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Climate Change & Its Impact on Indian Agriculture

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Abstract

The 21st century's main concern or problem is climate change. During 1880 to 2012 the average global temperature was increased. Many scientists and policy makers projected climate change for India also. According to them increase in temperature will be around 4 degree or more in 2050s which will cause shortfall in the number of rainfall days and increase in the environmental disasters like drought, floods and cyclones. It affects whole environment, most important Climate change effects the agriculture, which is a back bone of our economy. For developing country like India where agriculture is depended on monsoon the effects is more. Any change in agriculture productivity could impact food prices which would affect its accessibility. Due to this in flationary pressure poverty will also increase. So for poverty reduction, for food security and most important for inclusive economic growth, it is necessary to achieve high growth rate in agriculture.

In the light of above discussion present paper makes an attempt to highlight the problem of climate change in India and its impact on Indian agriculture.

Keywords: Climate Change, Food Security, Agriculture Productivity.

Introduction

In September 2015 the member nations of United Nations adopted 17 sustainable goals and which came in to effect on 1 January 2016.13th sustainable goal urges countries to take necessary action for solving the problem of climate change and its impact.

The 21stcentury's main concern or problem is climate change. The climate of Earth is changing which have serious consequences on our daily lives. It is causing a problem for world economies as people are experiencing changing weather conditions, rising sea levels and extreme weather shocks. Greenhouse emissions are the main cause of climate change, which is continuously increasing due to human activities. During 1880 to 2012 the average global temperature was increased. Many scientists and policy makers projected climate change for India also. According to them increase in temperature will be around 4 degree or more in 2050s which will cause shortfall in the number of rainfall days and increase in the environmental disasters like drought, floods and cyclones. It affects our whole environment, most important Climate change effects the agriculture. Studies by Dinar et al. (1998), Seo and Mendelsohn (2008), Mall et al.(2006) and Cline (2007)shows a significant effects of climate change on the average crop production . Due to which there is risk on food security of our country as the availability of food is affected by changes in Agriculture Productivity. For developing country like India where agriculture is depended on monsoon the effects is more. Any change in agriculture productivity could impact food prices which would affect its accessibility.

CLIMATE CHANGE

"The change in the state of the climate that can be identified(e.g. using statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period of time typically decades or longer. It refers to any change overtime, whether due to variability or as a result of human activity."IPC. Climate Change 2007.

Weather of any place refers to the condition of the atmosphere for a short period of time on the other hand climate refers to the average condition of the atmosphere of a large area for a longer period of time.That means Weather change refers to the change in atmospheric condition of any particular place and Climate change is the change in the weather condition of any particular place, so weather change is the short time period

concept and climate change is a long time period concept. It takes around hundreds or even millions of years to change the climate of any place.

Climate Change in India

Figure 1A &1B shows the changes in average temperature and rainfall between the last decade and 1950-1980 periods. In Figure 1A large part of map covered in red shows the pattern of average warming.In some states of India for example North-East states, Kerala,Tamil Nadu, Rajasthan and Gujarat there is an increase in average temperature but there are some states like Punjab, Odisha and U.P which are least affected. On the other hand figure 1Bshows that the extremed eficiencies of rainfall is concentrated in U.P, North–East, Kerala, Chhattisgarh and Jharkhand .But there has been an increase in rainfall for states like Gujarat, Odisha and Andhra Pradesh.

Spatial Changes In Temperatuespatial Changes In Rainfall
Changes in average temperature and rainfall between the last decades and1950-1980

