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Drought and its impacts in Ethiopia

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1. Introduction

Drought is inarguably one of the most challenging and complex natural disasters (Sivakumar, 2014, Van and Anne, 2015; Wilhite et al., 2007) from management perspective (Wilhite et al. 2007). It has been a part of the climate, and it has affected many countries in the world (Gutierrez et al., 2014) and this included Ethiopia and the horn of Africa and many other Sub-Saharan countries. Among the developed countries, Australia, Brazil, and California State in USA have the history of drought. It is now fully recognized that drought is a global climatic phenomenon although the factors that causes it are not yet fully and convincingly explained. It occurs in most climatic regimes in the world (Wilhite et al., 2007). Drought is described by many as insidious natural hazard that has a slow on-set and develops over months or even years (Wilhite et al., 2007) to reach with a full blown impact. In its final stage of occurrence, it often covers a large geographic area or region (Wilhite et al. 1991).

Drought occurs when the seasonal precipitation drops below normal or long term average (Wilhite et al., 2005). Drought in Ethiopia occurs during the different seasons that occur in different regions in the country and it exists when seasonal rainfall drops below normal by almost 30% to 50%. Some argue that it is difficult to give a universal definition for drought (Hughes, 2015), because drought is a complex phenomenon (Van and Anne, 2015). However several authors have given their version of the definition of drought or discussed its definitions in their articles (Van and Anne, 2015, Wilhite et al., 2007; Dracup et al., 1980), Wilhite and Glantz, 1985), Hisdal, 2002), Tallaksen and Van Lanen, 2004), Mishra and Singh, 2010) and Sheffield J. Wood, 2011). The simplest definition of drought from hydrological point of view is given as “a deficit of water compared with normal conditions” (Sheffield J, Wood, 2011 edited in Van and Anne, 2015).

Climate variability and extreme weather events (drought) threatens the livelihood of many populations throughout the world. Available reports suggest that the recurrence period of such extreme climatic events (drought) is shortening (Blunden and Arendt, 2012; Gutierrez et al., 2014). Drought in Ethiopia has shown a spatial and temporal distribution over the last fifty years and there are certain regions in the country that are affected by drought more frequently; the eastern and south eastern and rift valley regions. The recurrence frequency was one in ten years during earlier periods. Three decades ago Haile (1988) reported drought in Ethiopia to occur with 3–5 and 6–8 years in northern parts of the country and every 8–10 years for the whole country. Recently it was observed that drought frequency shortens and devastating drought occurred in three successive years. The drought that occurred in 2015–2017 (OHCA, 2017; USGS, 2017) is a case in point. It is believed that global warming has played a pivotal role in shortening the recurrence frequency of the droughts in Ethiopia, and it is believed to have increased the severity of the impact as well (Wilhite, and Smith, 2005). The fourth assessment report of the intergovernmental panel on climate change has reinforced this assessment and it indicated that the tropics of Africa and Asia are expected to experience a significant change in the frequency and intensity of droughts in the mid to late of the 21st century (IPCC, 2007) and this has come as serious concern for many developing countries in these two regions; Africa and Asia. With Ethiopia's bourgeoning population reaching to 107 million in 2018, it is taking and must take this prediction very seriously.

2. Why drought seems an avoidable threat in Ethiopia?

2.1. The geography, climate and natural resources

The geography, climate and natural resources of a country determine its vulnerability to climate hazard. Ethiopia is located in the tropics between 3° and 15° N and it constitutes a major portion of the horn of Africa Region. It has different physiographic features. The highland areas (40%) include areas having elevations greater than 2500 m, and reaching to 4500 m.a.s.l. (Alpine), and the temperature is much cooler in these areas, ranging between 6 °C (43 °F) and 26 °C (79 °F). The central plateau falls in the intermediate range between 1800 and 2500 m.a.s.l., and it has a moderate climate with minimal seasonal temperature variation. The lowlands have elevation less than 1500 m and temperature variations are much greater between 25 and 30 °C (McSweeney et al., 2003). These areas are hot and arid and it exists in the north eastern, eastern and south eastern parts of the country and along the borders with South Sudan, Sudan and Kenya.

Several factors influence the climate in the region, and one of these factors is the regular migration of the Inter-Tropical Convergence Zone (ITCZ) (McSweeney et al., 2003) that moves to the north between March and September and to the south in between October and January. The exact position of the ITCZ changes over the course of the year,

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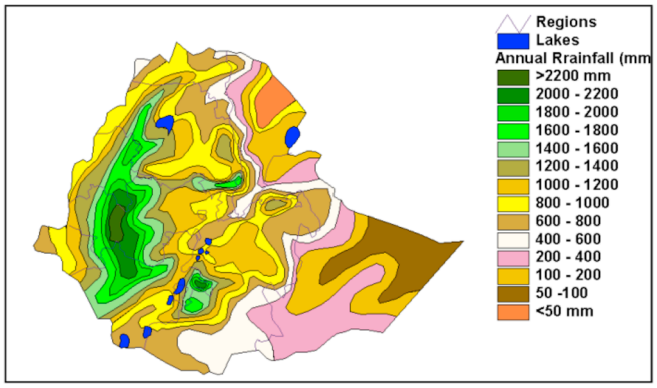


Fig. 1. Longterm Rainfall distribution.

oscillating across the equator - from its northern most position over northern Ethiopia in July and August and position itself to the south well below the equator in November/December. The geographic position offered a complex orographic and global air circulation patterns that plays a key role in influencing the amount and distribution of rainfall and overall climate of the country. The long term average rainfall of the country is shown in Fig. 1.

Korecha and Barnston (2007) did an extensive review of the rainfall in Ethiopia. According to this report, the system of atmospheric air and oceanic circulation that contributed to the seasonal rainfall and overall climate in the country include: (i) the movement of the Inter Tropical Convergence Zone (ITCZ), (ii) the formation of heat flows (low pressure system) over the Sahara and Arabian land masses, (iii) development of sub-tropical high pressures over the Azores and St Helena islands in the southern Atlantic Ocean, and Mascarene Islands in the southern Indian ocean; (iv) Southerly/southwesterly cross – equatorial moisture flow from the Southern Indian Ocean, Central Tropical Africa, and the Equatorial Atlantic; (v) upper level Tropical Easterly Jet flowing over Ethiopia; and (vi) the low level Jet (Somali jet). The high and low pressure systems developed in different parts of the region at different times influence the direction, the strength and moisture holding capacity of the global air circulations which controls the seasonal rainfalls in the country. According to the Ethiopian National Meteorological Services Agency (NMSA), there are three distinct seasons based on rainfall: (i) the main rainy season (June to September which is the wet season for most parts of the country), (ii) dry season (October to January) and (iii) the short rainy season (February to May). The main rainfall season (June to September) accounts for 50–80% of the total annual rainfall and it covers a large proportion of the country. A major portion of the seasonal rainfall occurs in the months of July and August with the peak rainfall falling in late July and before mid-August. This seasonal rainfall is strongly influenced by the north ward movement of ITCZ. The annual rainfall on the central plateau is about 1220 mm (Osman, 2002). The western and central part of the country receives measurable rainfall of 70–90% of the days (Korecha et al., 2007). The North Eastern, Eastern and South Eastern lowlands and the Great Rift Valley areas receive significantly less rainfall and are relatively drier during main season, and they are the most vulnerable areas in the country. The low lands of Somali Region have an average annual rainfall of 100 mm (40 in). Danakil Depression[1] receives less than 50 mm annually. Borena zone in South Oromia Region and Konso Woreda in SNNP Region have bimodal rainfall distribution and they have different rainy seasons, and rain occurs in October to November and March to June. The highlands of Eastern Hararghe [in Oromia Region] are other areas with bi-modal rainfall distribution as the central highlands with higher rainfall in June to September.

