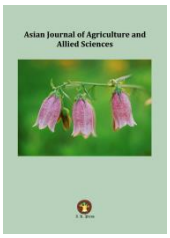

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The Impact of Gibe III Hydro Dam-Induced Flood Disaster and Its Influence on the Livelihood of the Dassenech, South Omo, Ethiopia

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Even though the government has invested huge resources at upstream of the Omo River basin, it has not adequately considered either the rights of the Lower Omo ValleyValley downstream vulnerable pastoral and agro-pastoral communities or the induced flooding disaster risk that it poses on the live and livelihood system of the villagers. The crisis unfolded because of the Gibe III dam, which induced disaster for the Dassenech people. Such an effect disrupts the entire subsistence economy and livelihood system of the Lower Omo Valley Dassenech communities, not only food security severely threatened their survival system and transboundary regional peace and

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security as well. This destruction of pastoral and agro-pastoral livelihoods swiftly produced major humanitarian disasters including recurrent occurrences of flooding and drought in the area, with widespread conditions of starvation, disease, and spiral interethnic armed conflict in the tri-nation border region as groups desperately compete for vanishing resources. Mitigation and compensation measures related to the dam's impacts are wholly inadequate, even undermining the existing subsistence livelihood, impoverished socio-economic, and politically vulnerable and marginalized pastoral and agro-pastoral villagers of the Dassenech.

Keywords: Hydro dam – induced; flood disaster; Omo river; induced effect; livelihood system; Dassenech people.

1. INTRODUCTION

"There is scientific consensus on the alteration of global climate that has taken place as a result of human interference (i.e., climate change), and caused, and will continue to cause, impacts on natural and human systems, including peoples and societies around the world" [1]. "These impacts are expected to become more pronounced in recent decades. It may lead to livelihood losses because it increases and threatens the provision of ecosystem services. As a result of such changes in the ecosystem services severe extreme weather events become common phenomena [2-6]. Among these the impact of flooding become a series concern that takes lives away and destroys infrastructure, resulting in livelihood and productivity losses. Yet at the same time, they have caused tremendous losses and resulted in untold suffering for millions worldwide. The damage caused by floods to people and property across the planet has been extremely severe in recent decades" [36]. Even today, floods lead to all-natural disasters in the number of people affected, resulting in economic losses and rising alarmingly [7].

"Most disaster in the country is caused by river overflow when prolonged rainfall causes rivers to overflow and inundate lowland plains. Among the major river flooding disaster-prone areas are part of Oromia and Afar regions lying along the mid- and downstream plains of the Awash River; part of the Somali region along the Wabishebelle, Genale, and Dawa rivers; low-lying area of Gambella along the Baro, Gilo, and Akobo rivers; downstream area along the Omo river, and extensive floodplains surrounding lake Tana, and the Gumara and Rib river in Amhara" [8]. "Indeed, in the years between (2023 and 2024) in Ethiopia, flooding disasters from heavy rainfall and river overflow have severely affected an estimated 1.5 million people, mainly in the Somali, Oromia, Afar, South Ethiopia, and Gambela regions. An estimated 632, 700 people have been displaced, 57 deaths and affected thousands of livestock, damaging and destroying infrastructure and crops and farmlands" (OCHA, and UNICEF, 2023). Among these regions, Southern Lower Omo Valley pastoral and agro-pastoral communities were severely affected as a result of recurrent occurrences of Omo River flooding. Specifically Dasenech pastoral and agro-pastoral has experienced the worst floods disaster with a devastating livelihood impact in the year between 2023 and 2024. Unseasonal Gibe III dam reservoir artificial flooding resulted in the overflow of the Omo River and inundated 28 of the 40 kebeles in the Dassench woreda. This research therefore explores Hydrodam-induced flood disasters and their influence on the livelihood of the Dassenech in South Omo Ethiopia.

2. LITERATURE REVIEW

"Throughout the history of mankind, floods have brought untold wealth and prosperity to civilization, as well as means of livelihood systems in most lowland areas across the Globe. Flood retreat farming is mostly practiced in arid and semi-arid areas and it is a unique form of water resources development and management that often uses water supply from ephemeral streams for various agricultural activities" [9-11]. "It is climate-smart agriculture that can be widely applied for crop production, agro-forest and range land management, and domestic and livestock water supply. Flood retreat farming can be expressed through; spate irrigation – direct diversion of flashy floods into the downstream command area; flood inundation and recession – river overflow their embankments and flood adjacent areas; flood spreading weirs – direct division/storage of flashy flood into the upstream side command area" [12]. Across the world flood based farming systems account for over 15-30 million hectares [13].

"It also supports around 75 million most vulnerable segments of society around the world.

Furthermore, it covers over one and half million hectares in Ethiopia as well as borders counts of Kenya and the potential could be higher" [13]. In Ethiopia, it is widely practiced in areas like the Omo Ghibe River, Raya Valley, Kobe, Fogera/lake Tana, Baro Akobo, Wabishebele, Upper Awash/Becho Plains, etc. Arid and semi-arid areas of Ethiopia mostly practice flood-based farming systems [13]. "Flood–based farming systems represent a unique option for the management of scarce water resources in support of agricultural production and livelihoods of marginalized populations in many arid and semi-arid parts of the country. Spate irrigation and zero-tillage farming are one of the traditional agricultural practices employed by farmers, and agro-pastoralist to supplement their livelihoods. It mainly occurs in areas where flat lands or lowland areas" [13]. "These ephemeral streams are also sources of fertile sediments which are characterized by deep and fertile soil suitable for flood recession agriculture as a result of alluvial deposition. Most spate irrigation is found in the Middle East, North Africa, West Asia, East Africa, and parts of Latin America" [13]. In Ethiopia, it is practiced in many parts thus, the lowland of the Omo Ghibe basin is one practiced by the Omo River surrounding downstream agro-pastoralist communities of South Omo (Dassenech, Hamer, Nyagatom, and Selamago.).

