

Full Length Research Paper

Climate compatible development in Ethiopia: A policy review on water resources and disaster risk management of Ethiopia

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Received 13 August, 2019; Accepted 14 September, 2021

Climate Compatible Development (CCD) is an emerging development approach which seeks to minimize the threat posed by climate change while maximize the opportunities for development. In view of the adverse impact of climate change on the general development of the country, Ethiopia, a number of polices which constitute climate change mitigation and adaptation strategies have been adopted and established. Among such polices, Ethiopian water resources and disaster risk management policy is expected to have direct and indirect role in addressing climate change mitigation and adaptation. Rainwater harvesting, water shed management, use of water efficiently, small scale irrigation and water resource protection, strengthening drought and flood early warning system are adaptation strategies for water resource policy, and water harvesting and improved energy efficiency are low carbon footprint strategies/mitigation strategies. Disaster risk management policy also comprises climate change and variability related disaster risk reduction strategies; enhancing early warning information system, and safety net program as the climate change mitigation and adaptation strategies, which are the major component of CCD. These policies also have its own limitation in relation to the system base and institutional gap in implementing CCD. In fact, these barriers can be eased by updating and/or adjustment of the policies under the framework of climate compatible development; mainstreaming climate change issues into water resource and disaster risk management policy; strengthening sector-wise linkage and synergy to avoid overlap; as well as monitoring the climate change mitigation and adaptation strategies among sectors.

Key words: Climate change, low-carbon footprint, adaptation, mainstreaming, Ethiopia

INTRODUCTION

Global climate is changing and have become a global issue in the recent decades. The change is coming in the

form of temperature change, precipitation change, sea level rise, and extreme events. The impact of climate

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change occurs on multiple dimensions ranging from impact on environmental goods and services to direct impact on human health and wellbeing. The severity of impacts will, however, depend strongly upon the existing environmental, demographic, social, and economic, governance and other factors that collectively determine exposure, sensitivity and capacity to resist, adapt to and recover from the effects (Intergovernmental Panel on Climate Change - IPCC, 2013). As shown in some evidence, climate change has already begun appearing in Ethiopia, which is one of the world countries that is mostly affected by climate change. Besides the direct effects such as an increase in average temperature or a change in rainfall patterns, climate change also presents the necessity and opportunity to switch to a new, sustainable development model (MoWR/NMSA, 2001). It has been noted that there is a general increasing trend of GHG emissions in Ethiopia in the period of 1990-1995 and it is expected to increase in the future along with socio-economic development and population growth. On the other hand, the sink capacity of the country in the LUCF sector is decreasing rapidly due to deforestation mainly for agricultural and energy use (EPCC, 2015).

In view of the adverse impact of climate change on the general development of the country, studies recommended that, unsustainable 'Business -as- usual' approach to the development should be replaced by climate-compatible development, which is the interface between mitigation, adaptation and development. IPCC Fourth Assessment Report also discussed adaptation and mitigation under climate change will require dynamic policies (Business as unusual) to cope with the high level of uncertainty in the timing and magnitude of potential climate changes and the rapidly evolving knowledge (Tubiello, 2012).

Ethiopia has adopted and established a number of policies, laws, programs and institutions which have bearings on climate change mitigation and adaptation. Some of these may not necessarily be established with explicit focus on climate change and its impacts. In 2011, the federal government of Ethiopia initiated Climate Resilient Green Economy (CRGE) initiatives to protect the country from the adverse effect of climate change and to build a climate resilient middle income green economy by 2025 (EPCC, 2015).

MoWRD/NMSA (2007) has mentioned that Ethiopian Water Resource Management Policy, and National Disaster Prevention and Preparedness (Currently, Disaster Risk Management Policy) are among the national policies initiatives that may directly and indirectly address climate change mitigation and adaptation. It also argued that the impact of climate change on water is central to all other impacts, and climate change is increasing the frequency and intensity of climate-related hazards, and hence the level and patterns of often inter-related risks.

This study, therefore, aims to review the existing water resources and disaster risk management policies in the context of climate compatible development approach. Based on the review, the paper discusses the indication of water and disaster risk management (DRM) policies, concepts of CCD, how much Water and DRM polices are climate compatible, and barriers and opportunities of the policies for CCD.

METHODOLOGY

This paper is based on an intensive qualitative document analysis, particularly water resource and disaster risk management Policy of Ethiopia. National documents such as Climate Change National Adaptation Programme of Action (NAPA), Initial National Communication of Ethiopia to UNFCCC, and National Disaster Risk Management Strategic Programme and Investment Framework, and related literatures in the area were also consulted to achieve the objectives of the paper. Interviews were also held with key informants from Ministry Of Water, Energy, and Electricity, and National Disaster Risk Management Commission .Semi structured questions were used during the interview.