The short season rainfall in the south and south-east is triggered by the winds from the Southern Indian Ocean - the monsoon winds. Hence the short rains in the south are brought by south-eastern winds from the Indian Ocean, while the heavy rains (June to September) originate mainly from the Atlantic Ocean and are related to south-west winds (Seleshi and Zanke, 2004). Many parts of the central, northern and eastern highlands receive short season rain in March to April. In 2018, a unique weather phenomenon was observed. The short season rain was relatively lower and long season rainfall covered fully the month of May. The estimated short season crop production in the central, northern and eastern highland areas of the country constitute about 20% during the normal rainfall season. The amount and distribution of the rainfall in the south western part of the country are relatively better compared to other parts of the country even during drought period. The rainfall declines as one travels to the north, north eastern and south eastern part of the country. Areas that show a coefficient of variation (CV) greater than 30% are reported as vulnerable to drought (Hare, 1985 in Haile, 1988).

Overall the country has distinct hydrological zones with different seasons covering different parts of the country. This shall be seen as a great opportunity and asset for the country to cope with the impact of drought as it offers alternative planning for the utilization of the rainwater and land resources that exists in different parts of the country. The rainfall in these areas can support both food production and rangeland development and rehabilitation, and for environmental protection activities.

More importantly, there are huge land and water resources in the country. There are evidences that suggest that most of the present drought affected areas are with abundant water and land resources that can support sustainable livelihood. There are rivers and ground water resources that can support drinking water supply and irrigation development. Many of the drought prone areas are productive if water sources are properly developed and if necessary transported from other nearby areas and made available for use where it is needed. Blue Nile Basin, Awash River Basin, Omo River Basin, Wabi Shebele River Basin and Dawa River Basin are among the nine river basins with huge land and water resources potential. The head stream originates in the central highlands of Ethiopia and traverse through the major drought affected regions in the country. If one examines the reports of food aid recipients, the populations in the low land areas of these river basins are food aid recipients. The ground water resource which is considered as drought resilient also exists in substantial quantity for use for domestic water supply and food production in many parts of the drought prone areas. Water Aid investigated ground water potential in drought affected Kob and Raya areas in the northern part of the country where many thousands people perished due to lack of water and food in the 1984 drought, and it found out a considerable ground water resources potential within 45 m depth.

2.2. Drought as a global meteorological phenomenon

The Ethiopian government (NMSA) shares climate data and information with international organizations such as the National Oceanic and Atmospheric Administration (NOAA) and the World Meteorological Organization (WMO). The satellite data and information received on climate from these agencies has helped Ethiopia to understand, explain and predict the weather, climate variability and extreme weather events that is occurring in Ethiopia. The timely climatic information exchange with WMO and NOAA has been useful in providing early warnings. Based on this collaborative exchange of climate information, Ethiopia has been able to understand the relationship between the drought in Ethiopia and the El Nino event that is regularly occurring in the equatorial pacific. The analysis of the low flows in the Nile River flow data in Egypt (Nicholson, 1983 in Haile, 1988) before the Aswan dam was constructed gave a clue that the low flows were

[1] Located in Afar Region at the north eastern part of Djibouti and it has an altitude of 110 m below sea level.

related with the drought period in the highlands of Ethiopia. These low flows were also found consistent with the occurrence of El Niño. Now it is a well-established fact that the drought in Ethiopia and much of the Horn of Africa has association with the occurrence of a warm Sea Surface Temperature (SST) observed in the equatorial pacific east. The high and low pressures developed in the western (La Liña) and eastern Pacific Ocean (El Niño) alternatively were among the earlier knowledge received from climate information sharing networking done with the international agencies.

The El Niño events in Ethiopia have been extensively reviewed by Korecha and Barnston (2007) using a long historical data on rainfall. The report indicated the existence of a strong correlation (0.91) with the SST or El Niño in the tropical pacific east. Georgis (1997) has also documented the El Nino events and the regions and the population affected by the El Nino induced drought in Ethiopia. It has become a common knowledge now that every drought in Ethiopia is El Niño induced. Glantz et al. (1991) describe the association as a linkage over great distance of seemingly disconnected weather anomalies. After the El Niño of 1957/58, the coincidence of warm ENSO episodes and droughts in Ethiopia in 1965, 1972/73, 1982/83, 1986, 1991/93, and 1997/98 became quite evident (Comenetz et al., 2003).

For many years over the decades, the El Niño induced droughts left excessive dryness and major rainfall failures in many parts of the country (Korecha et al., 2007). El Niño is now closely monitored and it is incorporated in the day to day operations of the National Meteorological Services Agency (NMSA) (Korecha et al.). Ethiopia is increasingly being considered as indicator of accurately reflecting whatever climatic variation takes place when major climatic controls fluctuate (Nicholson, 1997). The El Niño information is now a day used for drought early warning and prediction in the country (Tsegay et al., 2000). The government and other development partners and international aid agencies working on emergencies are also getting regular climate information on ENSO and El Niño from NMSA, USGS and the international organizations.

2.3. The spatial and temporal distribution of drought

Food aid distribution records and satellite based drought monitoring activities have been documented over the last decade, although with less detail. Based on these records, the coverage of the less intense drought affected areas are estimated to reach as high as 52%, and it is spreading out in different parts of the country. Highly vulnerable[2] areas with frequent and severe drought impacts exist in arid and semi-arid areas (annual rainfall less than 600 mm) and peripheral pastoralist areas, and these areas cover about 25–30% of the country. In a report released by the UN (2017), the number of people who needed lifesaving food aid in 2015/2016 drought has increased from 192 to 228 districts (30% of the country), while about 461 districts (60%) were categorized as being in at least some kind of difficulty. Overall it was fully recognized that drought affected areas were increasing both in geographic coverage and the number of affected population. Those that were hard hit by frequent drought were the pastoralists in Afar and Somali Regions and the lowland areas of Oromia and SNNP regions. Even under a good rainfall year, an estimated four to five million people were reported to have received food aid as there were communities eking out their livelihood with low resilient capacity in lowland arid areas and that are often vulnerable to climate extreme events. The areas that are highly degraded (soil and land environment) in the highland are recipient of the foods aid. These areas fail to produce sufficient food to meet their household food requirements.

