

Original Research Article

An Overview of Drought Hazards and Prospective Mitigation Approach in Bangladesh

Abstract

Climate change context is now consider to be a vital cause of worsen condition of different environmental sphere. The interference of outsider factor may tends to change optimal condition of the natural environment. Climatic variables shows some anomalies in terms of compositional variation and greater context of instability. Long term instability of temperature and rainfall pattern leads to regional and local drought hazards. Consequently, it has been showed that, productive sector failure, worsen socio-economic status. Particularly agricultural activities appeared as a more vulnerable sector owing to unexpected drought events especially in Bangladesh. Due to lower production rate has been created social crisis like as groundwater scarcity, food insecurity and livelihood change. Regarding with the literature and observation feature, uncertainty of the rainfall pattern indirectly make emphasis on over extraction of groundwater for the irrigation purpose. As an agro economy country, it is very important to count and take initiatives to mitigate the situational climatic hazards. On the basis of pragmatic extent, combined approach as categorical and sub-categorical aspects may ensure sustainability at the agricultural sector. At the local drought hazard management, sustainable water and land management could be a follower guideline to bring sustainability in the agricultural activities against with adverse environmental hazards.

Keyword: Drought Hazards, Temperature & Rainfall, Agricultural Activities, Social Crisis, Mitigation Measure & Sustainable Development

1. INTRODUCTION

In Bangladesh, droughts has been appeared as a recurrent phenomenon and devastating nature, it scientific acceptance less than cyclones or flood (Alexander 1995; Brammer 1987). Every year different natural disasters hit our country as flood, drought, cyclone, river bank erosion, earthquake etc. (Ali, 1996). Drought is one of most formidable disaster which is frequently occurred different region in Bangladesh. Drought is a natural slow onset hazard and has non-structural damaged. Long period dryness condition and unavailable water supply is called drought. That means the scarcity of water in the earth surface for domestic purposes, agricultural purposes, industrial needed. Drought can be defined by atmospheric or Meteorological, hydrological and agricultural condition. These conditions are closely related to each other. Meteorological condition leads to other conditions. If atmospheric condition is dry without rainfall effect on another condition. Drought triggers to other disaster as malnutrition, famine, social conflict so on. The density and distribution of population are also influenced by drought (Rakib et al., 2014a). Drought prone areas, people don't make their settlement because shortage of facilities.

Natural hazards turn into formidable situation for climate change. Agricultural sector is closely related with two natural disaster- flood and drought. Drought and untimed flood are enhanced by climate change. Regarding with IPCC (2007) special report

on climate change and its probable effects on rainfall pattern and warmer climate in Bangladesh, it may increase 5-6% rainfall by 2050 owing to snow melting which would be attributed to more intense monsoon, frequent and big flood, and prolonged flood as well as outside of the monsoon drought could be increased. More than 19 drought events severely hits to Bangladesh in the last fifteen years whereas a number of drought events (e.g. 1973, 1978, 1979, 1981, 1982, 1992, 1994, 1995, 2000 and 2006) are to be more worth mentioning (Habiba et al., 2012). Climate variability can also cause of global warming and sea level rise for increasing temperature. Global warming can bring about other disasters which may also hamper on crops. Cyclone is another disaster in the coastal region which is influenced by climate variability (Rahman, 2011). Bangladesh is more vulnerable country of climate change. Bangladesh is also more vulnerable of different natural disasters as flood, drought, cyclone are common. Climate change means the variability of climatic parameters- temperature, precipitation, humidity, wind direction, pressure are most important climatic factors. It is one of the most important country whereas drought is frequently occurred in a year. The mean temperature in Bangladesh has been recorded ranges from 26.9 to 31.1C during summer and 17 to 20.6 C during winter. In the climatic point of view, drought can be categorized into three distinct types, (i) from November to February (during winter season), (ii) March to May (during pre-monsoon hot summer season) and (iii) from June to October (during rainy season) (Rashid 1991). Drought and its severity has been drawn some social insecurities. Regarding with the scientist concern about the changing pattern of precipitation in Bangladesh, it is necessary to evaluate some important factors or implementing mitigation approach to reduce drought impacts like as risk and vulnerability assessment (Shahid, 2008). At the present time, along with high population growth and food demands does not support to the existing trends of the crop production trends. The crop production rate has been decreased due to the long term anomalies of the climatic variables. This changing pattern and its severity might be turn into colossal damage at the local and large scale.