RESULTS AND DISCUSSION

Overview of policies

The term 'policy' often refers to general objectives which a state/government strives to achieve using a range of instruments or tools (Lasswell and Kaplan, 1950; EPCC, 2015). However, the scope of the paper is limited to reviewing Ethiopian water resource and disaster risk management policy through climate-compatible development lens, strategies, programs and projects which are meant to translate the general objectives of the policy into concrete results are referred along with the given policy document. This policy review is limited to Ethiopian water resource and disaster risk management policy which focuses on strategies of the policy related to climate change adaptation and mitigation strategies.

Water policy

Ethiopia water policy was formulated in 1999 with the belief that an appropriate water resource management policy for the sector will enhance the development of the countries water resource to make optimum contribution to an accelerated socio-economic growth. The policy was formulated based on the constitution of the FDRE Government Macro Economic and social policies and development strategies as well as objectives accepted by FDRE and the principle of water resource development objective that would enhance the social economic development of the peoples of Ethiopia. The policy sets forth general objectives and principles covering

socioeconomic benefits, water allocation, drought and disaster management, flood regulation, conservation, and more. Specific sector policies address the three fundamental focus areas of water supply and sanitation, irrigation, and hydropower development. In general, water resource management policy of Ethiopia has mainly focused on about 16s general water policy issues (MoWR, 1999).

Water management institutions have been undergoing frequent restructuring and characterized by instabilities due to different reasons. Currently, the water sector governance structure encompasses federal level ministry, regional level water and energy bureaus and supporting zonal and woreda¹ level water resource development offices. The Ministry of Water, Irrigation and Electricity (Formerly Water, Irrigation and Energy) has the mandate of formulating national water policy, strategy, legal frameworks, plans, and for establishing national standards pertaining to water resources, establish relevant institutions, commission studies, plan and develop water supply and sanitation schemes, irrigation, hydropower and other energy forms, and water resources administration, protection, monitoring and allocation (MoWR, 2001). A number of proclamations support the framework policy, such as the Water Resources Management Proclamation (Proclamation 197/2000), the 2001 National Water Sector Strategy, and the 2002 Water Sector Development Program.

Disaster risk management policy

The Existing institutional arrangements for disaster risk management in Ethiopia are the result of a long institutional evolution. Over the last 30 years or more, institutional set up for disaster management system has gone through substantial changes in mandate (mission and objectives) and accountability. These changes are largely driven by changes in policy and approach to disaster management (DRMFSS, 2014). Currently, the government of Ethiopia has started the operation of new DRM policy which was formulated in 2013 and started implementation in 2015. Until 2013, the existing DRM policy was the National Policy on Disaster Prevention and Management signed in 1993. Based on lessons learned from previous experience, the current DRM policy include the necessity of a multi-hazard approach grounded in a deep understanding of specific disaster risk, and its link to development and vulnerability; emphasis on prevention, mitigation, preparedness and post-disaster

modalities and capacities; de-centralization of resources and structures; a clear determination of DRM responsibilities, supported by the capacity for legal enforcement and a high degree of accountability.

As its nature of disaster risk management, the policy states that coordination should be at the center and it identify lead institutions and hazards and related disasters they are responsible for. These institutions are Ministry of Agriculture, Ministry Of Environment, Climate Change and Forestry, Ministry of Health, Ministry of Water, Irrigation and Energy, Ministry of Federal Affairs, Ministry of Transport, Ministry of Mines, Ministry of National Defense, Ministry of Urban Development, Housing and Construction and Ministry of Education. Each ministry takes the leading role to relevant hazards and related disaster according to their operation area.

CLIMATE COMPATIBLE DEVELOPMENT: CONCEPTS

Climate compatible development (CCD) is an emerging development approach which seeks to minimize the threat posed by climate change while maximize the opportunities for development. It moves beyond the traditional separation of adaptation, mitigation, and development strategies and minimizes the harm caused by climate impacts while maximizing the many human development opportunities presented by low- emissions and more resilient future (Mitchell and Maxwell, 2010). It can be the outcome of the combined effect of low carbon development and climate resilient development. This is creating a new development landscape for policy makers, who need to nurture and sustain economic growth and social development in the face of multiple threats and uncertainties while also cutting emissions or keeping them low. CCD builds on the long-established concepts of adaptation and mitigation, as well as the newer concepts climate resilient development and low carbon (Figure 1).

