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Droughts in Asian Least Developed Countries: Vulnerability and sustainability

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ABSTRACT

Droughts occur both in developed and developing countries with significant impacts and are exacerbating in frequency, severity and duration. Over exploitation of water resources, weather variability and climate change are mostly responsible for such exacerbation. The impacts of droughts encompass the global ecosystem as a whole but vary from region to region. Least developed countries (LDCs) are becoming the worst sufferer of the impacts due to physical, social and economic as well as knowledge and skills differences. The increasing biophysical vulnerability contexts and intensity in the Asian LDCs causing adverse effects on food security, human health, biodiversity, water resources, hydroelectric power generation, streams, perennial springs, and livelihood. Drought is also responsible for increasing pollution, pests and diseases and forced migration and famine. Information indicates monsoon has become erratic contributing to up-scaling of droughts. South and Southeast Asian LDCs like Bangladesh, Nepal, Bhutan, Cambodia and Lao PDR under the monsoon climatic zone have also been suffering from increasing droughts arising out of delayed and changing distribution patterns of precipitation. Prolong dry spells increase the frequencies of wildfire in grasslands, forests, and range-lands. The rain-fed crops of the plains are facing challenges from soil-moisture stress with projected droughts. Droughts causing migration of fishes, and marine anadromus species are having adverse impacts on spawning habitats. Reduction in annual surface runoff is decreasing the ground and surface water with negative effect on agriculture and water supply for industrial and domestic sectors. As droughts are exacerbating the consequences are accelerating. However, traditionally people are adapting with the changing situations applying indigenous knowledge and practices for sustainable living. This paper reflects on prevalence and impacts of droughts, existing coping mechanisms, initiatives to combat impacts and further doubles in the context of Asian LDCs.

1. Introduction

Drought is the slow onset natural disaster that starts unnoticed and develops cumulatively and its impacts are not immediately observable (ARCS, 2007) and thus hampers lives and properties seriously. Various definitions of drought have the common elements of dryness in atmospheric condition and shortage of water; cause moisture deficit with adverse effects on vegetation, animals, and human over a sizeable area (Warwick, 1975). The National Drought Mitigation Centre (NDMC) USA, classified drought in three types, namely meteorological, agricultural and hydrological, while the US Geological Survey added with it the socio-economic category which is really a consequence of weather-related shortfall of water.

Meteorological drought causes serious hydrological imbalance in the affected area (Huschke, 1959) and results in deficiencies of precipitation while agricultural droughts adversely affect crop production (Rosenberg, 1979) i.e. food production and farming and impacts of hydrological drought (Vujica et al., 1977) include low precipitation and supply of water. Regardless of the types, droughts have adverse economic, social, environmental, and developmental consequences.

Since 1970s, there is a drying trend, globally and in many regions, especially in high northern latitudes (Trenberth et al., 2007). At the same time, a widespread increase in droughts and spatially coherent shifts in drought regimes are expected with changing global circulation pattern (Dai, 2011). Since 1950, many regions of Asia, Africa, Australia, Europe, and America have experienced longer and intense droughts (IPCC Special Report, 2012). Regional climate simulations and high resolution global atmospheric model simulations over Europe indicated that the Mediterranean region is prone to severe droughts.

The China drought from 1876 to 1878 affected 83 million people; the America drought started in 1579 and spread over the southwestern region and lasted for more than twenty years. The African Sahel was one of the worst droughts in history, started in 1968 lasted till 1988, forced to starve about 150 million people

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across the Sahel -from Senegal through Mauritania, Mali, Burkina Faso, Niger, Nigeria and Sudan to Ethiopia. Australian drought of 2002–2003 affected 19 million and led to devastating wildfire and Niger drought affected 3.6 million people during 2004–2006. Serious droughts happen again and again in China, India, Australia, Chile, Bolivia, Ethiopia, and the Philippines (Woods and Woods, 2007).

From early 2000 onwards severe droughts affected vast areas of South Asia, including Western India, Southern and Central Pakistan. The South Asian regions have been among the perennially drought-prone regions of the world. Afghanistan, India, Pakistan and Sri Lanka have reported droughts at least once in every three year period in the past five decades, while Bangladesh and Nepal also suffer from drought frequently. In 2012, Pakistan declared emergency in Tharpakrakar and Mirpur Khas districts due to severe drought and many people had to be resettled (Tareq, 2012). In Cambodia, severe drought affected the late season and longer-duration genotypes (Tsubo et al., 2009).

The current understanding of climate change in the monsoon regions remains one of the important uncertainties with respect to circulation and precipitation (Hargel et al., 2007); while the Asian monsoon regions feed nearly half of the world's population, and when the monsoon rainfalls fail to come, people face severe droughts and famine (Science Daily, 2010). Asia has a long history of droughts, which has been linked with other climate extremes–having severe impacts on the LDCs.