In the consequently, every year drought occurs in the northern part of Bangladesh. It affects the vast region on food security, economic performance in the affected areas. Several papers have been reported on the impacts of droughts on land degradation (Rasheed 1998; Karim and Iqbal 2001; Government of Bangladesh 2005), food production (Ahmed and Bernard 1989; Ericksen et al. 1993), agriculture (Karim et al. 1990; Jabber 1990; Jabber et al. 1982; Saleh et al. 2000; Mazid et al. 2005), society (Erickson et al. 1993; Paul 1998) and economy (Erickson et al. 1993; World Bank Bangladesh 2000). The land use change is one of the major cause to frequent occurrence of drought hazards in Bangladesh, in comparison with neighboring country (National Drought Mitigation Center 2006). Now it is a critical parameter to keep maintain food supply in the community but drought effected directly emphasis on food insecurity owing to damage agricultural production rate falling. Rahman and Biswas (1995) reported that, wheat and rice production rate decreased 3.59106 t from 1994-1995. At the time of drought events, it consequence directly attributed to the normal distribution of the water supply and probable demand. It has tremendous impact on the economy in northern districts. This paper aims to investigate the problematic site of the drought events with special reference to agricultural aspects and it also deals with mitigation approach combined approach through making interconnection among the drought events accelerating factors.

2. ANALYZE THE CAUSES AND IMPACTS OF DROUGHT HAZARD IN BANGLADESH

Bangladesh is located between 20°34' and 26°38' north latitude and 88°01' and 99°41' east Longitude. In terms of climatology, Bangladesh is positioned at the sub-tropical region. The mean precipitation in Bangladesh varies from 1,329 mm (In the northwest) to 4,338 mm (In the northeast) (Shahid et al., 2005). The average rainfall at the western part of Bangladesh approximately 2,044mm, which is much lower than others parts of the country (Shahid, 2008). Bangladesh is a one of most vulnerable countries to natural disaster for the unfavorable geographical location (Shahid, 2008). Disaster, natural hazards and risk is considered to be geographically in nature (Cutter 1993; Hewitt 1999). Every year drought visits some parts of our country mostly northwestern part including Rangpur and Rajshahi divisions. Bangladesh has not any permanent drought area but seasonal and contingent drought must be visited. Bangladesh belongs to high densely population and high level penury, low economic growth, mostly rely on agriculture, flat and low topography, reversing monsoon weather, temperature raising. High Temperature results declining soil moisture and water scarcity, the more variability of monsoon rainfall, rising evapotranspiration. Himalayan Mountain is situated in the north side of our country. As a result huge amount of rainfall occurs during monsoon. Sometimes it get plenty of water in rainy season and also inundate the low lying areas that means flood. If the climate change occur in the regular pattern then it will affect to both high and low lands through emerging with the flooding hazards and also it may extent through water holding variability with time and place (Postel et al., 1996). The causes of drought are closely related to climate variability. Climate variability is inversely related to vegetation. Continuous changing pattern of climatic variables may leads to drought hazard. Most of the river is going to dry owing to the long term impacts of flowing water body, results of rainfall uncertainty and artificial barrage at the upstream.