In the context of water sector, climate compatible development can be the synergy between climate-resilient water, low carbon water development, and land management and hydropower gives (Yohannes, 2015). It also works for disaster risk management sector. To achieve climate compatible development, the sector's strategies should interface with climate resilient disaster risk management approach and low carbon disaster risk management system. According to Mukuna (2015), as climate compatible development is still in its inception in most sectors, it requires policy making and mainstreaming at national level. Ficklin et al. (2017) mention that problems which complicate the operationalization of CCD are problem of conceptualization, the processes of assigning a value to the three components of CCD that guides the trade-offs made within it, and governance.

¹Woreda (also spelled wereda) is the third-level administrative divisions of Ethiopia. It further subdivided into a number of wards (kebele) or neighborhood associations, which are the smallest unit of local government in Ethiopia. It is equivalent with district

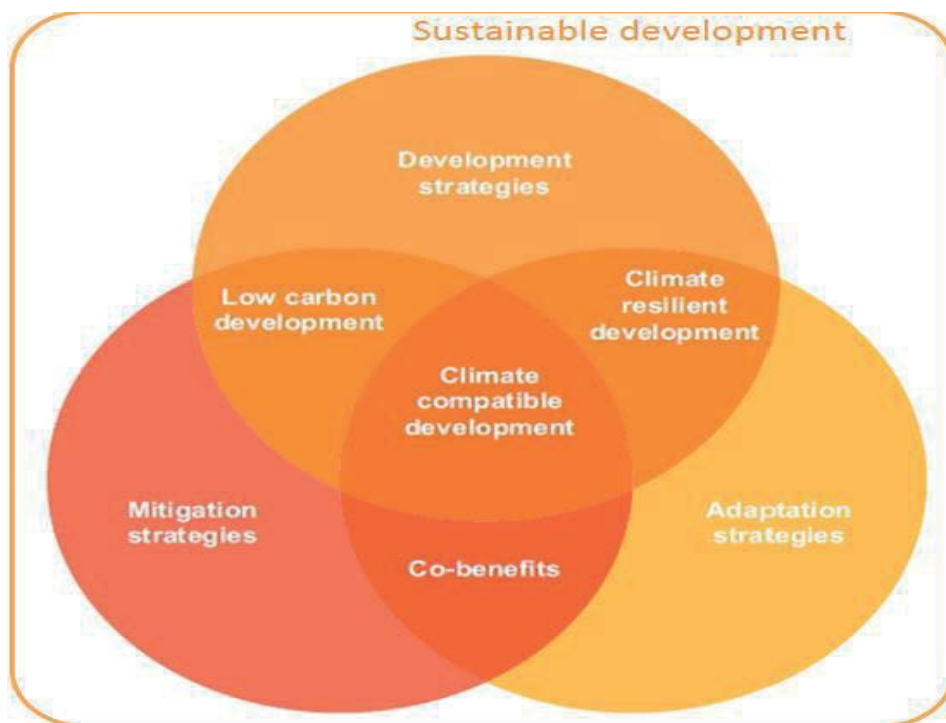


Figure 1. Conceptual framework for Climate Compatible Development.
Source: Mitchell and Maxwell (2010).

Climate compatible development in Water Sector

There is a high level of scientific confidence that climate change is likely to seriously affect the freshwater water resources of the earth, which will subsequently lead to damages on human life, socioeconomic infrastructure and environmental resources (IPCC, 2013). Semi-arid and arid areas are particularly vulnerable to the impacts of climate change, where water is a limiting factor for socioeconomic activities and environmental functions. Areas that have low water infrastructure, particularly developing countries are also vulnerable to the impacts of climate change.

Ethiopia has an abundance of water resources, including 12 river basins with ground water potential of approximately 2.6 billion cubic meters (MoWR/NMSA). However, these are unevenly distributed across the country and much of the country's flow-waters flow across borders. To date, only a small proportion of these water resources have been developed for sectors such as hydropower, agriculture, water supply or sanitation. Ethiopian water resource is vulnerable to increased temperature, increased intensity of precipitation, increased unreliability of rains and recurrent drought, and the sector also holds promise for different national strategies related with adaptation and mitigation to climate change (EPCC, 2015). The annual distribution of

rainfall is of great interest to the water industry.