"Despite that, recent years as a result of human interference altered flooding disasters around the globe, and thus an increasing number of various studies are modeling the impact of global climate change on floods, with the main focus on changing magnitude and frequency of the flood events" [37] (Gain et al., 2013; Raff et al, 2009). Which become among the most frequently occurring and deadly natural phenomena, affecting an average of 520 million people a year [14]. However, future projections of the meteorological triggers, including heavy precipitation and snowmelt may change differently and later characteristics of the flood event [15]. As a result, "factors related to the casual sort of flood disaster like seasonality and triggering conditions need to be addressed next to the change in frequency and magnitude of flood" [16]. However, if floods are well managed, they can serve as sources of livelihood and survival systems. In many parts of the Blue Nile countries, flood is the only opportunity where sources (Agriculture, hydropower, agroforestry, etc) of livelihood can be improved. However, flooding may also frequently occur as a result of anthropogenic activities including unplanned growth and development in floodplains or from a dam or embankment giving way [17-20].

In Ethiopia, in the years between 2023 and 2024, heavy rainfall and river overflow have severely affected millions of people across various regions of the country. In the southern part of the country, lower Omo Valley downstream pastoral and Agro-pastoralist communities of Dassench people experienced the worst flooding disaster and caused tremendous damage to lives and livelihood systems. Local pastoral and agro-pastoral people perceive and believe that the Omo River flood will continue to cause serious economic and environmental losses due to unanticipated government intervention upstream of the Omo River basin. This signifies the inappropriateness of government development programs in the upstream basin [8,21,12,22].

"Pastoral and Agro-pastoralist communities of Dassench people in the valley of the Omo River basin practice flood-based farming which is limited to flood recession agriculture" (Admas, 1992). "In the water resources study of [23] the Omo Ghibe River Basin, flood recession is categorized as a land use class associated with the delta of the river, and it is also mentioned to occur in narrow bands along the banks of the lower Omo valley. With the developmental intervention upstream of the Omo river basin - the Omo Ghibe I, II, III hydropower development dam projects, the flood recession agriculture has been affected seasonally as a result of hydro dam-induced flood disaster in the area. As a result, the pastoral and agro-pastoralists are unable to cope with the effects of the fluctuating nature of the Omo River as well as its related impacts. The perception that many local people believe that hydro dam-induced floods will continue to cause serious livelihood and environmental losses".

2.1 Gibe III Hydro dam-induced Flood Disaster

According to IGAD [13], the Omo Ghibe basin is one of the most important water resource basins in Ethiopia as it carries close to 13% of the annual surface water resource of the country, next to Abay and Baro-Akobo. Moreover, the basin is one of the largest hydropower potential next to Abay. Despite these huge resource potentials, the Ethiopian people in general and the people in the basin in particular so far benefited little [21].

"Even though, the Omo River is mostly considered a lifeline for southwest Ethiopia's indigenous lower Omo Valley pastoral and agro-pastoral peoples whose food security and economy depend on the rivers and seasonal flooding and subsequent flood-retreat cultivation of the riverbanks" [24]. The lower Omo valley is the home of an estimated 500,000 people, a significant number of who practice traditional pastoralist and agro-pastoralist livelihoods [24]. At least eight distinct Indigenous communities depend on the river flood cycle within the isolated lower Omo valley: The Mursi, Bodi, Muguji (Kwegu), Kara, Hamer, Besheda, Nyangatom, and Dassench. Although many keep livestock, cultivation is essential to local livelihood as grasslands are becoming more degraded and herding more vulnerable as a result of recurrent occurrences of drought.

2.2 Livelihood Vulnerability of Dassenech

A 'livelihood may be defined as a level of wealth and of stocks and flow of food and cash which provide for physical and social well-being and security against poorer or marginalized social groups (Niekerk, 2011). The poverty line and other definitions of deprivation are based on flows (eg. Income), and on assets or reserves that can be disposed of in emergencies (drought, flooding, etc). Assets such as land, livestock, etc reduce vulnerability and act as buffers to shocks [25,26,13,27]. The strength of a given livelihood system is measured by its productive outcomes, but equally by its resilience to shocks, seasonal change, and trends. Shocks might include flood disasters, conflict, and economic downturns. More gradual and often predictable, trends in politics and governance, technology use, economics, and availability of natural resources, can pose serious obstacles to the future of many livelihoods of the lower Omo valley Dassenech people. These changes impact the availability of assets and the opportunities to transform those assets into a "living". Under such conditions, people must adapt existing strategies or develop new strategies to survive (Niekerk, 2011). Even though**,** most marginalized social groups (pastoral and agro-pastoral communities) in arid and semi-arid areas of the lower Omo Valley – Dassenech livelihood system were the most vulnerable to the effects of multiple shocks due to hydro dam-induced flood disaster in the area including drought, food insecurity, displacement among others which as well accompanied with various factors.