The lower rate of the river discharge in the dry season negatively impacts on ecosystem, river morphology and aquatic ecosystem at the western part of Bangladesh (Shahid, 2008). In Bangladesh, Brahmaputra River is more vulnerable to flow of water, and it consider to be threaten for the food security of an estimated 26 million people (Immerzeel et al., 2010). On the other hand, Ganges-Brahmaputra river basin is consider to be susceptible at the time extreme flooding and monsoon rainfall (Mirza, 2002; Warrick et al., 1996). The water discharges of the Ganges River has significantly decreased (Around 57%) compare with the before stage to after Farakka Barrage at the upstream (World Bank Bangladesh 1998). Teesta is the main river in the northern part of Bangladesh. Teesta River enters into Bangladesh through the Nilpharmary and Lalmonirhat districts. Government of Bangladesh has constructed a barrage on Teesta River at Dalia in Lalmonirhat district, is a major source of water irrigation in northern part of Bangladesh. The neighbor country of Bangladesh including India has also constructed an embankment on Tissta River in its side of the territory at Gazoldoba in jolpaiguri (Bangladesh Water Development Board, The daily star.2012; Higano et al., 2002). During monsoon season open the all doors of Gazoldoba barrage in India results flood in the low areas of northern part of Bangladesh. On the other hand, during dry season only few doors open for normally water flow result drought. On the other hand, The causes of Meteorological drought are atmospheric or climatic parameters as low Rainfall, high Temperature,

low Humidity, high Evaporation (FAO, 2007), no cloud formation below the normal level and provide the dryness condition in the atmosphere. Meteorological drought brings about hydrological and agricultural drought. At the time drought hazards, the lower rate of river discharge and simultaneously over extraction of groundwater in the dry season accelerate to falling groundwater table and it helps to make water shortage problem each and every sector at the local scale. In the growing fields of development sector like as economic development, urbanization, industrialization and population growth demands for more water at the time of deficit rainfall rate, then drought impacts appear as a local level disaster in the severity scale (Shahid and Behrawan, 2008).

2.1 Deforestation and Hydrological Cycle

Vegetation is most important issue that contributes to climatic factors- temperature, precipitation and also carbon sequestration. Deforestation is an opposite term of afforestation. It is a directly and indirectly cause of drought. Deforestation means cutting and clearing of vegetation. It occurs due to cut down of trees and vegetation to be used or sold as fuel, while cleared land is used as agricultural land, plantations of commodities and settlements. ~~Deforestation is directly related population.~~ The intensity of deforestation increases with the increasing number of population. Densely populated region in the northern parts of our country have low percentage of vegetation. Deforestation can cause of damaged to habitat, loss of biodiversity, river bank erosion which brings about drought. It can also cause of extreme temperature, low and high precipitation. ~~Temperature is increasing day by day due to shortage of vegetation and increasing greenhouse gases.~~ A greenhouse gas as carbon di oxide is a good absorber of temperature. It contains more temperature warm up gradually atmosphere its broad term Global warming. But Deforestation and Greenhouse gases are inversely related to each other. A total amount of anthropogenic greenhouse gases (GHGs) emission, 10-12% emit from farming activities in 2005. Less emission of N₂O and CH₄, small amount biomass burning as fuel, increasing C sequestering and technical options may apply to reduce emission (Smith et al., 2007a). ~~Owing to industrialization and agricultural practices, greenhouse gases emission are increasing day by day.~~ In future, it could be a priority basis first threatening component for the living organism with special to human being to survive in the universe. But, if agricultural expansion continuing through deforestation then it would be intensified 10% of the total greenhouse gases which were reduced at the period of 2015-2020, and it could be helps to stored approximately 500 Mt CO_{2-eq} (Smith et al., 2008). Changing pattern of agricultural system may reduce to climate change at the local and global scale.

Landless labor and farmers depends on rainfed agriculture but now it is appeared as vulnerable sector owing to rainfall and seasonal variability (Vermeulen et al., 2011). The climate change and its variables variability leads to alter hydrological cycle and crop production rate (Easterling et al., 2007) and land degradation (Sivakumar and Ndiang'ui, 2007). Hydrological that means ~~Water cycle is also affected by deforestation. Trees extract groundwater through their roots and release it into the atmosphere through transpiration. Deforestation reduces the content of water in the soil and groundwater as well as atmospheric moisture. Transpiration is a most factor of water cycle which is done by vegetation.~~ Trees help to form cloud and occurring

precipitation. Deforestation affects the water cycle significantly as trees roots create macro pores – large conduits – in the soil that increase infiltration of water. Vegetation contributes to evaporation and reduces soil moisture via transpiration. Trees litter and other organic residue change soil properties that affect the capacity of soil to store water and litter stems. At last deforestation can cause of increasing temperature, loss of soil properties and water holding capacity, death of beneficial organism of soil.