The 2015 drought covered large part of the country. The strength of the moist air coming into the country from the south east of the Atlantic Ocean and the monsoon winds from the southern part of the Indian Ocean got weak and did not reach the north and sufficiently cover the eastern part of Ethiopia. As a result, the rainfall received was far lower than normal certainly creating severe drought in many parts of the north and eastern highlands and the remote northeast and south eastern parts of the country. The short season rain in 2015, for instance, received 65% of the normal rainfall for the period from 1981 to 2014 (USGS, 2016). The north eastern and eastern highlands including the northern rift valley areas were severely affected. Moderately affected areas were found in the north western and central highlands. According to USGS report (2016), areas that were most severely affected were North Eastern, Rift Valley Areas, Eastern and Southern and South Eastern parts of the country that were largely inhabited by the pastoralist communities whose livelihood depend primarily on livestock. As a result of the drought, there was no adequate water and pasture for their livestock and the people lost a large part of their animals (up to 50%) in 2016/17. The western and southwestern part of the country received sufficient rainfall to support crop production, and this indicates that the drought does not cover all parts of the country.

2.4. Challenges for monitoring and predicting drought in Ethiopia

The droughts in the 1970s were longer and more intense, and occurred most of the time in both short and long rainfall seasons. The 1974 drought resulted in the death of approximately 250,000 people (Birtukan, 2014.). Since then, the adverse climatic variability and extreme climatic events increased in the magnitude of the social, economic and environmental impacts. The population pressure in the rural areas increased steadily from nearly 34 million in 1974 to 90 million in 2016 and it played a role in increasing the impact. As a result, the natural resource base and the environment at large have been severely degraded. The forest cover dropped from 25% to 3%, and recently the government reported it has bounced back to 11–15%. Since the mid of the 1970, the spring and summer rains have declined by 15–20% (USGS, 2012). The drought became more frequent in recent years and many writers gave varying recurrence period; between five and ten years (WIC, 1999) and between three and five years (O'Brien, 2016, WB, 2006). Others suggest that drought occurred every 3 to 5 and 6–8 years in northern Ethiopia and every 8–10 years for the whole country (Haile, 1988). Successive droughts hit the country in 2015 and 2016. In 2017, a torrential and exceptionally higher main season rainfall occurred covering large part of the country. The short season (March–April) rainfall was virtually a failure.

Decision makers need timely and accurate climate information and about the on-set and development of drought conditions (Wilhite, 2005). In the Ethiopian case, rainfall and socio economic indicators were important variables for monitoring the onset and progress of drought in Ethiopia. However, securing sufficient and reliable climatic and socio economic data in time remains a challenge as the rainfall observation stations in many parts of the drought prone areas in the country are still insufficiently covered with meteorological stations and the existing ones are thinly distributed and have a history of poor data collection.

Developing a full-blown early warning system requires resources; finance, skilled manpower and technological capacities and commitment. In developed countries, satellite tracking system and a web-based interface on climate data is being used for data collection, transmission, directly inputting and analysis. In 2016 Oxfam GB and other development partners in Ethiopia presented their intent to support the development of drought early warning system at woreda/district level using IT based platform – at least invitation for a consultancy service was put out in public. The result of this study is unknown. In addition there has been an ongoing and relentless effort on monitoring and predicting the El Niño by many international organizations such NASA, NOAA, WMO, EU Space Agency, etc., and Ethiopia has had full access to this information through NMSA. It has benefitted from this network of sharing information. As a result of this opportunity and local efforts in

[2] Has a 30% chance of having drought each year.

developing models, NMSA[3] is now in a position to be able to predict El Niño and its associated drought in Ethiopia adequately and far enough in advance for decision making. The 2015 drought was a successful show case.[4] The model that the NMSA was using to predict El Niño was the analogue method. The observed climate data was related to the "constructed analogues" of past El Niño. The 2015 El Niño was predicted using the earlier "constructed analogue" technique and this has been related with the early warning information received from international partners. In spite of all these, predicting drought at district level remains a huge challenge.

Other efforts in the country have been made to identify tools and instruments for predicting and forecasting drought and these included the identification and testing of drought monitoring indicators such as Standardized Precipitation Index[5] (SPI). SPI (McKee et al., 1993) was used to identify drought periods in Ethiopia (Belayneh, 2012; Alem, 2012; El Kenawy et al., 2016) using historical rainfall data. The indicators were able to identify drought periods properly and the results obtained were encouraging. However, the limitation of this indicator is the lack of simulation models to generate future long-term rainfall data to identify future drought year.

3. Impacts of drought

Based on past experiences, drought affected nearly all sectors in Ethiopia; agriculture (loss of crops and livestock), water resources (increase in evaporation and decline in availability of fresh water which results in water stress), inadequate water for industry, reduced electricity production [from hydropower], etc. Although it has not been assessed and documented properly, the impact on ecosystems is significant (loss of wet lands and lakes, loss of forest and soil cover, increased soil erosion and land degradation, etc.). The social and economic impacts (increased human and livestock diseases, migration, and conflict over water, and the decline in the National Gross Domestic Product (GDP)) are hugely important. Perhaps nowhere else is the change in weather (drought) and climate regimes more noticeable than in water sector (Kundzewicz et al., 2007 in Gutierrez et al., 2014), which in turn affects all other sectors significantly, and this is as a result of the meteorological drought (Van Dijk et al., 2013).

3.1. Impact on crops and livestock

The farmers' perception of drought in Ethiopia is based on the failure of the seasonal rainfall (June to September) and consequently the loss of crops and livestock (elsewhere it is recognized as agricultural drought). The loss of crops and livestock often results in severe household food shortages and psychological stress and insecurity among the affected people. The seasonal rainfall failure (meteorological drought) is largely due to climate variability and its impact results in widespread failure of seasonal crops, pasture and forage and massive death of livestock in pastoralist areas, and widespread hunger among the affected population. The recent drought of 2015 caused hunger for a population of about 10 million people (10%) (estimate based on the number of people requiring food aid).

The impact on agriculture always brings heavy human and livestock loss in Ethiopia. The 1984, 2002 droughts were the most devastating and historic in creating huge food shortage for a large proportion of the population that relied heavily and predominantly on subsistent-rain-fed agriculture and pastoral livelihood. The drought in 1984 resulted in famine as the drought prolonged a year and severe water and food shortage occurred, and widespread hunger and diseases destroyed the livelihood of millions of people covering large part of the country. The local people called such period as "*Kefu Qen*" or evil day (Stefan et al., 2010). There were many *kefu Qens* since antiquity as a result of the recurrent droughts in Ethiopia.