3. METHODS

3.1 Study Area

Dassenech District, which is found in South Omo of the former SNNPR state in Southwest Ethiopia. It is 860 km away from Addis Ababa and 205 km from Jinka. The woreda is bounded by Hamer woreda to the North and east, Kenya to the south, and Nyangatom woreda to the west and Northwest. The woreda covers a total area of 234,274 ha, with elevation ranging from 275 meters to 400 meters above sea level, and is found at a latitude and longitude of 4 48 HYPERLINK "https://geohack.toolforge.org/geohack.php?pagename=Omorate HYPERLINK "https://geohack.toolforge.org/geohack.php?pagename=Omorate&params=4_48_N_35_58_E_region:ET-SN_type:city(3363)"& HYPERLINK "https://geohack.toolforge.org/geohack.php?pagename=Omorate&params=4_48_N_35_58_E_region:ET-SN_type:city(3363)"params=4_48_N_35_58_E_region:ET-SN_type: city(3363)". It has only one Agroecological zone - Kolla (100%). The mean annual rainfall of the Woreda is about 350 mm. The annual mean temperature ranges from 30C to 40C (Dassenech Woreda Pastoral Development office, 2023). The Dassenech are the people who speak an East Cushitic language and live in Ethiopia and Kenya border on the northern shore of Lake Turkana and further north along the Omo River. The population is estimated at 48,067 (CSA 2007: 84) and according to Woreda Health Centre the population of Dassenech is currently estimated to be above 80,000. According to unpublished data from the South Omo Zone Administration, the land area of the Dassanech is 2,575 sq km. Until 2006, the area was part of the administrative unit of Kuraz woreda. Following the 2006 administrative restructuring, Dassanech land was elevated to a District (Woreda) level with its capital at Omorate, some 852 km south of Addis Ababa. The Dassanech Woreda is divided into 40 units called kebele, which nearly 94.8 % of the predominant population is pastoralist and agro-pastoralist.

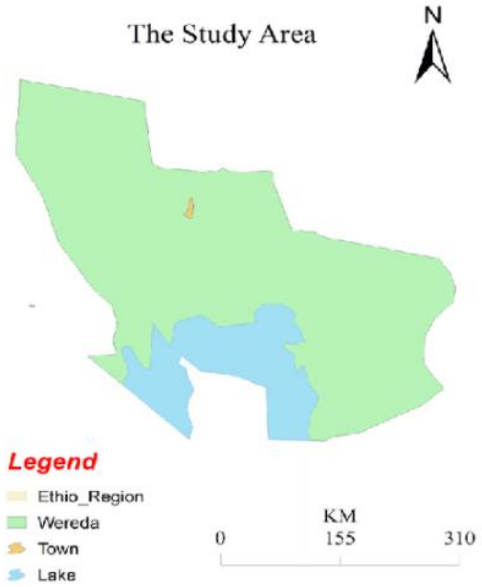

Fig. 1. Map of Dassenech Woreda

3.2 Methodological Paradigm

In social science research, there are three major theoretical paradigms; positivism, phenomenology or interpretativist, and pragmatism. Among these phenomenological or interpretivists, have a long history in philosophy and sociology [9; Bruyn, 1966; Husserl, 1962; Psathas, 1973; Schutz, 1962, 1966). To understand social phenomena from the actor's perspective and point of view and to examine the world they experienced, the researcher employed an interpretivism epistemological paradigm to explore the study area emphasis of this research. The important reality is what people perceive it to be. As Jack Douglas [28] wrote, “The ‘forces’ that move human beings, as human beings rather than simply as human bodies . . . are ‘meaningful stuff.’ They are internal ideas, feelings, and motives.” The interpretativist seeks understanding through qualitative methods, such as participant observation, in-depth interviewing, and others, that yield descriptive data [29]. Therefore, the researcher explores the trends and patterns of the flooding disaster, and its livelihood impacts from the perspective and experiences of pastoralist and agro-pastoralist communities of Dassenech people.

3.3 Study Approach and Design

As Glaser and Strauss [17] “grounded theory”, theory may be said to be grounded to the extent that it is derived from and based on the data themselves. Therefore, due to the exploratory nature of this study, the researcher used a qualitative research design and employed participatory rural appraisal tools and techniques to fill the gaps in the proposed data collection tools of the study. This enables to development of concepts, insights, and understanding about the study area of emphasis in this research paper. As well as to analyze, theorize, or build theory rather than collect data to assess preconceived models, hypotheses, or theories with the assumption that knowledge is constructed. Therefore, to explore and describe the phenomena understudy of this research in a narrative fashion of the identified major themes, the researcher learned from the perspective of the study target population which taps into their interpretations and experiences toward flooding disasters, early warning systems, and its impact on the pastoralist and agro-pastoralist livelihood of Dassenech people.

3.4 Sampling Procedure and Sample Size

Qualitative researchers are skeptical that any conclusions can be broadly generalized to a large population because any effort to generalize extrapolates the characteristics of a sampling unit beyond the context that gives it meaning [29]. There are several different sampling design methods that researchers may employ in sampling study area target populations. The design will likely differ per research type, taking

into account, the purposes of this study and major themes, the researcher employs a purposive sampling procedure by using a non-probability purposive sampling strategy. This enabled for in-depth understanding of the study area emphasis of this research. However, for this study, the sample size is based on the major themes of the study under exploration. Therefore, the researcher tried to select an equal representation from the identified sample respondents of the study.