2.3 Temperature and Agricultural Activities

Extreme temperature hampers on agricultural crops and soil characteristics. Sometimes incidences of pest and diseases increase in the cropland due to high temperature. Agriculture and food security incorporated with the climatic effects, it the global temperature increase 2C (low-end) predictions by 2100 then its major implications will influence to rural poverty and urban food security (Vermeulen et al., 2011). Climatic impacts is negatively attributed to food production, patterns of crop productivity, fishery and livestock system, food distribution and market access (Nelson et al., 2009; Liverman and Kapadia, 2010). Climatic impacts may impair of crop physiological structure along with quality, in the developing world most of which countries is located at the tropical line (Tubiello & Fischer, 2007). Different bacteria, algae and virus borne diseases can be increased. As a result it decreases the expected result of crop production that means the economic loss of a region or whole country. Soil quality is also affected by increasing temperature. A number of author has been reported that, for the reducing of climatic rise should be control some important factors like as livelihood system and miscellany crop yields, soil and water resource management and plant protection initiatives to control crop production (Molua, 2008; Rudolf & Hermann, 2009). Soil temperature is most important for crops production. If the soil temperature will increase crops production ultimately reduce by affecting diseases. Different beneficial organisms in the soil for crops production cannot survive in high temperature. **Fog** is a most important beneficial organism in the soil. Fog decreases the harmful pest and insects within the crops by eating the harmful organisms. It cannot tolerate in high temperature. On the hand farmers utilize different chemicals pesticides and fertilizers for good crops production when crops are affected by climate change. For the use of chemical pesticides and fertilizers, beneficial organisms are died by harmful organisms and create water pollution. In addition, **Climate** change may affect to the crop production and growing period and farmers need to change their crop varieties, crop densities, fertilization levels and sowing dates when planting crops (Kang et al., 2009). Sometimes water borne diseases may affect in the cropland due to water pollution.

2.4 Precipitation and Apparent Impact

We often think about drought in relation to precipitation applying to the degree of dryness and the duration of the dry period. This is known as a meteorological drought which is highly specific to a region as average precipitation may vary considerably spatially. Low precipitation effects on stream flow, soil moisture, reservoirs and lakes water levels, and ground water recharge. **Precipitation related causes for drought in the northern part of Bangladesh.** Most of the natural hazards and disaster follow global context owing global warming, and number of climatic model has been projected that, normal precipitation rate decreases in dry season

and increase at the time of monsoon in south Asia (Christensen et al. 2007). We can observe unfavorable condition of cloud formation due to the main causes climate change. The condition remains long time if will bring about drought over the country. If precipitation is absence in a region temperature will increase in the atmosphere (Dey et al., 2011a). As a result the soil moisture will decrease slowly that means rising evaporation and transpiration by plants. Ground water level (Dey et al., 2011b), also decrease with low precipitation and low infiltration of water. The properties of soil reduce which effect on the agricultural production. Farmers should not aware about the problems which can cause of drought and another hazards as decreasing ground water level, low crops production and economic growth. People should not conscious about water harvesting and water supply programs, excavation, awareness building programs. The depth of rivers, ponds, cannels, channels reduced in the northern areas for river bank erosion. As a result large amount of water cannot hold in the reservoirs for dry season.

About 80% rainfall (FAO, 2007) occurs during monsoon naturally but we cannot sustainable manage the amount water and River water flow. We are failure to conserve the adequate water for our later usages. Most of people are blamed on their destiny that they were settled in the famine and drought prone areas. They cannot try to change their destiny through technically. They are upset to show the problems but cannot find out the solutions.