There are 49 LDCs in the world which are spread over Asia and Africa. Most LDCs (34) are in Africa while Asia-Pacific has 14 and one in America. Asian LDCs mainly includes Bangladesh, Nepal, Bhutan, Myanmar, Afghanistan, Yemen, Cambodia, and Lao PDR which have been subjected to investigation in this paper. Small Island Developing Countries (SIDs) belonging to the Asia-Pacific region can be looked at separately due to their special characteristics and there are 52 numbers of SIDs in the world (Wikipedia). Global locations of the LDCs can be seen as below (Fig. 1).

Most of the climate models project a decrease in precipitation in dry season and an increase during the monsoon in South Asia (Christensen et al., 2007). This causes extreme droughts in this region; along with other disasters Bangladesh and Nepal have already shown an increased frequency of droughts in recent years (NDMC, 2006).

Ever-increasing exploitation of water resources and consequent water scarcity responsible for future climate change will exacerbate the frequency, severity, and duration of drought events and associated impacts (Wilhite, 2005). Global and regional studies project a higher likelihood of hydrological drought by the end of this century in North and South America, South and Central Asia, west and central Australia, and central Eurasia. There are still further sources of uncertainties affecting the projections of trends in meteorological drought for the coming century.

The uncertainties in the development of the ocean circulation and feed-backs between land surface and atmospheric process are related to the effects of drought on vegetation physiology and dynamics. Soil moisture stress and evapotranspiration affects the transpiration, growth and water use efficiency and on the hydrological cycle (Betts et al., 2007).

Spatially varied trends have been observed during the second half of the twentieth century, with increasing dryness particularly in East and Southeast Asia, adversely affecting socio-economic, agricultural and environmental conditions like extreme dryness and wildfire (IPCC Special Report, 2012). About 23 million hectares of Asian rice producing areas experience frequent yield loss due to drought (Widawasky and O'Toole 1990). There has been a drastic reduction in lowland rain-fed rice production in the Mekong region of Cambodia and Lao PDR due to droughts.

Drought is intimately related with food and nutrient security; therefore, its diagnosis and monitoring are essential. The diagnosis of drought is also important for the utilization of drought projection using climate modeling facilities for the stakeholders and planners of a country. People who are already vulnerable and food insecure are likely to be affected first. Agriculture-based livelihood systems that are already vulnerable to food insecurity face immediate risk of increased crop failure, new patterns of pests and diseases, lack of appropriate seeds and planting material, and loss of livestock (FAO, 2008). Droughts often cause mass migration, famine and death, and critically affect the sustainability of a country or a region.

It is the most cosmopolitan disaster among the Asian LDCs. Since droughts start unnoticed and develop cumulatively hampering lives and properties, it is very difficult to cope up with the situation by the poor nations. Most of the LDCs are dependent on agriculture: farming, herding and fishing, the impact vary from region to region and the sufferings, although substantive are hardly noticed cumulatively.

Drought is, thus, one of the most complex natural phenomena, that is hard to quantify and manage, and has multiple severe social and economic impacts, especially in the Asian LDCs. The magnitude of these impacts is determined by the level of development,

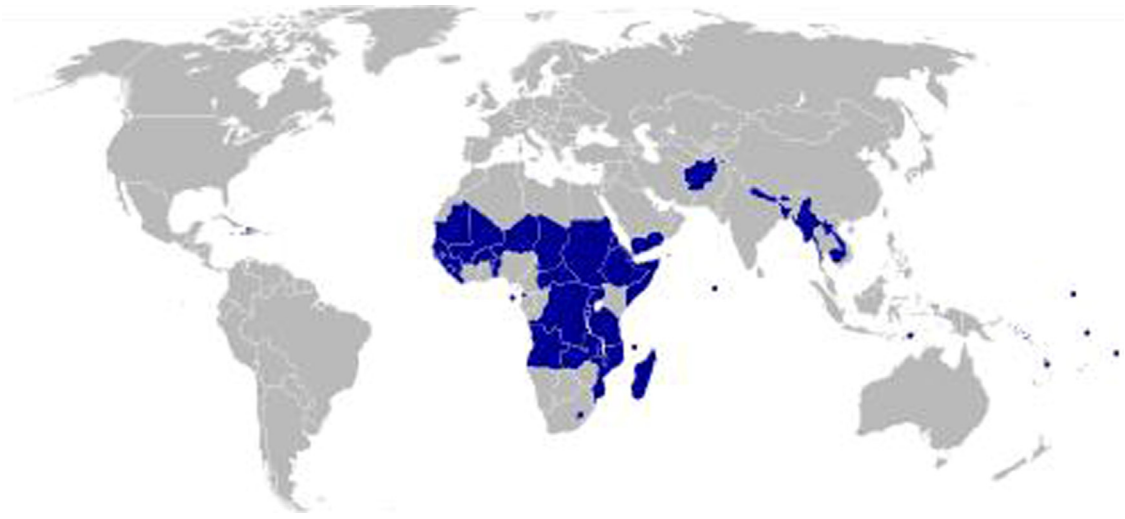

Fig. 1. Map of the World LDCs; Source Wikipedia (Wikipedia).