3.5 Source of Data

The researcher used primary and secondary sources of data for the study. Indeed, the primary sources of data have been collected through key informant interviews, in-depth interviews, Focus group discussions, and case studies, previous research papers related to pastoralists and agro-pastoralist issues especially about the study area and topic were secondary data sources. As well unpublished research, reports, journal articles, and literature on historical, socio-economic, cultural, political, and ecological data, and project Intervention reports by GO and various NGOs working in the area have been used as secondary data.

3.6 Method of Data Collection

Key informant interview: Key informant interviews are qualitative interviews with people who have knowledge and understanding of the specific topics of the study or problem being addressed in the community. Indeed, the researcher conducted key informant interviews with community leaders, elders, social institutions representatives, and development agents. According to Mikkelsen (2005), the representatives of key informant interviews were ordinary people and not necessarily the specialists, and better educated, than those in power or the officials. Therefore, to collect detailed data about the impact of Omo River Flooding and Communities' Vulnerability, Livelihood resilience and coping mechanism, and trends of Communities' livelihood based Flood-retreat Farming practice the researcher purposively selected four at-risk clusters of Omo river flooding and used a total of 16 people as key informant interviewee.

In-depth interview: An in-depth interview is a useful qualitative data collection technique that can be used for a variety of purposes, including needs assessment, program refinement, issue identification, and strategic planning. According to Lisa A. Guion, David C. Diehl, and Debra McDonald (30], in-depth interviews are most appropriate for situations in which the researcher wants to ask open-ended questions that elicit in-depth information from relatively few people (as opposed to the survey, which tends to be more quantitative and is conducted with large numbers of people). To collect and explore detailed information about the trend, and patterns of Omo River flooding, lower Omo Valley downstream pastoral and agro-pastoral communities' livelihood system, and their vulnerability to the effects of disastrous events, as well as mode of adaptation in the past and today twelve (12) interviewees were identified through purposive sampling method.

Focus group discussion: Focus group is considered a reasonable alternative to conduct several individual interviews with participants of the discussion. While, focus group discussion the study provided immense qualitative data or information about the trends and patterns of Omo River flooding, and adaptation and coping strategies as well as effects of hazardous events (drought, flooding, disease outbreak i.e human and livestock, conflict, etc) which is a significant part of the study discussion. Therefore, nearly four (4) focus group discussions have been conducted. , each group constituted of eight (8) participants, and 32 people in total were selected who live a long side downstream of Omo river valley village of Dassenech community.

Case study: Throughout, the data collection process the researcher purposively selected four (4) villages, which is based on their vulnerability and exposure to the effects of the Gibe III hydro dam-induced flood disaster, and its livelihood impact. The villager asked about the impact of flooding disasters on their livelihood activities, resources depended upon, and livelihood outcomes. Details of the subjective aspect, such as feelings, beliefs, impressions, or interpretations enabled an in-depth understanding of the flooding disaster experience of villagers. Semi-structured interviews have been administered to collect data from selected villagers.

3.7 Data Analysis and Interpretation

The data gathered through those above qualitative data collection tools were organized in line with the objectives of this research study via employing qualitative analytical procedures. The data was categorized logically as identified patterns in and between the concepts. Therefore,

the research used content analysis which is guided by the grounded theory approach. The transcribed data was then categorized according to the themes that guided the discussions of this study; finally, all collected qualitative data were analyzed using thematic analysis.

4. RESULTS AND DISCUSSION

4.1 Population, Settlement, and Livelihood Strategies

The lower Omo valley stretches over Dassenech, Hammer, Nyangatom, and Selamago Woredas and is well endowed with both cultural diversity and natural resources. The population within these four Districts of the lower Omo Valley downstream pastoral and agro-pastoral communities is estimated to be about 131,831 of which 50.3% were males and 49.7% were females in the year 2007 (EEPCO, 2009). There are 28,713 households with an average of 4.6 people per household. Of the total population, an estimated 50% are economically active (age 14 – 64), 45% are youth (age 0 – 14) and 2% are elders. The population is predominantly rural with nearly 94.8% living in rural areas. The urban population is estimated to be only about 5.2% (EEPCO, 2009). “The livelihood strategies of the Dasseneh are based on livestock production, flood recession crop production, and fishing (in that order of importance). Animals (especially cattle) are given high social value and represent social status symbols. Hence, they are not meant to be sold or killed except in drastic situations (i.e. food shortage) and socially or culturally justified reasons (eg, festivity). The youth, children, and few adults living in the cattle camp largely subsist on milk and blood. Occasionally, they consume some grain that they bring from the village, where the majority of people live. While the majority of animals are sent to the cattle camp, some milking cows and small ruminants are kept in the vicinity of the permanent villages” (Yntiso, 2012). In general, the livelihood strategies of the Dassenech pastoral and agro-pastoral communities depend on livestock herding, flood recession irrigation agriculture fishery, and other non-farm activities.

Agriculture: “There are different farming systems in the lower Omo, which are influenced by agro-climate and socioeconomic constraints, and these include cereal-based mixed farming systems and flood retreat cultivation” (EEPCO, 2009). Rain-fed crops are cultivated in three out of the four Districts of the lower Omo Valley downstream communities, where flood recession cropping is so much important more specifically at Dassenech communities, due to rainfall at lower altitudes is insufficient to support any rainfed cropping in the area. Labor for hoe cultivation and weeding is the main input and is generally said to be in short supply due to communities' demand for livestock herding, low population levels and poor general health, and oxen non used partly due to traditional indigenous farming systems, cultural objections and also because of losses of diseases.