3.2. Impact on water resources and its environment

Over the last two decades, Ethiopia has been building massive infrastructure to harvest water for generating electricity and developing irrigation to produce food and fiber crops for domestic consumption and support local industries. Presently several dams are built and as a result the country has increased its water security. Industrialization which requires electric power is also growing to diversify the country's economy. The recent droughts are impacting the country more seriously; far beyond creating shortage of food. The water resources in both manmade and natural water bodies are shrinking severely affecting the availability of water for irrigation and electricity production and in return affects the economy. The drop in lake levels, low flows in rivers/streams and drop in ground water levels are often recognized as hydrological drought (Van and Anne, 2015) is becoming a common phenomenon. It is also characterized by changes in wet lands, decreased biomass or vegetative cover and over all damage to the land (land degradation) in all ecologies due to excessive dryness. In pastoralist areas this situation results in damage and loss of rangelands. Soil loss by wind erosion in pastoralist areas is a common feature during such droughts.

3.3. Socio economic impact

Mesfin (1984), Pankhurst (1986) and Degene (1990) wrote an extensive account and assessment (case studies) on droughts and its social, economic and environmental impacts in certain hot spot regions in Ethiopia. In the first reference, four major droughts with a wide range of impacts of historic significance were recorded; (i) The devastation of oxen by render pest in the 1888–1892, (ii) The Tigray famine of 1958 which killed over 100,000 people, (iii) The Wag – Lasta famine of 1966, and (iv) The Wollo Famine of 1973/74. These droughts affected large number of people over the years. The number varied significantly between 2 million in 1972 and 14 million in 2002/3 with a significant and sharp increase in 1976–1977, 1982–1984 and 1991–2002.

UNOCHA has documented the number of people affected by food shortages (based on emergency food aid reports) in each drought year over the last several decades. The number of the people affected by the drought varies from region to region and it is unfailingly growing. The 2015 drought left over 10 million people (10%) in 2016 (see Table 1), and it was reported as the strongest drought in the past fifty years (USGS, 2016). The number of people that needed food aid varied by region; Tigray, Afar and Somali Regions were hard hit and the population affected was 24%, 25% and 21%, respectively. More food aid was required in Oromya followed by Amhara and Tigray Regions. In terms of large geographic coverage, more areas were affected in Afar and Somali Regions. Children, largely in pastoralist areas, were more affected by the drought as it decimated nearly 50% of the livestock in the regions. The UN Office for the Coordination of Humanitarian Affairs (UNOCHA) reported that an estimated USD 3.9 billion was required to effectively respond to this emergency situation (UNOCHA, 2016).

The population affected by the droughts based on the number of people receiving emergency food aid over the last fifty years in Ethiopia is given in Fig. 2. Based on the data shown on Fig. 2, nearly 4 to 5 million people on average require food aid each year even under normal rainfall year in most parts of the country, and the areas most affected are in central, northern and eastern and southern lowlands. Beyond the impacts on agriculture, these drought years were associated with social and economic disruptions and political instability. In financial terms, the estimated cost of drought as reported by Save the Children and OXFAM/UK (2012) was US $1.1 billion per year based on

[3] Personal communication with staff from NMSA in 2016.

[4] Personal communication with the NMSA staff that El Nino was well predicted.

[5] Can be read as "Standard Rainfall Index".

Table 1
Number of people receiving food aid in 2016.

Regions	Number of people		Percentage
	January	June	
Tigray	2.3	2.3	24%
Afar	0.4	0.4	25%
Amhara	2.3	2.3	11%
Oromia	3.8	3.8	11%
SNNP	0.8	0.8	4%
Somali	1.6	1.2	21%
Ben-Gumuz	0.079	–	8%
Gambella	0.043	–	10%
Dire Dawa	0.057	0.057	
Harari	0.014	0.014	
Total	11.314	10.871	

Source: **FORTUNE**, a local News Paper, August 21, 2016.

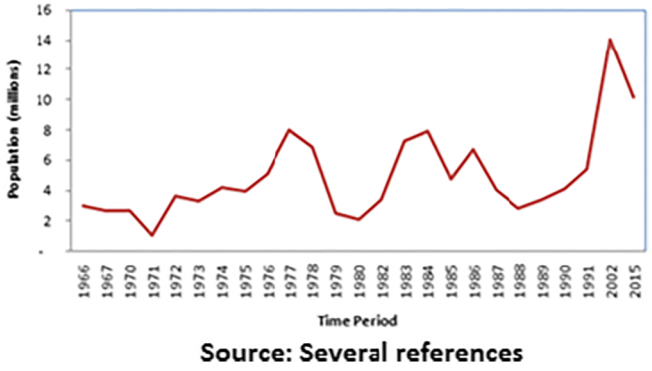
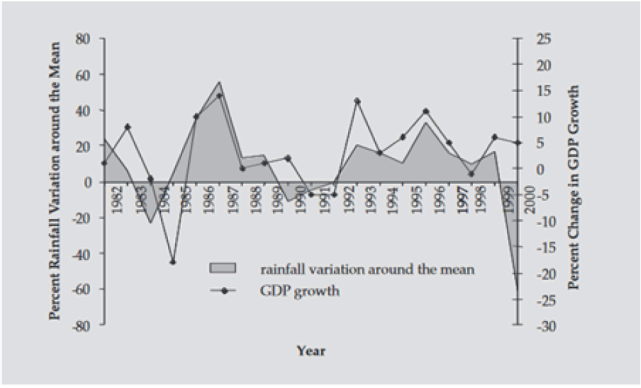


Fig. 2. Population requireig food aid.
Source: Several references.

the level of food aid supported in the form of emergency response by donors. It does not actually estimate the full damaged to crops and overall yield loss, reduced productivity of crop land, insect and other pest and rodent infestations. It did not account reduced availability of water for domestic and irrigation use, energy (electricity) production, etc.

The social impacts are difficult to account, and it include mental and physical stress [such as anxiety, depression, loss of security and domestic violence/conflict on water use). The drought and famine in 1974 and 1984 caused a major political instability that brought down the regime that has been in power for about 50 years and the succeeding military government to a major shakeup and eventually removed by a rebel group.



Source: World Bank 2006. Ethiopia: Managing Water Resources to Maximize Sustainable Growth

Fig. 3. Rainfall variation around the mean and GDP Growth.
Source: World Bank 2006. Ethiopia: Managing Water Resources to Maximize Sustainable Growth.

3.4. Impact on the economy

The economic impacts of drought (economic drought) in Ethiopia have been significant. Drought has been seriously affecting the meager economy as power shortages occur from low flows of the rivers in the country. As a result rationing electricity was a common practice. According to a report by UNDP (2012), the cost of drought is estimated to absorb 25% of the GDP (the economy of the country) which relied heavily on rain - fed agriculture. This is resulting from low agricultural production, decline in electricity production from hydropower, water shortage for domestic and irrigation use, migration of productive manpower and political instability (social impact).