Figure 2 indicated that the projected change in monthly mean precipitation per month by 2050 compared to the reference period (1986-2005) under all RCPs of CIMP5 ensemble modeling. Positive values indicate that monthly rainfall will likely increase compared to the baseline, and vice versa. The shaded area represents the range between the 10th and 90th percentile of all climate projections. On the other hand, in climate-compatible development of water sector, water related and water implied adaptation strategies should interface with water resource development strategies, resulting in climate-resilient water development. Water implied mitigation strategies should also interface with water resource development strategies, resulting in low carbon water development. Land management and hydropower dam results from the interface between water related and water implied mitigation strategies. So, in aggregating the interface between climate resilient water development, low carbon water development, land management and hydro power gives climate compatible development in the water sector (Yohannes, 2015).

Therefore, these basic concepts are taken as a framework to review the Ethiopian water policy in the context of climate compatible development. And the following sub session discusses the existing water related adaptation strategies and its interface with water

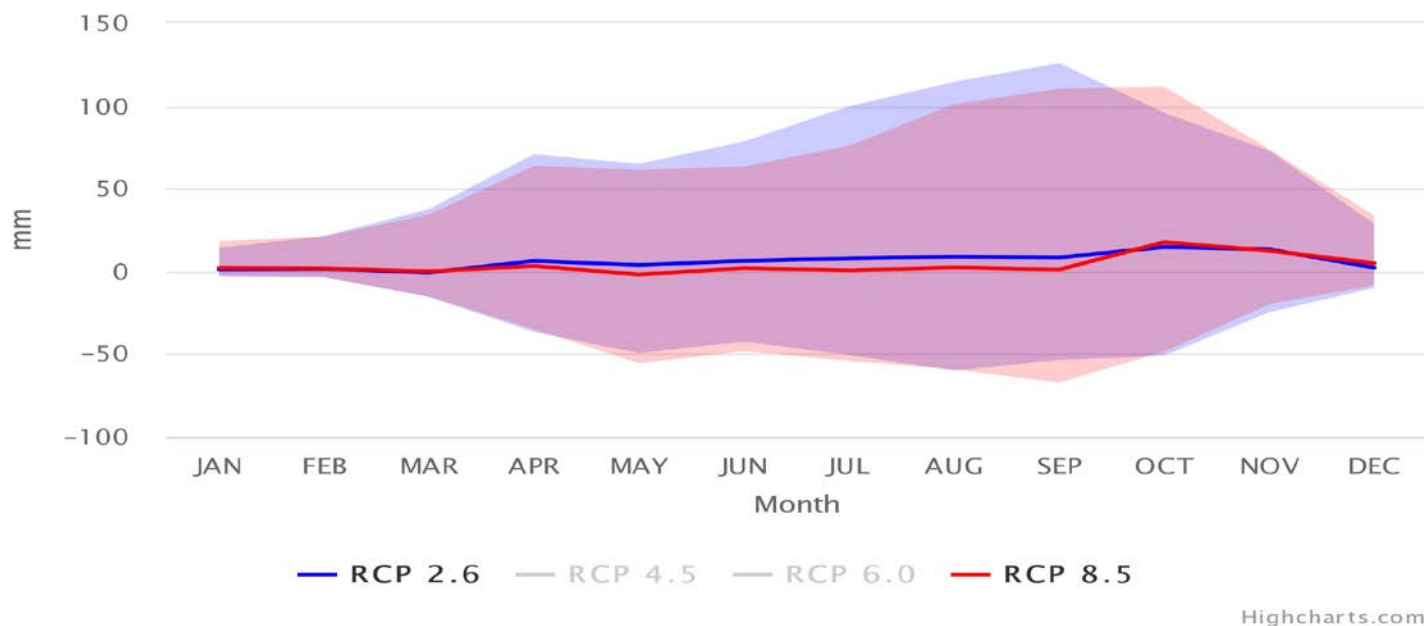


Figure 2. The projected change in mean monthly precipitation in Ethiopia for the period of 2040-2059. Source: WB (n.d.) Climate Change Knowledge Portal.

development strategies.

Water related adaptation strategies in Water Sector

Adaptation strategies are one element of CCD which involves the adjustment of ecological, social, and economic system in order to reduce the vulnerability of communities, regions, and activities to climate change. The following are adaptation strategies found in the water policy directly or indirectly.

Rainwater harvesting: Rainwater harvesting has been mentioned in the Inter Panel on Climate Change (IPCC), National Adaptation Programme of Action (NAPA) and Climate Change Strategies (CCS) as a key strategy option for climate change adaptation in the Ethiopian water sector. In the policy statement, the importance of water harvesting has stated under the general water resource management policy as:

“The strategies of the policy are to promote and enhance traditional and localized water harvesting techniques in view of the advantages provided by the schemes’ dependence on local resources and indigenous skills.” (Ministry of Water Resource, 1991).

