

A study on the impact of climate change on agriculture and agro based industries in Karnataka

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Abstract - Karnataka has experienced most of volatilities of nature in the recent past. The study titled 'Climate Change Scenario in Karnataka' submitted to Government by the 'Karnataka State Natural Disaster Management Centre (KSNDMC)' also reveals the fact that the probability of drought has increased in many parts of the state over the last four decades. The reduction is more during July, which is a crucial month of the southwest monsoon season, when sowing is taken up on a large scale in the state. As we know, the life on earth is sustained by several climatic factors, which has undergone with numerous transformations. Extreme weather conditions such as floods, droughts, heat waves, raising temperatures, landslides, hailstorms, and many of these natural disasters are outcome of the same climatic change. Climate change has been considered to have catastrophic effects on planet Earth. These effects have brought about colossal loss to human lives, livestock, to agricultural crops, infrastructure, public and private properties etc.,

Karnataka being an agrarian economy, where majority of the working population contemplates agricultural activities, these climatic changes have brought disastrous effects both on agriculture. This is the primary effect. But there are many industries situated in the state, which completely depends on agricultural output and use them as input, such as Textile industry uses, Cotton as input or raw material, Sugar industry uses Sugarcane, Oil industry uses Oil seeds, Beedi and Cigarette industry uses tobacco, Biscuits manufacturing industry uses Wheat, Rubber manufacturing industry uses Rubber milk, Jute industries uses Jute, Silk industry uses raw silk, Fruit juice manufacturing industry uses fruit pulp as raw materials. These are the output of agricultural sector. These industries are termed as 'Agro Based Industries'. Therefore, due to climatic change, when agricultural sector is affected, even industrial sector also would get affected. This paper makes an attempt to reconcile climatic changes in Karnataka and its consequent effect on agricultural output and agro based industries performance being affected out of such climatic changes.

Index Terms - Agricultural Productivity, Climate Change, Agro based industries, Industrial productivity.

INTRODUCTION

The term 'Climate Change' was proposed by the World Meteorological Organization (WMO) in 1966 to encompass all forms of climatic variability on timescales longer than 10 years, regardless of cause. The Climate change refers to changes in factors such as Temperature, Humidity, Air pressure, Wind, Clouds and Precipitation patterns over time. The imprints of Climate change are observed clearly across the world. Changes in Climatic factors that occur over a longer period of time, typically over decades or longer is termed as 'Climate Change'. Understanding the features of climate change in the past is the key to comprehend the present and future climate scenarios. There are many "Natural" and "Anthropogenic" (human-induced) factors that contribute to the climate change. It is abundantly clear from the evidence in the Geological records that Earth's Climate has been changing at different frequencies of timescale.

Earth's atmosphere contains various gases that act as a blanket to trap heat received from the Sun and prevent it from escaping back into space. This process is known as the Greenhouse Effect, and the gases are referred to as Green-House Gases. The main Green-House Gases in nature are Carbon dioxide (CO₂), Methane (CH₄) and Nitrous oxide (N₂O). Without the greenhouse effect, the planet would be too cold to support life. Over the years, the amount of Green-House Gases trapped in Earth's atmosphere has increased significantly, causing worldwide temperatures to rise. The decompose process of plant and animal matter also produces CO₂, which is then absorbed by the plants during photosynthesis. This natural cycle keeps the level of CO₂ in the atmosphere fairly stable. Further, Volcanic activity also affects the climate, because eruptions discharge Green-House

Gases and other pollutants into the atmosphere. According to the results of IPCC, (2013), the level of Greenhouse Gases has surpassed the highest levels of concentrations on earth over the last 8,00,000 years. This greenhouse effect, in turn, is causing increased rainfall, frequent hot extremes, floods, droughts, cyclones and gradual recession of glaciers. The level of greenhouse gases has now exceeded the preindustrial values that existed thousands of years ago.

The effects of climate fluctuations and the vulnerability of the small and medium farmers to these climate conditions make it daunting for the institutions and the policy makers. Moderate variations in the weather during the crucial stages of crop development can also have a major impact on the yield. While cost of inputs, types of implements used, availability of irrigation water, rainfall and commodity prices can also be some of the other factors that lead to an alteration in the yield, it is estimated that severe climate changes leading to natural and manmade calamities like floods, droughts, cyclones, hailstorms, landslides etc. impact the agriculture productivity most unfavorably.