Flood recession agriculture: “The Omo River rises during the rainy season and overflows its bank to flood the land on the plains at the lower Omo Valley downstream area bordering the river, which permits crops to grow on the residual soil moisture after the floods recede. Further, upstream where the valley slopes are too steep to allow large-scale flooding, areas of recession crops are grown on the river banks, especially where silt has been deposited at bends on the river. Flood recession cropping is important for the lower Omo Valley downstream communities, more specifically for the Dassenech people which supplement their livelihood system from the Omo River. According to various reports, including Dassenech woreda Agriculture and Natural Resource Development Offices” (ANRDO, 2024), for most pastoral and agro-pastoral rural people of Dassenech communities, the grain produced from Omo river flood recession cultivation sufficient for 3 – 6 months for household consumption as well as market sales. Thereafter, they depend on livestock products, small-scale irrigation, food aid from government safety net programs, and NGO emergency and development intervention, even though they are exposed to the effects of recurrent occurrences of drought and food insecurity. Drought and food insecurity in the lower Omo River downstream communities are highly associated with natural factors, inadequate or inappropriate developmental intervention programs, and the socioeconomic base of the population. Uneven distribution and erratic rainfall, floods, landslides, pest infestation, and epidemic diseases of humans and livestock are all considered major factors. On the other hand, less infrastructure, inadequate development intervention necessary agricultural inputs, and others are conceived under second factors. Even though, according to the key informant interview of this study flood recession agriculture significantly declined for the last 5 – 10 years which is mainly caused by the government hydropower dam (Gibe III) development

Fig. 2. Flood recession cultivation Kelem Cluster of the Dassenech (2024)

intervention program upstream, as well as limited agricultural extension support program resulted in deterioration and decline the livelihood system and strategies of the lower Omo valley downstream Dassenech communities.

Irrigated agriculture: "Irrigation farms and schemes are found mainly in the lower reaches of Omo River downstream communities more specifically; Dassenech, Nyangatom, and Selamago communities, even though most are small-scale farms growing high-value crops like sorghum, vegetables, fruits, and forages through using electric-power and diesel pumps, as well windmills to extract water from the Omo river" (EEPCO, 2009). According to one of the informants of this study, from the 40 kebeles of the District, almost 28 kebeles practice small-scale irrigation agriculture for household and livestock consumption as well as for market sales to support their livelihood system. Overall, the level of irrigation-based agricultural development is quite minimal as compared to villagers' flood recession agricultural production system, and damage caused by annual natural, and artificial Omo river flooding released from the Gibe III dam reservoir.

Livestock and Grazing Resources: According to Ethiopian Electric Power Cooperation (EEPCO, 2009), "the livestock population of the lower Omo Valley downstream communities is estimated to be 1.2 million, poultry 71,880, and 132,500 bee colonies. Livestock provides the pastoralists and agro-pastoralists of the southern Omo lowlands has several benefits. The major ones that relate to or are associated with their livelihood include milk, meat, and live animals. The major sources of feed for livestock in the area are natural pasture, aftermath grazing, and crop residues. Natural pastures contributed a greater proportion followed by small-scale irrigation-based forage development and crop residues. An important feed is also obtained from the recession of the flood from the Omo River. A wide range of livestock diseases affect animals due to limited existing veterinary services and severely handicapped by lack of resources, as well as access to other infrastructure (roads, markets, etc) are very poor. Despite that, according to this study, key informant Omo river flood which occurred in the last year" (i.e 2023) caused huge damage to the livestock resources of Dassenech pastoral and agro-pastoral communities which resulted in the loss of one of their significant livelihood assets sources.

4.2 Trends and Patterns of Omo River Flooding

In large parts of the world, wetlands support local populations due to their high productivity, but at the same time are under increasing anthropogenic pressures [31]. This applies particularly to sub-Saharan African countries, where many people directly depend on wetlands for their subsistence livelihoods such as agriculture (livestock production, flood recession agriculture, and fishing (Adams, 1993) [31]. River deltas provide important resources for local communities but are often highly degraded (Syvitaski et al.2009) [32]. "One important driver of delta degradation is the lack of river dynamics and sedimentation resulting from upstream river modifications such as river dams, with implications for the ecology and the livelihood of those who depend on ecosystem goods and services" (Syvitski et al.2009). Large hydroelectric dams like Gibe III provide electricity and provide new opportunities for economic development, but their environmental and social sustainability is increasingly being questioned (Khagram 2004; Riethof 2017; Schapper et al. 2019). A major debate over dam projects and the associated water-energy-food security nexus is ongoing globally (Khagram 2004; Müller-Mahn and Gebreyes 2019).

Ethiopia has the highest hydropower capacity in Africa [27], pursuing a "climate-resilient Green Economy" strategy (FDRE, 2011). The Gilgel Gibe III dam (hereafter “Gibe III”) on the Omo River opened in 2016 is a major component of this strategy: it has doubled Ethiopia's installed electricity capacity and enabled the irrigation of large-scale agriculture schemes at the downstream pastoralist and agro-pastoralist communities (FDRoE, 2011); [33]. Even the construction of the Gibe III dam attracted international attention due to the importance of the free-fowling river for the livelihood system of Omo River downstream pastoralist and agro-pastoralist communities [19] Turton, 2018 “The Omo Delta in Lake Turkana is the home of the indigenous Dassenech people and is particularly important for their livelihood system as it provides water for livestock and humans, sediment, and nutrients for flood-recession agriculture and grazing throughout the year in an otherwise semi-arid region” (Yntiso, 2012) [10].