Managing and combating droughts as well as regulating floods are among the general objectives of the policy that can be directly or indirectly related with rain water

harvesting strategies. This conclusion, also supported by Yohannes (2014), indicates that appropriate rainwater-harvesting technologies are very important to manage and combat drought and flood through efficient storage and rehabilitation measures. Therefore, from this it can be understood that Ethiopian water policy has incorporated rainwater harvesting as an adaptation strategy. However, the implementation status of this strategy is not covered in this discussion as its scope is to review the policy in the lens of CCD.

Watershed management: Improvements in watershed management will be a crucial element for adaptation measure of climate change. The NAPA has incorporated watershed management as a potential adaptation options for climate change. It also related with other water resource management strategies like water harvesting and conservation practices. Also, the nature of this strategy related with the policy of water, agriculture and rural development and Environmental policy of Ethiopia.

Water policy of Ethiopia predate NAPA proposed adaptation options for climate change by incorporating watershed management as the major CC mitigation strategy and cross cutting issue in the policy. The policy states that to maximize water yield and quality, efficient and appropriate practices of watershed management should be promoted. Ensuring the watershed management as an integral part of the overall water resource management is also very important as the policy mentioned.

Water use efficiently: Using water efficiently is another adaptation option for climate change induced water problems. Recognizing the importance of efficient utilization of water, the policy has incorporated these measures under the general water resources management policy. It is also mentioned as a cross-cutting issue in the policy.

Small scale irrigation: This is also one of the policy priorities of Ethiopia as the national economic development strategy places heavier emphasis on the agricultural sector, which is a climate sensitive sector. And the water resource management policy of Ethiopia ensures that water can be made to contribute to the national economy through the development of the country's water resources and expanding irrigation schemes. This is so that agricultural production is improved by solving the problem of water shortage caused by the unpredictability of the rainfall.

It is also identified as adaptation options in NAPA. Irrigation in general and small-scale irrigation in particular, is among the focus of Ethiopian water resource management policy. This is due to the fact that smallholder farmers in Ethiopia has been exposed to different weather variability and climate change induced hazards frequently. For instance, the frequency and extent of drought has been significantly increasing during the last decades. For instance, the frequency of drought event was three in 10 years (1990-1999) and in the last decade (2000 - 2009) the number of droughts occurred to become eight (FDRE, 2015). Hence, small-scale irrigation is among the strategies of water resource management with the objective of improving the production of food crops and raw materials needed for agro industries as adaptation strategy will be very effective and appropriate.

Water resource protection: Water resource protection is also one of the cross-cutting issues in water resource policy of Ethiopia. Evidences show that one of the impacts of climate change is on the quality of water resources. The policy included water resource protection as cross-cutting issue to create appropriate mechanisms to protect the water resources of the country from pollution and depletion, and establish standards and procedures for various use of water in terms of quality and quantity. Most of the above water adaptation strategies are free of emission and qualify as carbon neutral (area closure, avoid farming of water sources, wet land). However, little water related adaptation measures included in the policy like small scale irrigation could have relatively large carbon prints (mal-adaptation). In addition to the above strategies, strengthening/enhancing drought and flood early warning system is also included in the policy and can be used as climate change adaptation strategy.

Water related mitigation strategies

Mitigation actions involve direct reduction of anthropogenic emissions or enhancement of carbon sinks that are necessary for limiting long-term climate damage. In the context of Ethiopia, the policy making process shall be inclined to the adaptation strategies as the contribution of Ethiopia to the global GHGs emission is insignificant or almost negligible. However, most of the development strategies are free of emission and relatively carbon neutral; hence, few water related strategies could have large carbon footprint. So, the Ministry of Water, Irrigation and Electricity (Formerly, Water, Irrigation and Energy) is responsible for mitigation of the given GHGs emitted from those strategies that have relatively high carbon footprint. Sometimes, adaptation strategies have consequence for mitigation strategies. According to Mukuna (2015), the most effective adaptation to climate change impacts also tries to reduce the cause of the change. So, adaptation strategies will also contribute to mitigation measures. Mitigation strategies related to water sector are:

Rain water harvesting: In addition to the adaptation role, this strategy may also help the mitigation option through creating favorable condition for forest and vegetation coverage, thereby contributing to carbon sinks. This practice has been also incorporated in water policy of Ethiopia.