Figure :1a

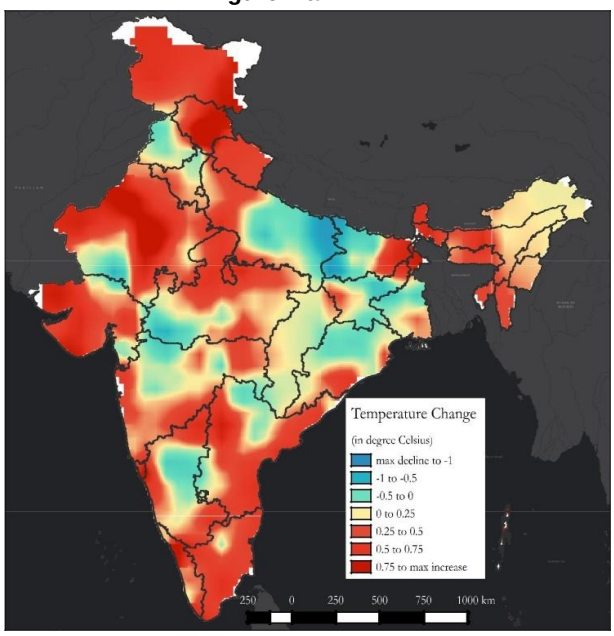
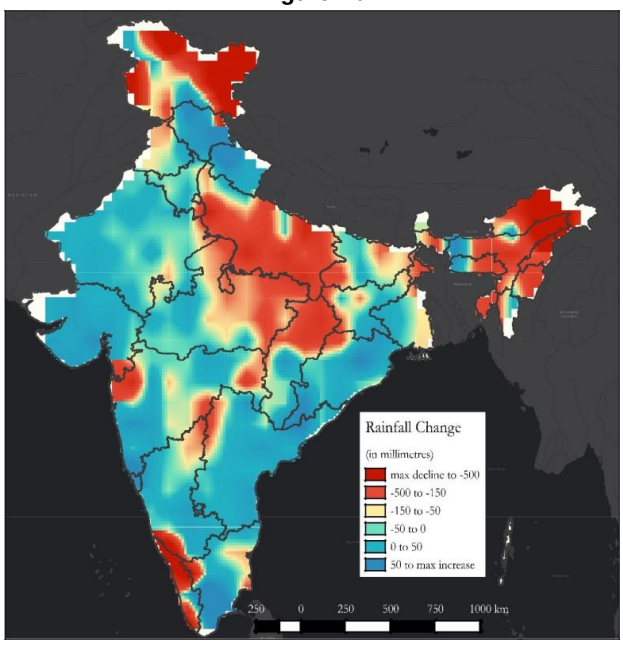


Figure:1b



Source: Economic Survey 2017-18

Agriculture in India

In India, Agriculture sector is the back bone of the economy. The share of Agriculture and allied activities in National income at basic prices was 16.5 percent in 2014-15 and 15.4 percent in 2015-16. Agriculture sector provides employment to 48.9 percent of population in 2011-12. This data clearly brings out the role and importance of Agriculture activities in Indian economy. *According to Ashok Dalwai 2012, the experience of BRIC countries (Brazil, Russia, India and China) clearly indicates that for reducing poverty ,a one percent growth in Agriculture is two to three times more effective than the same growth rate in non- agricultural sector.*In India 21.9 percentof population lives below poverty line.To reduce poverty in India, growth in Indian agriculture sector is prerequisite. As stated in the State of Indian Agriculture 2011-12 report, achieving higher growth rate in GDP cannot reduce poverty ratio unless and until agriculture growth rate also increases. Most important we can achieve inclusive growth through the growth of agricultural sector only. Agriculture sector is also important for earning foreign Exchange. The share of Agricultural exports in total exports is 12.7 percent in 2014-15.

Agriculture and its allied sectors like forestry, fisheries are sensitive to climate. Climate change affects the production process of these sectors in many ways. Climate change directly impact this sector through change in agriculture production & productivity and indirectly it impacts Economic growth rate of economy which in turn affect the demand of agriculture produce. Most important due to these changes in agriculture sector farmers income also declines, which is not good for growth of agriculture sector. If this problem of climate change in India is not addressed in time the problem of food security will become more severe.In India already the per capita net availability of food grains is only 489.3 grams per day.

Table-1
Per Capita Net Availability of Food grains (Per Day) In India(In Grams)

Year	Cereals	Pulses	Food Grains
1951	334.2	60.7	394.9
1961	399.7	69	468.7
1971	417.6	51.2	468.8
1981	417.3	37.5	454.8
1991	468.5	41.6	510.1
2001	386.2	30	416.2
2002	458.7	35.4	494.1
2003	408.5	29.1	437.6
2004	426.9	35.8	462.7
2005	390.9	31.5	422.4
2006	412.8	32.5	445.3
2007	407.4	35.5	442.8
2008	394.2	41.8	436
2009	407	37	444
2010	401.7	35.4	437.1
2011	410.6	43	468.8
2012	408.6	41.7	463.8
2013	433.2	43.3	491.9
2014	442.9	46.4	489.3

Source: Directorate of Economics and Statistics

As above table shows that over a period of 63 years (1951-2014) the food grains availability has increased by only 23 percent (per capita net availability). The main source of protein in the diet is pulses but it also declined from 60.7g per day in 1951 to 46.4 g per day in 2014

Objectives of the Study

The present paper makes an attempt to analyse the impact of climate change on Indian agriculture under following headings:

1. Analyse the impact of climate change on Agriculture Productivity.
2. Analyse the impact of climate change on Agriculture Crop yields.
3. Analyse the impact of climate change on Agriculture Farm Revenue.