Traditionally the pastoral and agro-pastoral villagers of the Dassenech people oscillate in appearance, number, and size over the years [10]. Shortly after the wet season, villagers bring their livestock herds to graze on fresh grass, herbs, and shrubs on the wide plains [10]. During the dry seasons, they return to settlement areas with continuous water supply from the Omo River for cattle grazing and agriculture (GoE and EEPC, 2009) and only the young men move with the cattle in search of pasture and water. The occurrences of seasonal natural flooding decreased substantially after the opening of the Gibe III dam [33] (Tebbs et al, 2019). “Since the completion of the dam in the year of 2015, rainwater from the highlands – Gibe and Gojeb catchments is first collected in the dam reservoir and then released continuously through the hydropower turbines, and flooding is controlled by dam releases in combination with rainfall in the remaining catchment below the dam. In parallel, villagization programs have been initiated by the government to encourage pastoralist and agro-pastoralist communities in the lower Omo basin downstream villages towards permanent settlement alongside of Omo River with the assumption to replace their lost livelihoods through irrigation schemes programs” (Kamski, 2016; Department of pastoralist affair, 2004; 2024). Even though sustainable development requires weighing the effects, costs, and benefits of the Omo River basin dam projects (Adams, 1993). “This requires an understanding of the needs of downstream pastoralist and agro-pastoralist communities and their resilience to induced changes” [33]. Such understanding can be gained through the collection of reliable data and by taking a more participatory approach to decision-making.

“Indigenous people of the lower Omo Valley downstream Communities are often neglected in decision-making processes, partly due to the lack of spatially explicit information on their settlements” [34], as is the case for the pastoralist and agro-pastoralists of southern Ethiopia whose livelihood are impacted by Gibe III dam. As a result, the Dassenech are at the same time vulnerable to and dependent on recurrent Omo river floods due to their settlement in the low plains of the Omo valley and their reliance on the delta ecosystem. Settlements in the Omo Delta are particularly difficult to assess because of the complex and spatially fluctuating environment (Haack, 1996). “Visual interpretation of remote sensing imagery presents an opportunity to assess long-term settlement change of pastoralist and agro-pastoralist people in such remote and dynamic environments, providing reliable data covering a long period at a scale that may not be achievable with field work” (Sanyal and Lu,2015; Deleu et al.2015; and Fox et al.2019). “Spatially explicit data on river settlements provide an important base for the river basin management strategies. Such strategies could include controlled environmental flow releases at dams to meet the needs of downstream pastoral and agro-pastoral communities and the environment” (Adams, 1993; Syvitski et al. 2009; Hoang et al. 2018), and must draw on a good understanding of lower Omo valley downstream human population distribution, land uses, and resource needs. The most important goal for decision-making processes is to empower marginalized people and to achieve free, prior and informed consent to the implementation of environmental policies and development programs.

According to the Dassenech Woreda Disaster Risk Reduction Development Office Assessment Report (2024), “a decade ago the pastoral and agro-pastoral communities of Dassenech people had a better life and livelihood system as compared to the current situation they are living in. Overflow of Omo River or Omo River flooding brings both opportunities and risks to the lower Omo Valley pastoral and agro-pastoral communities specifically to the Dassenech people. Following the Omo River flooding the village engaged in flood retreat agricultural

production to sublimate and improve their livelihood. Even though, since recent years, the trend and patterns of Omo River flooding have changed its intensity and magnitude and caused significant damage to the lives and livelihood of pastoral and agro-pastoral communities of Dassench people. As a result, most Omo River surrounding villagers i.e. nearly twenty-eight kebeles have been affected and lost most of their grazing and farmlands, social services providing institutions including schools, health posts and centers, human settlements as well their livelihood assets".

Based on assessment reports of District Disaster Risk Reduction (2024) due to the damage caused by the Omo River flooding nearly 15,888 children and 3,960 pregnant and lactating women were exposed to multifaceted risks such as malnutrition and food and clean water shortage, social displacement, disease outbreak, etc. The recurrent occurrences of Omo river flooding from 21 human health posts and 5 health centers, three health posts and one health center totally out of function, and the other remain found under serious risk condition which intensify villagers vulnerability to the effect of multifaceted disease outbreak and hampered health services provision system to the last mile pastoral and agro-pastoral communities of the lower Omo valley. As well the flooding also affects 65,750 livestock assets such as (61,170 cattle and 4, 580 goats and sheep). Even though the situation now become worse, it will further affect and expose nearly 1,354,000 livestock assets due to disease outbreaks and feed shortages.

Therefore, from 2008/to 2015 Omo River flooding caused significant damage to different government institutions including; human and animal health posts, health centers, schools, etc. While, following human displacement in the year 2012 and 2013 almost all primary school students became out of school and damaged schools property of more than fifteen (15) kebeles or Villages i.e (Toltale, Sermerate, Gibte, Gnimorulung, Loyre, Buzuno, Gnzefet, Gneteberuk, Elkolete, Bandra, Libemuket, Nebremus, Lomosiya, Mokonte, and Agolchiyes). However, in the year 2016, the situation becomes worse and affects other Omo rivers surrounding kebeles (Chetekogn, Shera, Loyere, and Kapusia). As a result, a total of 71 school classes and administrative rooms have been destroyed including scholastic materials and equipment, and 4,303 primary school students become out of school.