2.5 Water crisis and Agricultural Activities

The northern part of Bangladesh is known as a major source of national food production. Most of the people in this part of country are directly dependent on agriculture. In the past the main crops in the northern part cultivated Aman and boro rice. But nowadays varieties of crop are cultivated by the farmer of this region. They are not awareness about appropriate agricultural technologies. Generally the overall agricultural productivity in the region is very low mainly due to unavailability of irrigation facilities, inadequate rainfall in dry season and less water flow in the rivers. Drought events and it impacts is more severe than flood damage in Bangladesh. Then, drought hazards indicate to more rice production loss compare to flooding impacts to aggregate production between 1969-1970 and 1983-1984 (World Bank Bangladesh 1998). The famers of northern area, aush rice cultivates to be late by 2 months, to August-September instead of June-July. As a result the health of the crops disrupted because the rains end at development stage of the crop. Farmers extract of more ground water through deep and shallow tube-well for the purposes of agricultural and domestic usage. It is also related with number of farmer in this region. The amount of ground water extraction increases with the number of deep and shallow tube well which belong to the number of farmers. Ground water level is decreasing day by day due to extraction water exceeds the amount of infiltration water in the ground as well as aquifers (Rakib et al., 2015). More extensively groundwater are using in household and irrigation purpose but rainfall (during monsoon season) is the main source of groundwater recharge, owing to lack of rainfall and its uncertainty during monsoon cannot revitalize the groundwater level. Over extraction of groundwater for the irrigation purpose, groundwater level has been depleted at the different region of Bangladesh. Ministry of Environment and forest of Bangladesh (MOEF, 2002) has been reported that, ground aquifer level goes down 8.95 to 18.5 m in some area of the north-western part of Bangladesh.

This condition provides dryness situation in the earth surface without sufficient precipitation. As a result water table of aquifer goes gradually down. The properties of cultivate soil will decreased. Farmers cultivate their crops through Inappropriate cropping patterns, and changing Patterns of land use. In the agricultural land farmers use more chemical fertilizer in cultivated lands which reduce soil properties and water holding capacity. However, Agricultural production rate can be augmented with the application of irrigation and precipitation during the crop growth, meanwhile precipitation is more important for crop growth than temperature. Water holding capacity of soil could be supportive to reduce the frequency of drought and advance the crop yields (Dopova & Kercheva, 2005). Due to the climate change effects, water availability is a big question at the global scale while overall precipitation rate gradually decreasing in some region of the world. Along with the uncertainties of the climatic variables and socio-economic environmental effects suggest to efficient use of limited water and develop some new water resources (ACE, 2002). If we meet up our water crisis by the snowmelt process or snow aggregation, then water system would be more vulnerable to climate change (Dracup & Vicuna, 2005).

2.6 Drought Hazards and Social Crisis

Drought may create social impacts include life style, health, recreational, social programs, social conflict between people when occur scarcity of water. Different health problems find out during and after drought. In Bangladesh, a number of factors responsible to make more vulnerable to disaster poor infrastructure, inadequate financial resources, poor institutional capacity, high incidence of poverty and social inequity, high population density, High spatial and temporal climatic variability and extreme weather events (Ahmed 2004). Statistically showed that most vulnerable districts in the north Bangladesh – Kishorganj, Badarganj and Kurigram. Health problems occur during and after drought include malaria, cholera, dysentery, fever, typhoid, and most important diseases diarrhea (Dey et al., 2011b). Drought can cause of public safety from increasing number of fire and health problems. Climate shocks (e.g. drought, heat wave and flooding) leads to loss of life through the impairment of health, loss of life and, changing livelihood pattern with productivity loss and infrastructure destruction (Dercon, 2004; Carter et al., 2007). Different social programs as marriage, birthday party, festival ceremonies, and cultural functions are affected by drought. If a family loses own property due to drought marriage and another function will not celebrate easily. The patterns of cultural functions may be changed for drought. People suffer from anxiety or depression about economic losses caused by drought.