Analysis of Impact of Climate Change on Indian Agriculture

In this section of paper impact of climate changes has been analysedon some important indicators of Agriculture sector.

Impact of Climate Change on Agriculture Productivity

Table-2
Percentage Decline of Agriculture Yields

	Decline of agriculture yield due to increase in temperature (%)	Decline of Agriculture yield due to decrease in Rainfall (%)
Kharif (Irrigated)	2.7%	6.2%
Kharif (Unirrigated)	7%	14.7%
Kharif (Average)	4.0%	12.8%
Rabi (Irrigated)	3.0%	4.1%
Rabi (Unirrigated)	7.6%	8.6%
Rabi (Average)	4.7%	6.7%

Source-Economic Survey 2017-18

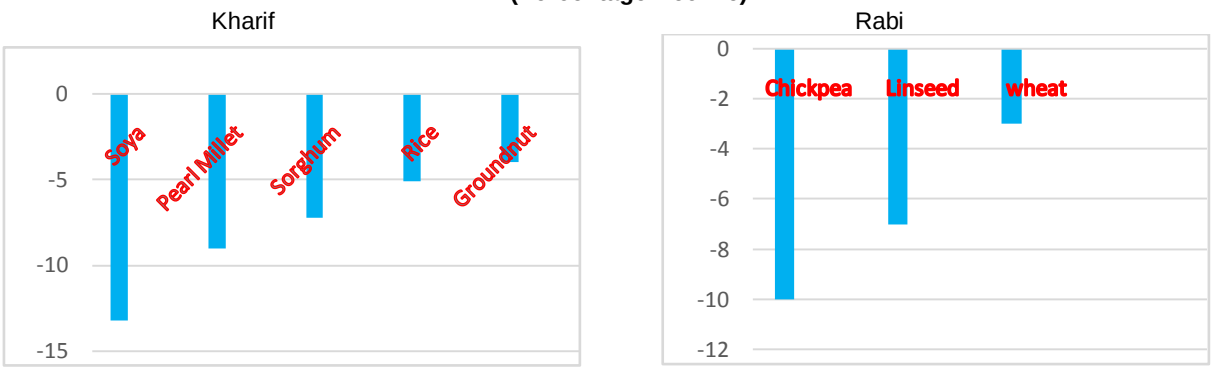
Above table depicts the decline of Agriculture yields in Irrigated and unirrigated areas, due to increase in temperature and decrease inrainfall. It clearly shows that due to extreme temperature shock (which means an area is significantly hotter than usual) there is a decline of 4 percent and a 4.7 percent in agriculture yields during Kharif season and Rabi season. On the other hand in extreme Rainfall shocks (which means an area is significantly receives less rain than usual) there is a decline of 12.8 percent and a 6.7 percent in Agriculture yields during Kharif and Rabi seasons.Secondly between irrigated and unirrigated area, unirrigated area bears the adverse effect of climate change more as compare to irrigated area. An unirrigated area is the area where more than 50 percent cropped area is dependent on monsoon.Above table clearly shows that due to Extreme temperature shock in unirrigated area decline of agriculture yields is 7 percent for Kharif and 7.6 percent for Rabi on the other hand for irrigated area it was only 2.7 percent for Kharif and 3.0 percent for Rabi. Correspondingly the effects of extreme rainfall shocks are 14.7 percentfor Kharif and 8.6 percent for rabi on the other hand for irrigated area it was only 6.2 percent for Kharif and 4.1 percent for Rabi.