Improve energy efficiency: Expansion of efficient lighting and improved cook stoves has the potential to significantly reduce the demand for energy and emission of GHGs. Thus, it can be taken as the mitigation option to climate change. In connection with this, Ethiopian water policy formulated in 1999 does not mention much or focus on improved energy efficiency activities rather than focusing on hydropower. However, currently the CRGE document well incorporated such kind of improved energy sources. Hydropower, which is the renewable source of energy, is also one of the mitigation or low carbon strategies cited in the water policy with the aim of enhancing efficient and sustainable development of water resource, aimed at meeting the national demand.

The water related mitigation strategies or direct reduction of anthropogenic GHGs emissions in the country is mostly linked with other sectoral policies such as agriculture and natural resource management sectors. This is due to the fact that most of the root causes for the emission are mostly related with poor agricultural activities and forest degradation. On the other side of mitigation or enhancement of carbon sinks, afforestation, agroforestry and conservation tillage are among water implied strategies which has been incorporated directly or indirectly in relevant polices such as Agriculture and

Natural Resource Management of Ethiopia.

Barriers and opportunities for CCD in Water Sector

Policy of the given sector plays a great role in the realization of CCD. The realization of CCD in water sector also requires that its framework and objective are in full agreement with the existing water resource policy. There are many physical, ecological, economical and institutional factors that limit the Climate-Compatible Development in water sector (EPCC, 2015). However, this part of the work discusses only the barriers and opportunities associated with the policy and institutional arrangements.

The water sector of Ethiopia has opportunities for CCD in the number of ways. Most of the strategies that are found in the policy have low carbon footprint and have also dual role for adaptation while existing as development strategies. Availability of huge renewable energy source like hydropower is among the opportunity for low carbon development. According to Yohannes (2015), water policies of Ethiopia predate the endorsement of climate compatible development as the only pathway to sustainable development. The policy is to be inclusive in regard to adaptation strategies and could serve as enabling framework for most of the proposed water-based adaptation options found in the national climate change document.

Most water implied mitigation strategies are to be operated out of the sphere of the water ministry as the nature of root causes are sector-wide and multi-sectoral response need. This creates difficulties to implement and monitor the mitigation strategies associated with water. The opportunities in relation with the climate mitigation strategies are the availability of hydropower potential, which is low carbon footprint source of energy.

Climate compatible development in Disaster Risk Management System (DRM)

Ethiopia is exposed to a wide range of hazards associated with the country's diverse geo-climatic and socio-economic conditions. At the same time, these disasters can be exacerbated by climate change which is changing the frequency and intensity of natural events increasing the vulnerability of populations to hazards and it is likely to become more unpredictable in the coming years. With this recognition, the Government of Ethiopia started a paradigm shift a few years ago, largely triggered by the Government policies and the Hyogo Framework for Action, shifting the focus from reactive crises management to a more proactive multi-sectoral and multi-hazard Disaster Risk Management System

(DRMFSS, 2014).

Climate related hazards in Ethiopia include drought, floods, heavy rains, and the country is also vulnerable to these kind of climate related hazards because of different reasons, including very high dependence on rainfed agriculture which is very sensitive to climate variability and change, under-development of water resources, low health service coverage, high population growth rate, low economic development level, low adaptive capacity, inadequate road infrastructure in drought prone areas, weak institutions, lack of awareness, etc. (MoWR/NMSA, 2007). From this we can understand that disaster risk can be managed through a multi-sectoral approach system. There is also growing evidence that climate change is increasing the frequency and intensity of climate related hazards. In response to this problem, the government of Ethiopia has endorsed different policies in different time and the existing national policy and strategy for disaster risk management was enforced in 2013. The following DRM related adaptation and mitigation strategies are based on the recent policy formulated in 2013.

Disaster risk management related adaptation strategies

To examine disaster risk management related adaptation strategies, it is very important to understand the similarities and differences between disaster risk reduction (DRR) and climate change adaptation (CCA). The similarities include; both having similar aims which means reducing people's vulnerabilities and building resilience to hazard in the context of sustainable development. And they support each other for mutual benefits; DRR supports CCA through reducing climate-related disaster risk, and in offsetting the long-term implications of climate change like reforestation (one of a key DRR measure) will lessen the impact of flood, but it will also offset long term soil degradation and control local temperature and rainfall (DRMFSS, 2014).

The differences between DRR and CCA includes hazard type that they address. DRR addresses all type of hazards (whether climate-related or others like geological) while CCA addresses only hydro meteorological hazards; and DRR concerned with the present and near future whereas CCA concerned with the short-, medium- and long-term future. Moreover, Climate-Change Adaptation (CCA) involves climate-related disasters and non-disaster related climate impact (unpredictable rain, sea level rise, temperature and saline intrusion). It is acknowledged by academics and development practitioners that the integration between DRR and CCA is very important to reduce the growing risk associated to climate change, to avoid the duplication of the activities; and to achieve sustainable development goals at broad.