The World Bank (2006) did an extensive investigation on the relationship between the rainfall variability (hydrological variability) and the GDP (national economy). Analyzing nearly two decade of rainfall and GDP data, it found out that the GDP was oscillating consistent with the rainfall (hydrological) variability[6] indicating the presence of strong association between hydrological variability and GDP (World Bank, 2006). Fig. 3 shows that the higher the rainfall deficit (hydrological drought), the larger the decline in agricultural production and the GDP in the country, and vice versa. For instance during the drought in the 1984/1985, GDP declined by 9.7% and agriculture output declined by 21%, and the gross domestic savings declined by 58.6%. According to this same report, the failure to mitigate hydrological variability in Ethiopia increased the prevailing poverty by 25% and reduced the growth potential of the economy by about 40%. Hence Ethiopia's economy has been heavily influenced by the rainfall variability or hydrological drought. Fig. 3 shows the fluctuations of the Ethiopian economy (GDP) with rainfall variation at different periods. The data on the graph shows the echo of the country's economic performance against the extreme hydrological variability. The 1984, 2000 droughts showed extreme rainfall variability and showed the lowest GDP over the study period.

4. Drought response

The government institution responsible for drought response and management is the Disaster Risk Management Commission (DRMC). It was established in 1976 as a Relief and Rehabilitation Commission (RRC) following the 1974/75 drought. It did not have a system of drought response and management at the time and most of the work was emergency food distribution on ad hoc basis. In 1995, it was restructured and renamed as Disaster Prevention and Preparedness Commission (DPPC) and it has attempted to relate the relief work with development assistance and tried to establish a system of management for the relief work. DPPC has evolved to Disaster Preparedness and Prevention Agency (DPPA) and Food Security Coordination Bureau (FSCB). The institutional structure follows a similar arrangement down to woreda level.[7] In 2005, DPPC was scraped and the FSCB was incorporated within the Ministry of Agriculture and Natural Resources Development. Disaster Risk Management Commission (DRMC) was re-established after the 2015 drought. DRMC is now responsible for all disaster emergencies that include drought, flooding, epidemic diseases, etc., and the commission contains 14 directorates. A disaster risk management council at higher level was established in 2015 with a

[6] It is the term used by the World Bank (2006) and it is interchangeably used with the term hydrological variability. All years with rainfall deficit below long term annual average is consistently falling with low GDP periods.

[7] It is equivalent to district, and it is the lowest decentralized administrative unit in the Federal Government structure.

special proclamation by parliament and its role and responsibility was to lead and oversees the implementation of the National Disaster and Risk Management Policy, declare disaster officially, and provide general direction and overall disaster response.

The national DRMC council is chaired by the Prime Minister, and members of the council are several, but lead sectoral ministries and institutions include the Ministry of Agriculture (MoA), Ministry of Health (MoH), Ministry of Water, Irrigation and Electricity (MoWIE), Ministry of Federal Affairs, Ministry of Education (MoE) and National Meteorological Services Agency (NMSA). The Federal Disaster Risk Management Commission acts as a secretariat. The concerned ministries took ownership and responsibility on the implementation of the disaster response and related activities. The same structure exists at the regional and woreda level, and they are under the leadership of the Regional State Presidents and woreda administrators, respectively. There are many international and aid agencies and multilateral organizations that work very closely on drought alongside the government structure at the Federal and Regional level starting from the early part of the field assessment to the mobilization and distribution of relief food for the drought victims. These International NGOs include OXFAM International (GB/Canada/USA), Save the Children International, CARE International and Catholic Relief Services (CRS), while the multilateral and bilateral organizations include UNOCHA, UN World Food Program (UN/WFP), USAID, EU and UNICEF.

An early warning committee at national level was first established in 1977 and was composed of government organization such as; NMSA, MoA and MoH. The committee analyzed the collected climatic and socio economic data at central level and prepared early warning reports. Presently, the same set up exists except there were improved tools and instruments to provide early warning of drought. The NMSA had the highest responsibility for monitoring drought and producing early warning reports on the evolvement and on-set of drought and its development using a specialized meteorological data and information. Early warning function at the woreda level was held by a small unit within the Woreda Agriculture Office.

The customary drought response which was followed for decades had been to appeal to the international community for emergency food assistance. The mode of response by the different institutions RRC, DPPC, DRMFSS and the present DRMC has been a wait and react, and it provided “Emergency Relief Assistance” through the DRMC. The mode of governance on drought response has been highly centralized. A policy framework was developed and directives were given from the central government. At the federal level there had been technical working groups which were composed of representatives from line ministries and international aid agencies that supported and facilitated the situation assessment, mobilization of resources and coordination of the overall relief work. For the 2015/16 emergency response, the technical working group was chaired by the Director of the DRMC and co-chaired by UNOCHA. At regional level, the technical committee was chaired by the Bureau of Agriculture and co-chair by FAO. During situation assessment, each sector representative from federal line ministries prepared field report and submits to DRMC. The report contained a number of people affected in each region and the report had to be approved by each of the respective regional governments before it is an official report. The food shortage [gap] in each region was compiled and the consolidated report finally sent to the council for approval.

In 2015 drought response was much better organized and coordinated.[8] The government used its own resources to purchase and transport food valued over USD 1 billion. The international aid agencies also mobilized their resources.[9] However, the drought response by the government and aid agencies followed the same old “reactive and crisis management approach. The emergency response focuses on around saving lives of people by providing emergency food assistance to drought victims. The government reviews the early warning report by the NMSA and instructs the line ministries to come up with possible drought response plans. Among the list of activities in pastoralist areas where severe impact occurred, the government and aid agencies mobilized food and water trucking services and to a limited extent delivered forage to save the livestock in areas where it was seriously affected. The International Aid Agencies contribution had been largely in providing the needed food resources with limited funding to cover administrative and logistical costs to transport the food from the port to the warehouses and further to distribution sites. Schemm (2017) quoted the DMRC Director as saying “emergency response is just a pain killer” and he indicated that the government plan to embark on development that can solve the real problem. He hinted for a more serious well-targeted development activities such as water harvesting, irrigation, etc. Since the 1980s, the government has been carrying out “Productive Safety Net Program, PSNP” in different parts of the country. This program targeted watershed based development and rehabilitation activities, which consisted of soil and water conservation activities, planting trees, design and construction of micro dams and ponds to recharge ground water as well. There were small-scale irrigation and water supply schemes, but they were limited in scope and not at a scale to effectively respond to the prevailing risk of the drought. This development program has been supported through the use of food and cash resources, and it is now in its fourth cycle.