Climate change and its driving force leads to acute food insecurity who spend maximum portion of their income to consume food. Using climate based food production technology would be helpful to make balance in the market approach to food producers and consumers (Rakib et al., 2014b). Overall production rate of some agricultural crops has been decreased due to unwanted change of natural climate which tends to occur drought effects like as wheat, jute, corn, sugarcane, potatoes, several types of pulse and oil seed and, vegetables (Ahmed, 2006). Regarding with the FAO's information, the number of people has been identified who are suffering from chronic hunger from under 800 million (1996) to over a billion (FAO, 2009a) whereas most of the hungry countries belongs to south Asia and sub-saharan Africa. In the growing world, water demands may appear as a common and fundamental

crisis in the community. In the northwestern part of Bangladesh, social peoples engaged to water related conflict due to the shortage of water at the dry season (Habiba et al., 2011).

2.7 Drought Mitigation Approach

To meet up global Food security to the whole population is one of the major challenge for 21 century while total number of population augmenting, but it is threatened by climate change and stressed environment (Lal, 2005). Significantly increasing the studies on climatic impacts and adaptation strategy as a major scientific concerning issues at the present world e.g. productivity loss of framing crops such as wheat, maize and rice (Howden & O' Leary, 1997; Hoogenboom, 2000; Gbetibouo & Hassa, 2005; Aggarwal et al., 2006a; Aggarwal et al., 2006b; Dhungana et al., 2006; Challinor & Wheeler, 2008), forest (Lexer et al., 2002), industry (Harle, 2007), water resource of the catchment area (Chang et al., 2002; Wilby et al., 2005; Wilby et al., 2005; Herrera-pantoja & Hiscock, 2008) and landscape (Dockerty, 2005; Dockerty, 2006). On the other hand, climate variables and even high technology of the agriculture area is considered to be potential factors to influence the crop productivity year to year (Kang et al., 2009). In addition, Crop breeding is a substantial way to overcome climatic effects on crop productivity through increasing food production (Evenson and Gollin, 2003), it arguable mitigating climatic effects on agricultural sectors (Burney et al., 2010). However, biological potentiality is one most important factor to increase crop yields through biotechnology and conventional crop breeding (Godfray et al., 2010). Consequently it has been developed with the consideration of thinking about climate change adapting farming system like as drought, heat, pest persistence and water logging (Vermeulen et al., 2011).

Drought mitigation approach is a complex process which consist of several steps to follow consecutive way to reduce climatic stress such as soil management, crop management, tree plantation, reservoir renovation and new reservoir develop, rain water harvesting, local reservoir management, river basin management and groundwater management (Figure 1). Each of the step contains specific point of interest which may indicate to its importance to combat desertification from a specific site. Soil management it deals with several aspects of the soil characteristics like heat protective organic biomass production, texture analysis and mix up with clay, water holding capacity buildup and earth worm culture whereas its standard feature might be fulfill the agricultural demand for the optimum production rate. Then, crop management is one of the vital aspects to fight against with global warming along with its adverse environmental crisis on crop through introducing new objects like short duration and high yield variety production rate, evaporation control by genetic engineering and seedling age (e.g. advance). In addition, tree plantation could be helpful to reduce greenhouse gases and make shadow surrounding the agricultural land it might be helpful to enhance soil properties like as soil moisture increase and water holding capacity buildup through biomass production. Hydrological cycle plays a crucial role to make balance in the different components. One of the components abnormalities could be affect to the whole cycle and its one of the most important cause global warming and precipitation discontinuation. It has been negatively impacted on agricultural production and global food security. Over extraction of groundwater directly attributed to make imbalance condition in between groundwater

recharge and discharge. In the aspects of long term impacts, groundwater gradually tends to move downward. Consecutively, river discharge and/or stream flow depends on upstream water load and precipitation rate. Sometimes, its absence could be indicate to lower rate of groundwater discharge and shortage of water for the irrigation purpose. A number of big rivers in Bangladesh is going to dry out owing to water crisis at the time of rainy season. The negative impacts act as a latent hit to exposure of the agricultural land at the northern part of Bangladesh. It might be the main cause of the drought events. That's why it is critical to evaluate the probable impacts with the increasing level of water scarcity problem. Rain water harvesting and proper management approach would be a suitable way (e.g. local reservoir management, river basin management, make up new reservoir, not waste water through unwanted discharging from local water body and given interval to groundwater discharge) to reduce the degree of agricultural hazards. Bangladesh is one of the most important agro-economic based country. It is clear that socioeconomic condition depends on agricultural produced crops. If agricultural production rate follow the upward trends then it would be possible to fight against with food scarcity problem at the northern part of Bangladesh. This thematic guideline would be ensure to sustainable agricultural system through shearing drought mitigation strategy and social development.