The World Bank in its report published in 2013 predicted that there will be a 10 percent yearly increase in the average intensity of monsoon and a 15 percent annual change in the precipitation levels, for an increase in the global warming mean of 4 percent. Gradual change in climate is expected to increase the frequency and intensity of current hazards and the prospects of extreme events, acting as a catalyst to the emergence of new hazards like sea-level rise and new vulnerabilities with differential geographic and socioeconomic impacts. The increase in vulnerabilities would further result in higher susceptibility of poor and other communities which contribute to one fourth and half of the population of most Indian cities. Climate variations have started to degrade India's economic growth rates, adversely affecting the livelihood of millions of people. Keeping in mind its importance for the survival of civilizations, it is indispensable for the agriculture institutions, government and the policy makers to address these issues and strengthen the agriculture sector maintaining its growth as it is an increasingly important strategic, economic and political concern. Even small temperature increase in arid and semi-arid tropical regions could well lower agricultural

productivity. The water scarcity will dramatically increase vulnerability and threaten food supplies. In addition, vector-borne diseases such as malaria and dengue fever and water-borne diseases such as cholera could increase.

Karnataka State has sub-humid to humid climate on the West Coast and Western Ghats region and semiarid to arid climate in central, southern and northern districts of plateau region. The year is divided into four seasons viz., Winter (January-February), Summer (March to May); South-West Monsoon (June to September) and North East monsoon (October to December). The state receives a normal annual rainfall of about 1150 mm, in which about 73 % of the rainfall occurs during the South West Monsoon season, 15 % during North East Monsoon and 10% during Pre-Monsoon season. There is a substantially high variability in spatial and temporal distribution of the rainfall over the state. Taluk wise normal rainfall of the state vary from 477 mm to 4747 mm. Rainfall contribution is very high, from Southwest Monsoon Season (around 80% of the state rainfall), it is seen that the annual rainfall is lowest (477mm) in the eastern parts of Chitradurga district and highest (4747mm) over the Western Ghats. More than 2/3rd of the state receives less than 750 mm of rainfall. Taluk wise Annual variability (CV) of the rainfall ranges from 16 to 40%. The atmospheric temperature in the state ranges from 23°C to 43°C in summer and 9°C to 27 °C in winter.

Karnataka State is divided into four regions namely

1. South Interior Karnataka
2. North Interior Karnataka
3. Malnad and
4. Coastal Karnataka.

These are further divided into ten Agro-Climatic Zones by University of Agricultural Sciences, Bengaluru under NARP program. Among these Agro-Climatic Zones, there are five dry zones with relatively low rainfall and more erratic distribution. Similarly, along the eastern part of the hill zones to the west of the dry zones with relatively more rainfall with less erratic distribution and a small portion in the north-eastern part of the State were also identified as transitional zones. The hill and Coastal belts cover the two distinct zones. Karnataka is one of the 16 states in India, which is frequently affected by drought and flood simultaneously in different regions. A systematic drought vulnerability study carried out by

KSNDMC indicate that, the Coastal and Malnad regions have less vulnerable area than South Interior and North Interior Karnataka.

REVIEW OF LITERATURE

IPCC, 1990; Adams et al., 1998: Agriculture is one of the sectors most affected by ongoing climate change. The wide range of literature on this subject demonstrates that damages caused by climate change can be relevant to both cropping and livestock activities.

Walker and Steffen, 1997; Bruijnzeel, 2004: Climate change will have a significant effect on the rural landscape and the equilibrium of agrarian and forest ecosystems.

Aggarwal (2009), there can be a 3 to 7% decrease in the productivity of wheat, soybean, mustard, groundnut and potato due to a 1-degree Celsius rise in the temperature. Consequently, a predicted rise in the temperature between 2.5 degree and 4.9 degree Celsius by the year 2099 would lead to 10 to 40 percent destruction of these crops.

IPCC Fourth assessment report, Climate Change 2007, on the other hand forecasts that there is a 2 to 5 percent chance of decline in the wheat and rice production in India for a rise in temperature between 0.5 and 1.5 degree Celsius. Further, studies have found that between 2010 and 2035, there is a possibility of decline in the productivity by 4.5 to 9 percent. This fall in the productive levels can amount to 1.5 percent of the Gross Domestic Product of the country. Indian agriculture sustains the livelihood of approximately 55 percent of the total population of the country and therefore, it seems obvious that any small variation in the climate will influence agriculture productivity and thus, the food security of several people dependent on agriculture for livelihood. Due to increasing carbon dioxide emissions and release of Greenhouse Gases, there is a high possibility of the occurrence of global warming in the near future. Weather shocks and changes in precipitation will have an impact on productivity resulting in alteration in prices, demand and supply, profitability and trade. These changes can become a major challenge and hinder the capability of the country to feed its multiplying population.

S.A Khan et al., (2009). Kumar and Parikh (2001) predicted that climate change would have a huge impact on the production of rice and wheat by 2060, which would in turn affect the livelihood and food security one million people in India. Excessive rainfall and drastic weather changes have adversely affected the production of Jowar, impacting the life of those dependent on farm in Karnataka.

OBJECTIVES OF THE STUDY

1. To study the impact of climatic change on environment.
2. To ascertain the effect of climatic change on agricultural productivity.
3. To find the co-relation between agricultural output and agro based industries.
4. To study how industrial productivity is affected due to poor agricultural output.

