

AGRICULTURE OF INDIA AND CLIMATIC CHANGE

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ABSTRACT

Climate change and agriculture are interrelated processes, both of which take place on a global scale. Climate change affects agriculture in a number of ways, including through changes in average temperatures, rainfall, and climate extremes (e.g., heat waves); changes in pests and diseases; changes in atmospheric carbon dioxide and ground-level ozone concentrations; changes in the nutritional quality of some foods; and changes in sea level. India is the large country with diverse climatic conditions. The Climate Change effect a lot Indian Agriculture as Two thirds area is rain dependent (High monsoon depended)Different seasons grow different crops by using different farming systems So, climatic change causes a great impact on the production of major crops which will be discuss in this paper. The paper mainly shows the interdependency of agriculture on climate and their effects on each other..

Agriculture contributes to climate change by (1) anthropogenic emissions of greenhouse gases (GHGs), and (2) by the conversion of non-agricultural land (e.g., forests) into agricultural land. Agriculture, forestry and land-use change contributed around 20 to 25% to global annual emissions in 2010.

There are a range of policies that can reduce the risk of negative climate change impacts on agriculture, and to reduce GHG emissions from the agriculture sector.

Keywords: *Agriculture, Climatic change, Climatic conditions, Effects by climatic changes, Greenhouse gases*

I. INTRODUCTION

Agriculture is one of the few sectors that can both contribute to mitigation and sequestration of carbon emissions and accounting for agriculture's carbon footprint is necessary, particularly if agriculture is included in greenhouse gas reduction commitments. However, the range and variability of estimates, and the complexity and uncertainty of accounting for indirect land use change remain to be resolved. Policies will play a role in enhancing the ability of agriculture to adapt to climate change, while also contributing to other environmental goals. Work in the OECD will continue to support the process following the forthcoming Conference of the Parties (COP 21) to the 1992 United Nations Framework Convention on Climate Change (UNFCCC). Ref. (1) Climate change is exacerbating the challenges faced by the agriculture sector, negatively affecting both crop and livestock systems in most regions. 2. Agriculture is also contributing a significant share of the greenhouse gas (GHG) emissions that are causing climate change – 17% directly through agricultural activities and an additional 7% to 14% through land use changes. Ref.(2) Change in climate conditions and the frequency of natural disasters in recent times has made it imperative to find Lasting adaptation solutions for the agriculture sector. Given that almost 60 % of the country's population relies on this sector for its livelihood and that it

contributes approximately 15.7% of India’s GDP, an analysis of changes which could impact crop yields and subsequently lead to an instable food security scenario is necessary.Ref.(7)

II. OBJECTIVES OF STUDY

The objective of present study is to investigate the impact of climate (through changes in temperature and precipitation) on four major crops namely; Wheat, Rice, Cotton and Sugarcane in the India. The study also makes projections regarding the effects of changes in temperature and precipitation on the crops production. This mainly shows the stages of development of each crop In order to bring the impact of climate change on the crops.

III. DATA AND METHODOLOGY:

Climate change is already affecting agriculture, with effects unevenly distributed across the world. Future climate change will likely negatively affect crop production in low latitude countries, while effects in northern latitudes may be positive or negative. Climate change will probably increase the risk of food insecurity for some vulnerable groups, such as the poor

Cline (2008 looked at how climate change might affect agricultural productivity in the 2080s. His study assumes that no efforts are made to reduce anthropogenic greenhouse gas emissions, leading to global warming of 3.3 °C above the pre-industrial level. He concluded that global agricultural productivity could be negatively affected by climate change, with the worst effects in developing countries Ref.(4) The effects of climatic change on agriculture over next fifty years is shown in the following table(1) which is as follows:

TABLE (1): Predicted effects of climate change on agriculture over the next 50 years Ref. (5):