Impact of Climate Change on Crop Yield

Impact of climate change on crop yield is analysed under two heading i.e effects of temperature increase on crop yield and effects of rainfall decrease on crop yield. Figure 2A & 2B depicts the effects of temperature increase on crop yields. Which clearly shows that crop yields of both rabi and kharif like

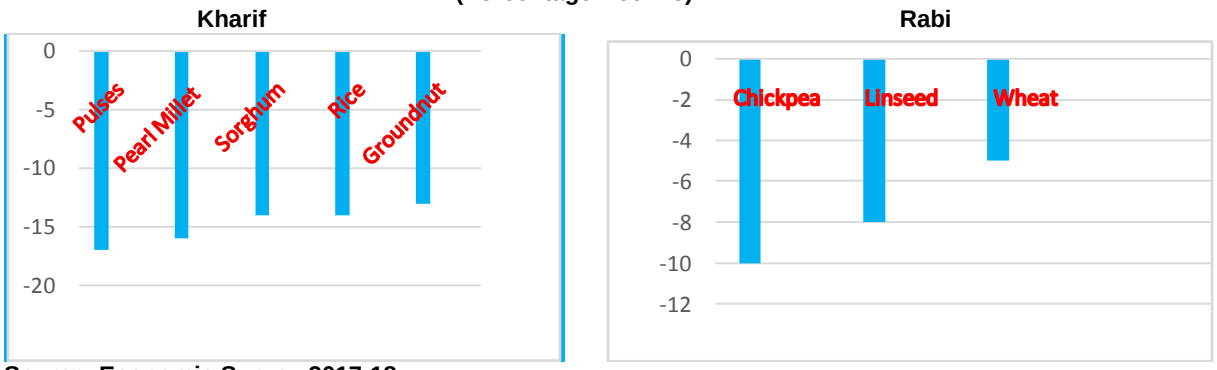
soya, chickpea pearl millet etc get effected due to extreme temperature increase. Figure 3 A & 3B clearly shows that among the crops grown in rainfed areas in both Rabi and kharif seasons pulses(which is a main source of protein in India) are more affected to weather shocks as compared to cereals (wheat and rice).

Figure-2A & 2B
Effects of Increase in Temperature on Crop Yields
(Percentage Decline)



Source-Economic Survey 2017-18

Figure :3A & 3B
Effects of Decrease in Rainfall on Crop Yields
(Percentage Decline)



Source: Economic Survey 2017-18

Impact of Climate Change on Farm Revenue

Table 3 clearly depicts the impact of climate change on Farm Revenue. Analysis of above table shows that due to extreme temperature shocks farmers income reduces by 4.3 percent for Kharif and 4.1 percent for Rabi. But on the other hand due to extreme rainfall shocks income reduces more, it reduces 13.7 percent for Kharif and 5.5 percent for rabi. This happens because of unirrigated area ,as they felt largest adverse effect of weather shock except for Kharif crop where extreme temperature shocks causes decline of farm revenue in irrigated area.

Table-3
Impact of Climate Change on Farm Revenue

	Decline in Revenue due to Increase in Temperature	Decline in Revenue due to Decrease in Rainfall
Kharif (Average)	4.3%	13.7%
Kharif (Irrigated)	7.0%	7.0%
Kharif (Unirrigated	5.1%	14.3%
Rabi (Average)	4.1%	5.5%
Rabi (Irrigated)	3.2%	4.0%
Rabi (Unirrigated)	5.9%	6.6%

Source :Economic Survey 2017-18

Conclusion and Suggestions

It is clear from the above discussion that on Indian agriculture climate change has a great impact. Indian agriculture got effected by the change in temperature and rainfall but there is a difference, the impact of temperature is higher and the impact of rainfall is significantly lower.Most important these impacts of climate changes were more significant for unirrigated areas as compared to irrigated areas.Due to these shocks farm income is declining.

India's population is increasing so the demand for food grain is also increasing. With Problem of climate change and limited resources the production of food grains will be a big challenge for India. To solve this problem India needs to take some major steps. Firstly Indian government should

increase public investment on agriculture research programmes so that new varieties of crop can be develop which can tolerate fluctuations in temperature and rainfall. In this way the effects of climate change on Agriculture productivity can be minimized. Secondly Government should promote minor irrigation project instead of major irrigation project with long gestation period.Technologies of drip irrigation, sprinklers and rain water harvesting should be encouraged. Thirdly as various studies reveal that in India over the past 30 years there was a decline in the water table. According to shah 2008, as compared to China or United States India pumps two times more ground water. Against the backdrop of problem of ground water depletion the objective of fully irrigating Indian Agriculture will be a biggest challenge for India.To tackle this problem the government should take necessary action to control ground water depletion. Lastly loss of farmers revenue due to climate change should be compensated by the government through crop insurance plan.A declining income will force farmers to give up farming as their main occupation, which will have negative impact on food grain availability.

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