RESEARCH METHODOLOGY

Locale of the study: the study is confined to Karnataka state.

Source of Data: The report is based primarily on secondary data. Therefore, “Climatic Change Scenario in Karnataka – A detailed parametric assessment” published by Karnataka State Natural Disaster Monitoring Centre, Government of Karnataka, 2020 has been referred for the data and information.

Sample frame: Agro based industries functioning in Karnataka State.

Impact of Climatic Change

Extreme Weather Events	Impact
Drought (Hydrological, Meteorological and Agricultural).	Crop loss, Malnutrition and Hunger. Diseases or epidemics outbreak, Drinking water scarcity in Rural and urban areas, Loss of Biodiversity, Loss of livelihood, Migration, Child labor
Flood (riverine and urban floods.).	Loss of life , Critical Infrastructure, Property
Hailstorm	Crop loss, Property loss
Tropical cyclone	Loss of life, Critical Infrastructure, Property, Loss of livelihood, Migration, Diseases outbreak
Heat waves or cold wave.	Loss of life, Crop loss, Drinking water scarcity in Rural and urban areas
Storm surges, Coastal Erosion, Saline water intrusion	Loss of life and coastal Biodiversity, Critical Infrastructure, private property loss
Landslides and mudflow.	Loss of life, Critical Infrastructure, Property Loss of Biodiversity,

Source: Secondary data, Karnataka State Natural Disaster Monitoring Centre.

FINDINGS OF THE STUDY

- Karnataka is the most drought-prone state after Rajasthan in India. The entire rainfed area in Karnataka state has been regularly affected by drought.
- Nearly 80% of Taluks in the state are drought prone. In the last two decades (2001-2019), the state has experienced drought of various severity for 15 years, only year 2005, 2010 and 2017 were exceptions.
- The variation in spatial and temporal distribution of south west monsoon rainfall is the main reason for the recurrence of Drought in the state.
- During the year 2016, out of 176 Taluks in the state, 139 Taluks were Drought affected in Kharif and 162 Taluks in Rabi season.
- During the year 2018, about 100 taluks were Drought affected in Kharif and 156 taluks in Rabi. This indicates the high vulnerability of state to drought.
- According to the Ministry of Agriculture and Farmers Welfare (MoAFC&W), Government of India, 16 districts of the state, the majority of which are from NIK, experienced drought for a period of 10 years during the last 15 years (2001–15).
- Flood is a high-water stage in which the water overflows its natural course and flows onto adjoining areas along its course causing severe damage.
- Karnataka experienced severe floods during 2005, 2009, 2018 and 2019.
- The impact of unprecedented rainfall was such that it changed the geomorphology, course of river and drainage of the region.
- The entire fertile topsoil has been washed away and trees were uprooted adversely affecting the local ecology.
- In 2019, the entire State was experiencing severe drought situation as a result of deficit rainfall and prolonged dry spell during pre-monsoon period (March-May) and Southwest Monsoon (June-July).
- The distribution of the rainfall has been skewed and the excessive rainfall has been confined to parts of North Interior Karnataka, Malnad and Coastal region.
- Critical infrastructure, such as roads, bridges/culverts, electrical infrastructure, schools, hospitals and anganwadis, etc, have been ravaged due to floods.
- The estimated crop loss due to flood and landslides is Rs.15,119.00 crores. The estimated total loss was to the tune of Rs. 38451.11 crores during 2018-19.
- Stabilization and growth of agricultural production results in rapid advancement in output and employment in agro-industries. Further, the cumulative effect of agricultural growth and growth of agro-industries creates greater opportunities for industrial growth as well as integration of the different sectors of the economy.
- Agro-based industries may be classified into two categories namely food processing industries and non- food processing industries. Food processing industries mainly deal with the preservation of perishable products and utilisation of by-products for other purposes. These types of industries include the processing of wheat, rice, maize, barley, pulses, meat, fruits, vegetables, etc.
- Agro based industries in India is one of the basic and backbone of Indian economy which provide employment, income generation, industrial inputs and outputs, regional growth and associated with all kind of walks of human beings. Growth of agricultural sector became a growth of socio-economic development of the country.

CONCLUSION

Agro based industry is regarded as the sunrise sector of the economy in view of its large potential for growth and likely socio-economic impact specifically on employment and income generation. Due to changes in the climatic condition, agricultural production is affected as agriculture sector always depends on the mercy of nature. In natural factors such as temperature, soil fertility, atmospheric humidity and all are favourable, agricultural productivity will also be good. On the other hand, due to rampant changes in climatic condition in the recent past, agricultural productivity is profoundly affected. Due to which, supply of raw material to agro based industries are affected. As a result of this, agro based industries are severely affected.

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