One of the recommendations of the World Bank study (2006) was to control the country's water resources through constructing large and medium size dams in order to address the energy fluctuation and water shortages. To increase water security and to minimize the hydrological variability and smoothing out of water supply and energy fluctuations, controlling the country's water resources is an avoidable intervention. It is an important strategy to boost the national economy (GDP) and mitigate the risk of drought. Not least, the small in-situ water harvesting activities and small household irrigation activities are critical and a priority intervention to increase food production and food security at household level. Table 2 presents the drought years over the last four decades, the regions affected and the drought responses made by the government and international aid agencies. Sources: several documents and humanitarian aid report by year.

5. What needs to be done to mitigate drought-associated risks?

Reducing the impacts of future drought in Ethiopia is a hugely important task to ensure healthy socio economic growth and development. It is part of a sustainable development strategy. In response to 2015 drought, the Ethiopian government spent over a billion dollars to purchase food grain from abroad as part of the emergency response. With the experiences of the 2015 drought, it is now time that the government and aid agencies look into other options beyond emergency (reactive) food aid. This author is proposing to build on the encouraging experiences on the 2015/16 emergency drought responses, and suggests some useful strategies to manage the impacts of future droughts proactively.

Drought is part of the normal climate that will come and go as it did in the past and will continue to occur in the future perhaps with greater frequency and severity due to a changing climate and increased vulnerabilities. To face this serious threat, the people and the government of Ethiopia should be willing to bring about a paradigm shift in the overall drought governance and response mechanism. First it is important to build confidence that the impacts of drought are manageable. There has to be a commitment on the part of the aid agencies and the government to bring change, moving away from purely crisis management approach to deal with drought emergencies. This approach needs to ensure effective development investment, strengthening data collection and information sharing, strengthening early warning system, deepening the existing development effort with special

[8] International Humanitarian Organizations (2016).

[9] Their response was reported as slow in the earlier part of the crisis.

Table 2
Drought and its impacts at different periods.

El Nino Induced drought	Seasonal Event	Regions/areas & population affected	Key impacts/effects of the drought	Responses
1972/73	- Receive 70% of the country's normal rainfall - Main season rainfall delayed by 15–30 days - Rainfall shortfalls	- Tigray and Wollo - North and south eastern areas of the country - Pastoralist areas	- Agricultural production reduced by 20% - In 1972–4.3 million people affected - In 1973–3 million people affected - Widespread shortage of water availability - Wide spread damage of crops by insects and pests - 200,000 people died - 30% of the livestock perished	Emergency food aid and other humanitarian assistance by the government and international aid agencies
1975/76	- Western and South Western parts of the country receive less rainfall	Easter & southern Tigray and Amhara. Southern Oromia and SNNP Regions, Afar and Somali lowlands	- In 1975–4 million people affected - In 1976–5 million people affected - Dam and reservoir water levels dropped significantly - Water shortage occurred	Emergency food aid and other humanitarian assistance by the government and international aid agencies
1978/79	- Receive 70% of the country's normal rainfall - Main season rainfall delayed by 15–30 days - Rainfall shortfalls	Southern Ethiopia Easter & southern Tigray and eastern Amhara. Low lands of southern Oromia and SNNP Regions, and Afar and Somali regions	- In 1978–7 million people affected - In 1979–3 million people affected - Dam and reservoir water level dropped significantly - Shortage of water availability - 1.4 million People affected	Emergency food aid and other humanitarian assistance by the government and international aid agencies
1982		Northern Ethiopia; Eritrea, Tigray & Wollo including northern Shewa	- Two million people affected	
1983/84	- Drought occur during the short and main seasons - Receive 70% of the country's normal rainfall - Main season rainfall delayed by 15–30 days - Rainfall shortfalls	Historic drought covering all regions of the country, and intensely. Most affected of the drought prone areas; Eastern and southern Tigray, north Wollo and north Shewa	- Eight million people affected and one million people dead, - 2.3 million people severely food insecure, drought extended by a year and famine occurred and cause the death of 250,000 people, - GDP fall by up to 25% (WB, 2006), - Water levels in dams and reservoirs dropped markedly creating shortage in water availability and power production (Electricity rationing) - Damage and loss of the rangeland in pastoralist areas due to rainfall failure during the short and long seasons - Livestock decimated in pastoralist areas due to water and forage shortage and after effect diseases - After effect: Outbreak of both human and livestock diseases	Massive emergency food assistance to the affected population Emergency health services to severely affected population, Development and rehabilitation work for resilience and stability of the environment. This involves interventions on the bio-physical environment. Development of strategic water facilities i.e. ponds, earth dams, boreholes, shallow wells and spring protection.
1987/88	Drought during the short season	- All regions, North Shewa, wollo, central eastern and southern Tigray most affected	- Seven million people affected - Wide spread shortage on water availability	Emergency food aid

El Nino Induced drought	Seasonal Event	Regions/areas and population affected	Key impacts/effects of the drought	Drought responses
1991/92	Rainfall failure during the long season	Most parts of the country, Tigray, Afar, Amhara, Somali, Oromia and SNNP Four million people affected	- Water, food and food shortages, - Large number of livestock decimated - Power production declined significantly - Water supply and Electricity rationed for cities and towns	Food aid by the government with assistance from Aid Agencies
1993/1994		Tigray and Wollo 7.6 million people		
1999/2000	Short season rainfall failure	All regions but Somali Region was most affected. About 10.5 million people	- About 10 million people affected - Measles case reported in many parts in Somali Region	Famine averted by rapid emergency response (FAO report)
2002/3	Rainfall failure in both seasons	All regions (many part of the country) mainly affected are Tigray, Amhara, Afar and Somali Regions. About 14 million people affected	- About 14 million people affected - Most of the pastoralist areas were affected and lost a large part of their livestock	About 14 million people were reported as needy population for food aid, Food aid by the government with assistance from Aid Agencies

(*continued on next page*)

Table 2 (*continued*)