Disaster Risk Assessment (Disaster Risk Profile² at District Level): To make the disaster risk management implementation in the country well-informed, the DRM policy statement discuss that a comprehensive information management system is required. This disaster risk assessment can be categorized as adaptation options for disaster risk management sector because it can act as baseline information for climate change adaptation as well as mitigation planning process. Disaster risk profile of the given district presents the characteristics of the given climate related hazard type, vulnerability conditions and existing adaptive capacity of the given community. According to DRMFSS (2014), to develop adequate adaptation measures, well informed information is required. Moreover, adaptation strategies including the ones that we have discussed in the water section like water harvesting and watershed management can be planned by this multi sectoral risk assessment information. The policy statement of DRM incorporates the risk assessment under its policy directions and strategies as:

“Disaster risk management shall be informed by disaster risk profile information to that effect, disaster risk profiles that contain information on each hazard, vulnerability and capacity to cope as well as other related baseline information shall be developed at the woreda level and organized in a database, periodically updated and put into practice” (National Policy and Strategy on Disaster Risk Management, 2013)

“Based on the disaster risk profile, activities need to be implemented before, during, and after the disaster period to minimize and prevent the impact of every hazard and associated” (National Policy and Strategy on Disaster Risk Management, 2013).

Enhancing early warning information: Early warning is the provision of timely and effective information through identified and mandated institutions to allow individuals and communities at risk take actions that reduce their risk and prepare effective response (UN/ISDR, 2009). In the context of this paper, it also worked for climate induces and/or related disaster risks. Early warning is a preparedness phase in the DRM cycle that helps to take right response for the present and/or future type of impact. Hence, reactive adaptation will follow based on the given early warning information. Reactive adaptation is one type of adaptation which results after the initial manifestations of changes.

National policy and strategy for disaster risk

management (2013) mentioned the importance of early warning information for adaptive measures including building essential community assets and resilience to direct climate change impact and extremes associated with it. According to the policy, providing or adopting response measures for the given climate related hazards on the basis of early warning and disaster risk assessment information enables resources allocated for the given adaptive response to be properly utilized for the intended purpose and it also allows for properly implementing recovery and rehabilitation interventions that will adapt the future adverse climate related impacts.

In general, for the appropriate adaptation measures, the policy incorporated Early Warning (EW) and disaster risk assessment information as a tool in its policy directions and strategies. The main tools currently used for EW that directly and indirectly relates with climate-related hazards are: regular monitoring (weekly and monthly), seasonal assessments, emergency nutrition assessment and satellite-based weather monitoring tool (LEAP).

Productive Safety Net Program (PSNP): Productive safety net program also can be categorized as one of climate response program that can act as mitigation and adaptation strategies depending on the type of activities found under the program. It is part of a larger program called food security program with the aim to protect food consumption of chronically food insecure rural households in a way that prevents asset depletion at household level and build assets at community level (DRMFSS, 2014); from this one can understand that, with different actions of the program it works before, during and after the climate-related hazards. Among the objectives of the program, reducing and eventually preventing disaster risk and vulnerability; and reducing dependency on an expectation for relief aid can be better achieved activities under productive safety net program.

The following are the major adaptation strategies carried out by the beneficiaries under the PSNP:

- *Improvement in Natural Resource Management:* Improving natural resource management (NRM) entails a paramount importance for CC adaptation and mitigation. Among the NRM activities, soil and water conservation; reduced surface runoff and soil erosion; increased infiltration; raised groundwater levels and enhanced spring yields; increased stream base flows; increased vegetation cover and biomass; and forestry, agro-forestry and forage development are the major adaptation activities of PSNP.

However, the national policy does not clearly show the sector wide-linkage and synergies that avoids the emerging overlap between relevant sectors, which has been working on the above-mentioned strategies.

² Woreda disaster risk profile is a disaster risk assessment programme led by government of Ethiopia which uses for planning and programming various developmental interventions. Detail can be found at <http://profile.dppc.et>

Climate-change related mitigation strategies in disaster risk management

Some climate-change related mitigation strategies have consequence for mitigation strategies. In disaster risk management system of Ethiopia, the above-mentioned adaptation strategies can also act as mitigation strategies. These are; disaster risk assessments (risk profiles at district level), and activities implemented under the Safety Net Program of Ethiopia such as soil and water conservation; structures to reduce surface runoff and soil erosion; Increase vegetation cover and biomass; forestry, agro-forestry and forage development. Risk profile of each woreda informs appropriate, area specific and multi sectoral climate change mitigation strategies and activities and the PSNP activities contributes for the restoration of degraded land and agroecosystems while contributing to improved food nutrition and security of the poor rural communities.