Despite that, the flooding also caused serious damage to irrigation water pumps and farm fields, human and livestock water points. Between the years 2008 - 2014, Omo River surrounding villagers lost 66 irrigation water pumps, 19 farm fields, 10 water storage, 6 hand dag-well and shallowly. Which aggravates their vulnerability to the effects of drought, disease outbreaks food shortages, etc. Despite this, in the year 2016 (2023 – 24), livelihood vulnerability became more severe and affected almost 28 Omo River surrounding kebeles of the District due to the effects of the Gibe III hydro dam-induced flooding disaster. This immensely aggravates the total destruction of the livelihood system of pastoral and agro-pastoral communities of the Dassenech.

4.3 Effects of Gibe III Dam on Pastoral and Agro-pastoral Livelihood

"The Gibe III dam and the irrigated agricultural enterprises it enables would usher in massive-scale indigenous livelihood and natural resource destruction in the lowermost Omo basin, Kenya's Lake Turkana region, and overall in the tri-nation border region. The dam would radically reduce the Omo River's downstream flow volume by at least 60 – 70% and cause a precipitous decrease in inflow to Lake Turkana during the reservoir filling period and beyond" [10]. Such loss of river flow volume would destroy critical fishery reproductive, and life cycle conditions and desiccate riverine and Omo Delta habitats for flood recession agriculture, livestock watering, and last resort grazing. It would also eliminate the pristine Omo riverine forest, which is the last of its type in sub-Saharan Africa and one of the richest remaining wildlife areas of Ethiopia as well as low-lying locales for recession agriculture along annually flooded riverside sand spits and waterside flats. Thus environments are vital to the survival of indigenous residents of pastoralists and agro-pastoralists of the Dassenech. This destruction would be greatly worsened by dam-enabled large-scale irrigated agricultural enterprises like sugar factories planted along the Omo River basin. The catastrophic level of human destruction would have already occurred by even the end of the Dam's closure for reservoir filling. Even though the artificial flood program was espoused as a solution after the filling period, it would be entirely inadequate to prevent massive human destruction among Ethiopian communities residing at the lower Omo Valley; despite it caused massive damage and worsened the crisis

of pastoral and agro-pastoral lower Omo valley people, specifically the Dassnech pastoral and agro-pastoral communities.

The destruction of pastoral and agro-pastoral livelihoods swiftly produced major humanitarian disasters including recurrent occurrences of flooding and drought in the area, with widespread conditions of starvation, disease, and spiraling interethnic armed conflict in the tri-nation border region as groups desperately compete for vanishing resources. Policies to effect the Gibe III dam and attendant irrigation agriculture violate the UN-recognized human right to adequate water and its associated right to livelihood for thousands of indigenous residents [10]. Also, major abstraction of river water for these irrigated large-scale commercial farms along the Omo River would both multiply and indefinitely extend the radical reduction of the natural Omo flow volume and lake inflow during the Gibe III reservoir filling period. In combination, these two major sources of water denial to the downstream communities and the emanation of the natural bases of Omo River's annual flooding which is vital for the sustainment of downstream pastoral and agro-pastoral communities' survival systems would create catastrophic losses of their livelihood systems – more importantly flood recession agriculture. As a result, most of the Dassenech pastoral and agro-pastoral communities that have been expropriated from their traditional land along the lowermost Omo have no option but to take refuge within (or nearby) the modern Omo delta. This involuntary movement into the delta region greatly worsens the already crowded conditions for the villagers already settled there.

4.4 Impacts on Flood Recession Agriculture and Grazing Resources

Until recently average flood conditions, river banks are submerged annually along the lower Omo River and around the river mouth. The annual Omo River flooding of the land bordering the Omo River soaks the land for traditional or indigenous flood recession crop cultivation and dry seasonal grazing, replenishes lakes and swamps on the usual floodplain, and favors fish (EEPCO, 2009). The environmental assessment undertaken by Ethiopian Electric Power Cooperation (EEPCO, 2009), indicates that to satisfy the demand for traditional flood recession agriculture, dry season grazing and fishery resources of the pastoralist and agro-pastoralist seasonal released and flood created on the flood recession farmland as well as the land bordering the Omo river. These controlled floods will allow for maintaining the required environmental flows also during the drought years. The regulating capacity of the reservoir will also allow for controlling natural flood peak discharge for a short duration. Even though, as per the informant of this study, the change in the natural patterns of Omo river flooding caused by the Gibe III hydropower dam negatively affects the lower Omo Valley downstream pastoral and agro-pastoral Dassenech Communities. As a result, they lost their traditional flood recession crop cultivation system, and seasonal grazing land, and disrupt the socio-economic well-being of the rural villagers. Further, more recently Omo River flooding caused irreplacalbele damage to the lives and properties of nearly 28 kebeles of the District. The damage caused by the Gibe III dam on the livelihood system of the Dassenech also manifested inter-ethnic conflict in the region.

4.5 Resource-Based Inter-Ethnic Conflict

Inter-ethnic conflicts in the lower Omo Valley of pastoralist and agro-pastoralist communities (where the Dassenech people live) have steadily increased in intensity and frequency. It appears that resource scarcity which could be explained in terms of natural and social factors, the growing pressure over fast dwindling resources, and certain cultural factors are the driving forces of conflict dynamics [35,38-42]. There are clear indications that the human and livestock populations in the study had been significantly decreased. Although adequate meteorological records are lacking to support arguments, climate change including Omo river flooding may contributed to the frequent recurrent occurrences of inter-ethnic conflict and drought together with other factors caused by scarcity of pasture and water, livestock disease epidemic, and more recently unseasonal Omo river flooding associated with Gibe III hydropower dam caused series damage on the livelihoods system of pastoralist and agro-pastoralist communities of lower Omo valley downstream communities. Based on the available evidence in line with the argument pursued in this study is that combined with a host of other factors exacerbated completion over vial resources escalate intra and inter-ethnic conflicts.