El Nino Induced drought	Seasonal Event	Regions/areas & population affected	Key impacts/effects of the drought	Responses
2006	Rainfall failure in both seasons	Low land and pastoralist areas, Tigray, Amhara, Afar and Somali Regions.	- Environmental health problems caused by wide spread littering of the landscape with bodies of dead animals - OXFAM/UK mobilized communities to collect dead animals, and burn and buried in Afar Region	7.6 million people affected
2011	Short season rainfall failure	The driest period in the Horn of Africa since 1995, Borena was most affected	● 4.5 million people affected ● Water shortage for livestock ● Rangeland deteriorated and created feed shortage	60% of the cattle decimated (OCHA, 2011)
2015	El Nino induced drought	Nearly all the nine regions	● 10 million people needing food aid in nine Regions	Emergency food aid
2016	Continuation of 2015 El Nino episode. Rainfall failure in both seasons in Somali Region (*Gu – April to June), and (Deyr – November to December)*	Nearly all the nine regions were reported as affected by the drought most affected were Somali, Afar and Tigray Regions. The strength of the drought reported as the worst in 50 years (USGS, 2016).	- Loss of livestock estimated at no less than US$200 million worth (James Geffrey report on Daily Monitor) ● Emergency water trucking was used in rural areas of Somali and Afar Regions when seasonal rain fully failed and reservoirs were dried up due to the extreme drought condition. OXFAM alone budgeted about USD 50 million ● Economy growth declined by 2.5% (PM Speech) - About 50% of the livestock population in Somali Region decimated - 5259 Acute watery diarrhea cases reported in Somali - 84,610 acutely malnourished under five children	A more comprehensive approach to saving lives. Government purchase food worth US$ 700 million. Humanitarian requirement estimated at US $ 948 million to 8.6 million affected populations in Eastern and Southern eastern parts of the country. Organized Emergency heath team and dispatched to the region to stop diarrheal diseases and saved lives.
2017	Spring season rainfall failed. The main rainfall season received heavy torrential rainfall and flooding covering many parts of the country	Districts needing life saving food aid increased from 192 to 228 in June 2017. At least a total of about 461 districts were categorized as being in at least some kind of difficulty.	- Widespread diarrheal outbreaks in Somali Region due to prolonged drought. Other regions are also affected - The number of people needing food aid increased to 7.8 million due to poor performance of the spring rain - Wide spread insect pest and damage to the crops - AWD continued in other regions; Amhara and Tigray	7.8 million people requiring food aid (Daily monitor, July 19, 2017)

emphasis and priority on drought vulnerable areas to reduce risks and ensure sustainable national and household food security. To this end, the following initiatives are recommended for their consideration by the government. Some of the recommendations have already been recommended on papers and but it requires professional services to realize their outcome.

5.1. Drought preparedness/readiness plans

In a well-researched effort, the following were recommended by Wilhite et al. (1991) [10] and (2005) as part of an effective drought response planning and mitigation processes.

- Appoint a drought task force both at higher and at the lower level; the existing council led by the PM is part of this plan. This structure should be followed down to Region and drought prone woreda and or even kebele level,
- Evaluate the risk of drought and revise drought preparedness and response plan every year,
- Effectively engage communities in the drought response plan and development activities,
- Publicize the drought preparedness plan and build public awareness and thrust,
- Engage the local people to resolve conflict over the use of grazing land and water points,
- Develop more water-supply and irrigation projects through developing surface and ground water potentials in high risk areas. High risk area maps are assumed prepared for the last few years by region and woreda offices,
- Create awareness at national and local level about drought and its impact through establishing a local and professional think tank on drought which will advise and help in the development of educational programs in media; radio, TV and the use of newspapers and other media outlet.
- Establish a nutritional surveillance team in each vulnerable woreda that will work under the woreda task force and conduct nutritional surveillance every year and keep record of a progressing food shortage at household level or groups at risk.

To implement the above plans (# (i)), the following are important recommendations.

5.2. Establishing and strengthening a national drought technical advisory committee (NDTAC)

NDTAC is a technical organ needed to guide the research and policy advisory role on drought for council and regional offices responsible in drought management. It can play a lead role in planning and managing conferences (both local and international), research programs and knowledge production and documentation. Today there are 44 universities and several agricultural research centers operating throughout the country and they are properly situated to support drought monitoring and response.

5.3. Identifying where vulnerabilities exist and mapping drought affected areas each year and properly documenting

Every year the geographic area affected by the drought should be mapped using GIS and it should be documented as part of the drought assessment report. The information on the map should include the locations (woredas/districts and kebeles[11] and the population size affected. Other information such as meteorological stations, roads, water supply points, food grain storage facilities, etc. should also be mapped.

5.4. Engaging the local community and making drought response participatory

The communities in well-known drought prone areas should be engaged and empowered in the decision making process while preparing the plan and implementing the response. Sufficient work should be done to make the community ready and they should be encouraged to prepare their own action plans on drought responses based on the principles of drought risk reduction provided in the national drought policy guidelines. The government and development partners' role should be to support the initiative and provide technical and financial assistance in the preparation and implementation of the plans. These development plans should be part of the annual action plan in the overall woreda and regional development program to combat drought proactively.

5.5. Ensuring sufficient fund for drought mitigation plan

It is imperative to secure a separate and sufficient budget for investment to support development initiatives in drought affected areas. It can be included as part of the regional development plan. It is important to develop drought preparedness plans to deal with the uncertain drought (rainfall variability and extended periods of water shortage) in a timely and systematic manner.

5.6. Capacity building

Develop a strong and effective government and community intuitions. These institutions need to be well trained for effective drought management and response. The presence of universities and colleges in most drought prone areas is an opportunity to support these efforts. Sufficient awareness should be created among the people about the drought and its impacts not only during the drought period but also on normal years to increase readiness for a proactive drought response.

Strengthening the drought monitoring and early warning system is also important. Three important tasks are crucial (i) equipping the drought prone and high risk areas with meteorological stations for data collection, (ii) Strengthening the capacity of the Early Warning Committee at Regional and Woreda level. (iii) Identify and adapt indicators for monitoring the onset and management of drought. Prepare drought management protocols and guideline manuals.

5.7. Strengthening the cooperation among the different development and humanitarian actors

The relationship between state and non-state actors/institutions or stakeholders should be strengthened. They should be identified by region and should sign memorandum of understanding defining their roles and contributions. Their strong cooperation in information sharing for early warning, organizing, mobilizing and delivering services effectively and efficiently is crucial for a successful drought response.

5.8. Risk assessment of the drought impact and documenting lesson learning on a regular basis

There is a need to establish a risk assessment committee (drought task force) at the lowest administrative level to facilitate the collection of data and information closely and on a continuous basis. This committee should conduct a vulnerability assessment to determine who and what is at risk and why.

[10] Adapted to the local situation in Ethiopia by the author of the article.

[11] Lowest community administrative structure – 8 km^2 area and with a population ranging between 10,000 and 30,000.

5.9. Infrastructure development

Access to all-weather road infrastructure with priority to drought prone areas is essential for effective drought response. It will enable the transport of food quickly and in sufficient quantity to the affected population at any time.

Another infrastructure of significant importance is the construction of large warehouse or storage facility for food at woreda level or even at kebele level. A well-targeted, transparent and accountable warehouse management is very critical.

In areas where ground water is feasible, well drilling for water supply and irrigation use are key infrastructures in drought response. There is already an experience in Kobo Girana and Raya valley in northern part of the country where people were affected massively by the historic hunger and famine in the 1974 and 1984 droughts. Today ground water is developed and used for water supply and irrigation which effectively eliminates food insecurity and hunger in these areas. In areas where ground water is not feasible, there may be a need for diversion of rivers from long distances at large scale in closed conduits, or open channels and the construction of reservoirs to reach the drought affected population in the face of harsh drought impacts. It is economical over long term basis.