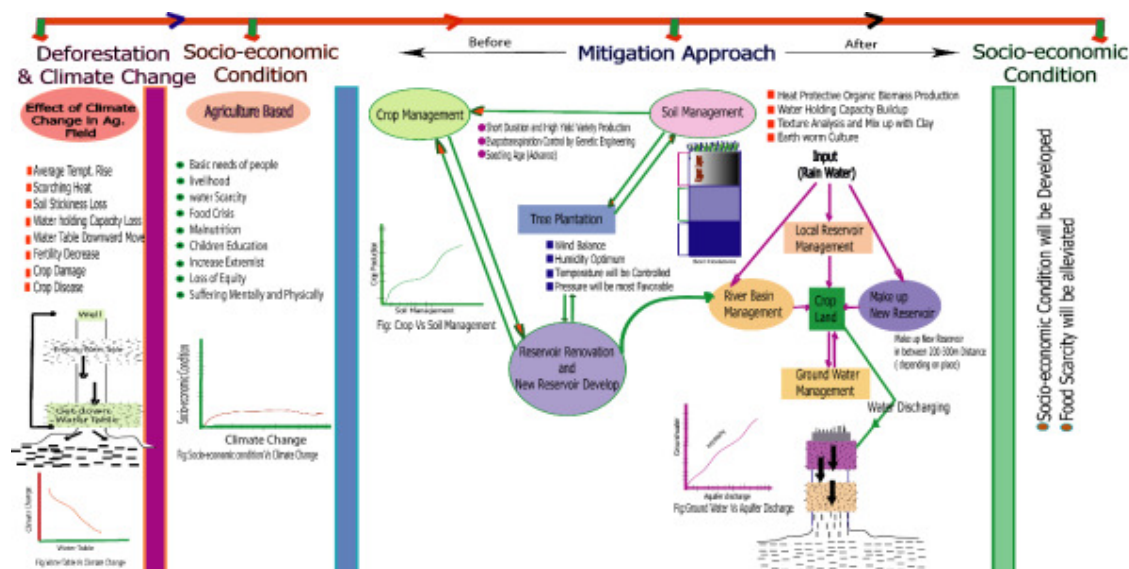


Figure 1: Shows prospective mitigation measures of drought hazards at the local scale

2.8 Sustainability and sustainable Development

Sustainability act as a key parameter to measure sustainable development in the society. Sustainable development depends on several sustainable factor whereas it might be act as key path finder to achieve sustainability against with adverse environmental or situational case. A number of factors identified as more critical issues which could be lead to complex way of development one each other. At the point of initial step it might be make a linkage among the development factors and its

presence helps to get sustainable socioeconomic structure. In the aspects of development strategy against with climatic hazards, sustainable society leads to ensure demand basis three important factors like sustainable agriculture, sustainable water management and sustainable land use (Figure 2). Each of the factor, deals with sub-categorical factors which would be triggered to development trends in the way to sustainability. Firstly, sustainable agriculture embodied with different three factors such sustainable crop management, sustainable soil management, sustainable utility of require fertilizer and conditioner. Secondly, sustainable land use indicate to another three important factor like adjusting suitable crops depending on time and place, tree plantation depending on multi-agricultural approach and chemical fertilizer use depending on soil properties and characteristics. Thirdly, sustainable water management refers to the three crucial aspects of the probable factor like new reservoir development and old renovation, rain water harvesting and sustainable use of water (e.g. ground and surface water).