"Before two-three decades we had a prosperous period and had better lives and livelihoods, through our flood recession agriculture we even produced enough surplus sorghum products which enabled us to cope with the seasonal occurrences of drought and other multifaceted risks. , from the last ten years, our village has become so vulnerable to the effects of drought and food insecurity as well as to government development intervention programs the upstream of Omo river basin – Gibe III dam. Even though most recently Omo river flooding not only did we lose our everything (our home and residential places, flood recession and irrigation farmland as well small ruminates (goat and sheep) have been taken away by the river flood".

Fig. 3. FGD during field study With Rate-Borkonech villagers (2024)

"Gibe III dam at the upstream of Omo River basin brought huge damage and effect for the last ten years on our pastoral and agro-pastoral villagers lives and livelihood system. Even though the local government tried to aware us of its importance, our villagers do not understand very well its side effects and related consequences and we lost our traditional flood recession crop cultivation system. In the year 2023 – 2024, Gibe III dam artificial flooding changed the natural flow patterns of the Omo River flood into the flood recession cultivation farm and grazing land, which disrupted and caused irreplaceable damage to our people's lives and properties.

As a result, our villagers were forced to migrate in search of residential places and reside along the Kenyan border. We are now in confrontation, vulnerable, and faced inter-ethnic conflict with the Kenyan–Turkan pastoral communities, even most recently they ride and taken away our cattle fishing nets and killed some of our herders".

Fig. 4. Koruluk Gnokogno – Koro cluster (Seremret kebele) key informant of the study, 2024

4.6 The Crisis of Unfolding Gibe III Dam in the Human Right Context

Indeed, hundreds of thousands of indigenous pastoralists and agro-pastoralists of multiple ethnicities at the lower Omo valley, specifically the Dassenech people have been so severely disenfranchised over decades that they have had no recourse but to move to land along the Omo River [10]. There they depend on the Omo River for varying combinations of livestock rising, flood recession agriculture, fishing, and other livelihood activities, as well as for potable water supply for household consumption. Even though the government underestimates the size of the vulnerable population and the real threat that government development intervention poses to their continued existence. Added to this impending destruction is the plausible threat of Gibe III dam-related effects and artificial flooding which caused unprecedented human and environmental decimation in the Omo basin [43-47]. Therefore, the government has not adequately considered either the rights of these indigenous pastoral and agro-pastoral communities or the risk that the Gibe III dam poses to them. As a result, it continued the violation of human rights outlined in Ethiopian constitutions and the UN declaration on indigenous people either eliminating the natural – seasonal Omo river flooding or unintended effect and damage caused by the Gibe III dam artificial flooding [48-50]. It entirely disrupts the entire subsistence economy of the lower Omo Valley

downstream pastoral and agro-pastoral communities – Dassnech people. Despite that, mitigation and compensation measures taken by the government are inadequate and undermine the existing subsistence economy and impoverished socio-economically and politically marginalized communities of the Dassenech.

5. CONCLUSION AND SUGGESTION

The change in the natural patterns of Omo River flooding caused by the Gibe III hydropower dam negatively affects vital sustainment of the lower Omo Valley downstream pastoralist and agro-pastoralist of the Dassenech Communities centuries-old Omo River-based adaptive livelihood strategies. As a result, they lost their traditional flood recession crop cultivation system, and seasonal grazing land, and disrupt the socio-economic well-being of villagers. Rapid diminishing of herd size and ecological degradation throughout pastureland alleged with recurrent excessive and destructive Omo River flooding disaster caused repeated tremendous loss and damage to the live and livelihood system of the villagers. This aggravates their marginalization and vulnerability to the effects of drought and food insecurity. This destruction of pastoral and agro-pastoral living and livelihood systems swiftly produce a major humanitarian crisis in the area, with widespread conditions of starvation, disease, and spiraling interethnic conflict. To mitigate such effect neither an effective flood early warning system nor actively sought to effectively address the Gibe III dam project impact brought to the lives and livelihood system of Dassenech people by concerned government entities.

According to the analysis of this article accompanied by the above conclusion the following suggestions are given (1) An effective early warning system at the pastoral and agro-pastoral communities of the lower Omo Valley should not only focus on efficient generation, analysis, and dissemination of timely and accurate information, but also actionable and sector-specific recovery and developmental intervention required to build sustainable livelihood based early warning system to at-risk communities, accompanied with inclusive and anticipatory action. (2) Strengthen the capacity of local and regional concerned government entities, and existing local knowledge and structure of pastoral and agro-pastoral communities' livelihood-based early warning system based on what villagers already know about the trend and patterns Omo River flood risk they face and their knowledge of anticipating the effects of Omo River flooding disaster coping strategies they already use. (3) Strengthen the ability of pastoral and agro-pastoral communities to respond to disasters through enhanced skills and knowledge of hazard risks, community participation, disaster preparedness, and set-up of early action systems. (4) Adapt lowland pastoral and agro-pastoral livelihood diversification, social protection, and resilience-building recovery policies, strategies, and programs.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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