural disasters. This balanced approach acknowledges the cultural heritage of Indigenous forecasting while leveraging scientific advancements to strengthen the resilience of communities in South Omo against flood risks.
- b) To enhance the effectiveness and scalability of indigenous EWSs in South Omo, it is important to develop a framework that bridges traditional practices with modern forecasting systems while fostering collaboration and standardization. It

may be important to establish a platform that facilitates the integration of indigenous knowledge with contemporary forecasting technologies, ensuring that local insights complement and enrich broader predictive models. This approach can enhance the adaptability and interoperability of EWSs, enabling them to address flood risks more comprehensively across diverse regions and communities. Additionally, implementing standardized procedures and data-sharing mechanisms is vital to promote coordination with external agencies and organizations, fostering collaboration and the exchange of best practices in disaster management.

- c) To address the significant limitation within EWSs in South Omo arising from dependency on specific individuals for early warning generation, it is important to transition towards a more structured, collective, and decentralized approach to forecasting and dissemination. It is useful to establish mechanisms that promote knowledge sharing, diversification of expertise, and the cultivation of a resilient system that is less reliant on individual interpretations. Encouraging community-wide participation in the early warning process, fostering a culture of collaboration and information exchange, and formalizing protocols for data collection and interpretation can help mitigate the risks associated with dependency on specific individuals. Implementing training programs to build capacity across a broader spectrum of community members and integrating traditional knowledge with modern forecasting techniques can enhance the robustness and reliability of the early warning system. It is possible to foster a more inclusive and decentralized approach and strengthen the effectiveness and sustainability of its Indigenous EWSs, ensuring timely and accurate responses to flood events while reducing vulnerabilities associated with individual dependency.
- d) To address the critical weakness of the lack of formal documentation within EWSs in South Omo, it is important to introduce a systematic recording and preservation of traditional knowledge for effective disaster risk reduction. A key recommendation is to establish formal mechanisms for documenting indigenous practices, insights, and response strategies related to flood events. Creating written records and cataloging this valuable information can ensure communities' continuity and transmission of essential knowledge across generations. Documenting Indigenous EWSs not only safeguards cultural heritage but also strengthens the resilience of traditional practices by enabling their integration with modern scientific approaches and the development of standardized frameworks for disaster preparedness and response. This documentation serves as a foundation for building credibility in disaster management collaborations and enhances the ability of communities to adapt to environmental challenges while bridging intergenerational gaps.

- e) To address the weakness of inadequate infrastructure within Indigenous EWSs in South Omo, it is important to invest in enhancing communication networks, data collection systems, and physical infrastructure. This can be achieved by improving access to reliable communication technologies, implementing robust data collection mechanisms, and developing essential physical structures like flood shelters and evacuation routes. Community training programs can be conducted to empower residents in utilizing EWSs effectively while developing collaborations with external agencies that can provide additional resources and expertise for infrastructure development and capacity building.
- f) To address the significant gender disparity within Indigenous EWSs in South Omo, it is important to promote gender equality through gender-sensitive training, the promotion of inclusivity in leadership roles, equitable distribution of responsibilities, challenging prevailing power dynamics, and utilizing gender-disaggregated data for tailored response strategies. Empowering both men and women to actively participate in decision-making processes recognizes and addresses gender-specific vulnerabilities, and fostering a culture of inclusivity and respect, South Omo can create more effective and equitable EWSs that leverage the diverse strengths and perspectives of all community members in preparing for and responding to natural disasters.
- g) To overcome the significant obstacle of securing adequate funding for Indigenous EWSs, it is important to establish mechanisms that ensure the availability of local emergency funds at the village or immediate area level. Building strong connections with intermediary administrative tiers can facilitate the flow of resources from centralized funds to grassroots levels, enhancing the sustainability and effectiveness of EWS initiatives.
- h) Moreover, it is crucial to emphasize the importance of integrating Indigenous EWSs within formal government structures. This can be achieved through the establishment of a dedicated institutional framework supported by appropriate legal mechanisms to ensure their continuous and effective operation.

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