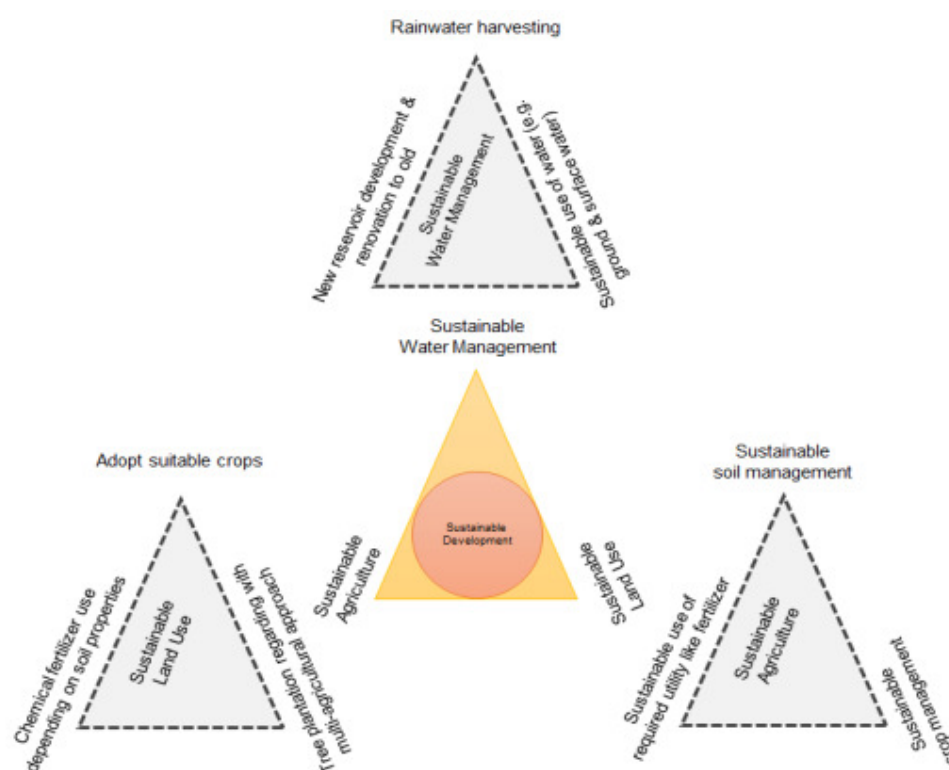


Figure 2: showing sustainable development approach to ensure sustainability in the agricultural component like as sustainable water management, sustainable land use and sustainable agriculture. Each of the key points embodied with a number of strategic factor that has been drawn some crucial fact to deals with social security to achieve sustainability in the community.

3. CONCLUSION

Drought hazards is an ultimate consequences of climate change which has been evolved through unevenly change of climatic variables. Its pervasiveness are not same like as intensity and magnitude. However, severity of the climatic hazard depends on direct and indirect factors that is always inducing change and augmenting negative derivatives of climate change. Its discontinuation and anomalies changing pattern indicate to long term instability of climatic controlling variables like temperature. It might be brought global change whereas anthropogenic input always added into the atmosphere, it would be enough to induce any devastating disaster. In Bangladesh, drought is frequently occurred at the regional scale or extensively depending on cause and time. Whereas, a major part of the national economy rely on agricultural sector but now it shows downward trends due to continuous losses of production rate. Simultaneously, water and land use pattern identified as a vulnerable component to gear up social status with the creasing rate socioeconomic growth, for instance it has been turned into backward trends. So, its negative consequences tends to expedite temperature and rainfall uncertainty, agricultural damage, worsen socioeconomic condition, social and food insecurity. To make balance among the social components it is very important to take some initiative at the national and international level to accelerate the existing way of development. Regarding with the observational status, it is possible to make some efforts for the mitigation purpose at the local scale to keep in balance production rate for the fulfillment of the local demands. In the combined approach, it is needed to maintain water and land use management for the sustainability of the agricultural sector to achieve sustainable development. It is important to meet up sub-categorical aspects of the three key elements to fit drought mitigation model to achieve sustainable development. It would be helpful to ensure sustainability in the agricultural sector against with drought events.

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