5.10. Policy review

Here is already a policy and a strategy for disaster management. There are also agricultural, population and health and water resource management policies. All gives a high priority for drought response effort particularly in water sector. However, as of this time, there was no land use policy. A land use policy is a key factor for improving land and water resources management and sustaining natural ecosystems and plant species. Integrating these policies towards drought preparedness for mitigation measures is laying the building blocks for reducing drought associated risk and overall drought management. Regular policy review will facilitate drought response implementation and increase adaptive (resilient) capacity.

There is a need to decentralize the governance system of drought response through improving the disaster management policy. It is always important to continuously evaluate how useful and effective current policy is in mitigating the impacts of drought and how well these policies are integrated and implemented. Without a shared policy that applies to all relevant sectors and at all levels, prevention, preparedness and drought management and response are likely to be fragmented, badly coordinated and less effective.

5.11. The use of new technologies to cope with drought impacts

There are a lot of technologies that are available for use in drought affected areas worldwide. Mobile and telemetry use for real time data reporting for early warning, and adaptive research of crops that survives under drought should be strengthened. Crop research include improving and fast tracking the selection of drought tolerant crops [including local varieties], on the adaptation of crops to the changing environment, identify and develop improved soil moisture conservation practices that can increase the performance of in-situ water availability and crop yield. This technology evaluation and the selection of research projects can be handled both by the different universities and research centers that are well spread out to cover the different climatic and ecological zones in the country.

5.12. Establish and maintain a functioning and sustainable institutions

Strong institutions particularly at woreda level are key to good governance in drought management. Without good governance, there is little chance to be successful in addressing drought related impacts. Institutions are changing more frequently and there is a high turnover of staff particularly at woreda level and this is a limitation for effective drought management.

5.13. Natural resource management and development

Soil and water conservation activities should continue with improved design, construction and rehabilitation/maintenance of the structures to improve water conservation and biological resources. This part of the development work provide effective buffer and give a capacity for resilience to the affected community. A properly rehabilitated watershed and environment reduce soil erosion and land degradation thereby increasing the capacity of the soil to retain moisture and capture the runoff to recharge groundwater that can be used later during the drought period.

5.14. Increase community resilience

Continuously develop and sustain the natural ecosystem that offers more safeguard against harsh climate variability including drought. Maintaining ecosystems include stocking plant species and increasing supportive infrastructures (micro and macro dams and reservoirs).

Diversifying the enterprises of the rural people in small and micro enterprises could support livelihood resilience. Training on different business enterprises should be given and provision of small credit fund for properly targeted investments can of be great support to the affected community.

5.15. Improving communication and dissemination of information in drought prone areas

There are more technologies today than ever before that can improve real time communication on the slow on set of drought for early warning support and monitoring the implementation of development activities. The following technologies are of significant importance.

- The use of telemetry, mobile and on-line internet use for meteorological data real time transmission for early warning,
- The use of media for sharing information and education of the vulnerable communities in the forecasting of drought and its impacts;
- The use water pumps and ground water monitoring technologies for water supply and irrigation development;
- Increase use and improvement of the natural resources management techniques;

5.16. Continuously assess and improve the efficiency of the system of governance

Devolve the decision making power to the affected people and ensure effective public engagement at all matters on drought and its associated impacts. Drought has been a highly politicized subject and it has been often handled by the government structure alone. Building the knowledge base on drought through conferences and workshops, sharing and disseminating the information is very critical. The decision-making and the implementation of the drought preparedness and response programs need to be more transparent and accountable and the process of information gathering and making available for users should be less bureaucratic.

Supportive institutions such as universities and agricultural research centers should be engaged with appropriate responsibilities in data collection, analysis, research on policy and strategy that are crucially needed in the governance system. Under the mandate of these institutions, rainfall observation stations could be expanded, data collected and analysis could be carried out and results could be shared with the NMSA on a regular basis.

5.17. Expansion of the country's industrialization into drought prone areas

In pastoralist areas, there is a need to diversify from livestock economy to small-scale industry systematically. (i) diversify the existing livestock based household economy by engaging them in small scale agricultural business such as livestock fattening and other livestock based business, and (ii) develop large scale industrial programs such as cattle slaughter house development and meat packing industry. The pastoralists could be potential areas for meat and milk industry with a local and export potential.

6. Conclusion

Ethiopia has huge natural resource base and enormous potential to cope with the impacts of drought. It has varying agro-climatic zones with different rainfall seasons. The presence of a huge rain-fed agricultural potential is equally a blessing although this resource potential has not been augmented by technologies that increases agricultural productivity. The rain-fed production system is still traditional. If there is a political will and commitment on the part of the government and development partners, rain-fed production can be used to buffer the risk or minimize the impacts of hydrological and meteorological drought. The use of improved seed, soil conservation practices and implement land use, the productivity of rain-fed production can be increased. This has been observed in Australia that it was possible to produce 50 bushels of wheat per acre with an annual rainfall of 250 mm, and this is quite enormous productivity from a rain-fed agriculture, and this was a 30 years ago experience.

To overcome development challenges and disasters such as drought, the following are critical; (i) properly planned infrastructure, (ii) adequate financing, (iii) good governance and (iv) enabling environment. The Ethiopian economy was reported to be growing at double digits over the last one decade, and unlike previous situations, the country showed greater resilience to the 2015 and 2016 droughts and responded without serious causalities using its own resources. However, the recurring nature of the drought and the growing number of affected population as a result of the drought reminds the people and the government to remain vigilant and understand the full scale of the challenge of the future drought on the livelihood of the people and the economy of the country.

There is huge knowledge on drought and its response in Ethiopia (Lautze et al., 2003). Many of the aid agencies, however, are largely participating on emergencies, and their primary mission may be humanitarian assistance. It is necessary to review their mission and commit themselves in ending the cyclic emergencies and be able to support and focus on sustainable development as well. Their participation in infrastructure development programs such as rainwater harvesting, water well drilling for domestic water and irrigation water supply can reduce significantly the level of emergency food aid needed during drought period. They should play a supportive role in these well-identified and strategic investment areas.

It is also important to engage with the Integrated Drought Management Program (IDPM) (WMO and GWP, 2014) developed by the World Meteorological Organization (WMO) and the Global Water Partnership (GWP) in 2013 following the High-Level Meeting on National Drought Policy (HMNDP). The IDMP's mission is to provide information on the development of national drought policies aimed at drought risk reduction and this program can assist Ethiopia in this proposed shift to a new paradigm for drought management. In fact, the IDMP was involved in the organization of a regional capacity building workshop on national drought policy in Ethiopia in 2014 under the leadership of WMO, FAO, UNCCD, UN-Water and the Convention on Biological Diversity.

Cognizant to the immensely huge and untapped natural resource potential of the country and realizing the economic, social and political havoc that drought is able to create as it did in the past, it may be timely that the government and development partners consider some of the above suggestions and incorporate them in their annual development action plans in an integrated whole. This will allow them to set a proactive drought response and sustainable development program to end emergencies. Every effort should be made to establish a good drought governance system based on the principles of risk reduction.

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