According to the DRM policy, disaster risk management including CC mitigation is not solely the responsibility of one sector. By underlining the DRM coordination as the main principle of the policy implementation, the policy has assigned lead sector institutions for every hazard and related disasters they are responsible for. Based on this ground, most of the above-mentioned mitigation strategies are implemented and led by Ministry of Agriculture, and Ministry of Environment, Climate Change and Forestry and the DRM office is responsible for the coordination, monitoring and evaluation of its implementation through the DRM coordination structures sated in the policy. In accordance to the policy, it has been undertaking the woreda/district disaster risk mitigation and adaptation planning. These multi-sectoral mitigation and adaptation plan needs to be integrated and coordinated with other plans and programs at the same level including the woreda development plan, PSNP, pastoral community development plan (PCDP), and Growth Transformation Plan (GTP). Based on the data gained from NDRMC, comprehensive risk mitigation and climate change adaptation plan has developed for about 290 districts as March 2019. The planning comprises key sectors including Agriculture (including natural resource management), Water, Health, Livestock and the above strategies can be included depending on the characteristics of the district. Mainstreaming of DRM into sectoral institutions was also among the key directions and strategies that the policy composed. In accordance to this strategy, the government has issued the guideline for mainstreaming disaster risks into investment decisions in Ethiopia. However, overlap of activities among these ministry/sectors was identified as a challenge in the implementation of CCD. This could be due to lack of strong legal framework for sector-wide coordination and implementation of DRM system in the country.

Barriers and opportunities for CCD in Disaster Risk Management

The DRM system in Ethiopia has been evolving rapidly over recent years with substantial progress made in building the overall system envisioned in the DRM policy. Based on the key informants and desk review, the DRM system has both gaps and opportunities in implementing climate compatible development. In accordance to the CCD framework, when we see the existing DRM policy in the lens of climate compatible development framework, the following could be the policy and system level, as well as institutional level gaps for implementing CCD practices.

Policy and system level gaps

- i) The policy does not show clear definition of DRM cycle and the establishment of its interrelationship with climate change mitigation and adaptation strategies.
- ii) The lack of sector-wide linkages and synergies is evident in the emerging overlap between DRM, climate change adaptation and mitigation strategies among sectors.
- iii) Much of the resource is skewed towards emergency assistance rather than climate change adaptation and mitigation strategies. And this is not also clearly stated in the policy on how this can be shifted to risk reduction approach.

Institutional gaps

- i) As its nature of the multi-sectoral approach of the sector, the organizational structures themselves do not have harmonized roles and responsibilities in climate change mitigation and adaptation strategies. Also, it can lead to duplication of effort in key functional areas.

CONCLUSION AND RECOMMENDATIONS

There is a growing consensus on the scientific literatures that the impact of climate change and climate variability in Ethiopia has been increasing on different sectors including water resources development and disaster risk management. And it has been noted that there is a general increasing trend of GHG emission compared to the last decades. In view of this situation, CCD has been suggested by different studies as a means of achieving sustainable development.

Ethiopia has been adopted and has established a number of polices which has bearing on climate change mitigation and adaptation, as well as elements of CCD. Ethiopian water resource and disaster risk management are among the polices that may directly and indirectly

address climate change mitigation and adaptation. Based on this review, most of the strategies of water resource policies of Ethiopia are climate compatible. The sector includes adaptation strategies such as: rainwater harvesting, watershed management, use of water efficiently, small scale irrigation and water resource protection, strengthening drought and flood early warning system. Also, as the sector is low carbon footprint, there are some mitigation strategies like rainwater harvesting and improved energy efficiency. Disaster risk management policy also comprises climate change adaptation strategies such as disaster risk assessment (DR profiling), enhancing early warning information system and safety net programs and most of these adaptation strategies also works for mitigation consequences. Based on desk review and key informants, some DRM related system based and institutional gaps in implementing CCD were also identified. Therefore, in order to realize climate compatible development, the following general recommendations are suggested;

- i) Updating and/or reforming of the policies are needed under the framework of climate compatible development.
- ii) Mainstreaming of CCD practices into water resource and disaster risk management policy and monitoring its implementation.
- iii) Strengthening sector-wise linkage and synergy to avoid overlap and for effective monitoring of the climate change mitigation and adaptation strategies among sectors.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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