Climatic element	Expected changes by 2050's	Confidence in prediction	Effects on agriculture
CO ₂	Increase from 360 ppm to 450 - 600 ppm (2005 levels now at 379 ppm)	Very high	Good for crops: increased photosynthesis; reduced water use
Sea level rise	Rise by 10 -15 cm Increased in south and offset in north by natural subsistence/rebound	Very high	Loss of land, coastal erosion, flooding, salinisation of groundwater
Temperature	Rise by 1-2°C. Winters warming more than summers. Increased frequency of heat waves	High	Faster, shorter, earlier growing seasons, range moving north and to higher altitudes, heat stress risk, increased evapotranspiration
Precipitation	Seasonal changes by ± 10%	Low	Impacts on drought risk' soil workability, water logging irrigation supply, transpiration

Storminess	Increased wind speeds, especially in north. More intense rainfall events.	Very low	Lodging, soil erosion, reduced infiltration of rainfall
Variability	Increases across most climatic variables. Predictions uncertain	Very low	Changing risk of damaging events (heat waves, frost, droughts floods) which effect crops and timing of farm operations

Source: Climate change and Agriculture, MAFF (2000)

IV. EFFECT ON MAJOR CROPS (RICE, WHEAT) PRODUCTION

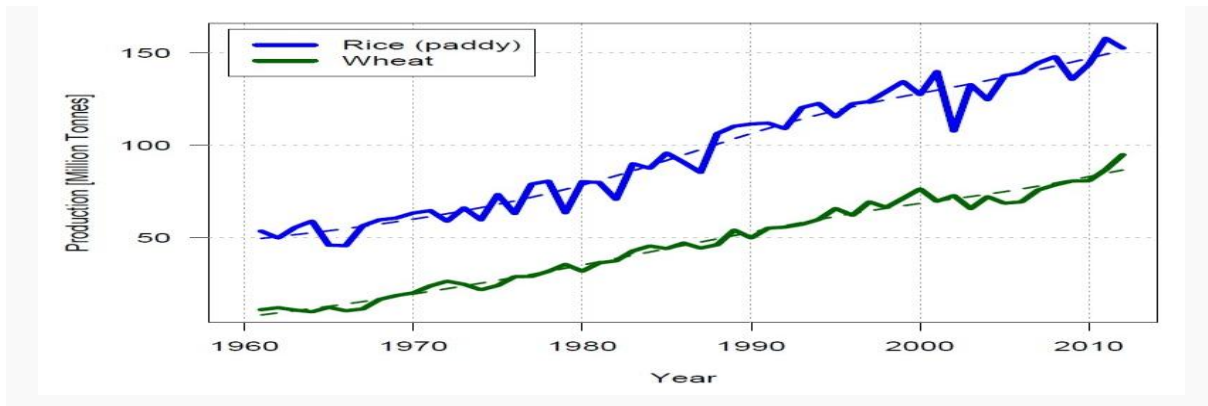
Weather is the condition of the atmosphere at a particular place and time. It is characterized by parameters such as temperature, humidity, rain and wind. Climate is the long term pattern of weather conditions for a given area. Climate change refers to a statistically significant variation in either the mean state of the climate or its variability, persisting for an extended period. India is home to extraordinary variety of climatic regions, ranging from tropical in the south to temperate and alpine in the Himalayan north, where elevated regions receive sustained winter snowfall. The nation’s climate is strongly influenced by the Himalayas and the Thar Desert. Four major climatic groupings predominate into which fall seven climatic zones which are defined on the basis of temperature and precipitation.

Climate change is the most important global environmental challenge facing humanity with implications for natural ecosystems, agriculture & health The perusal of general circulation models (GCM s) on climate change indicate that rising levels of greenhouse gases (GHGs) are likely to increase the global average surface temperature by 1.5-4.5°C over the next 100 years. The difference of average temperature between the last ice age and present climate is 6°C. This will raise sea-levels, shift climate zones pole ward, decrease soil moisture and storms. Global warming is predicted to affect agricultural production .Ref. (6) Rice and wheat, being the staple food, play a crucial role in the food security of India. Increase in temperature, atmospheric greenhouse gases, and soil degradation and competition for land and water resources will have multiple impacts on the rice–wheat cropping system of northwest India

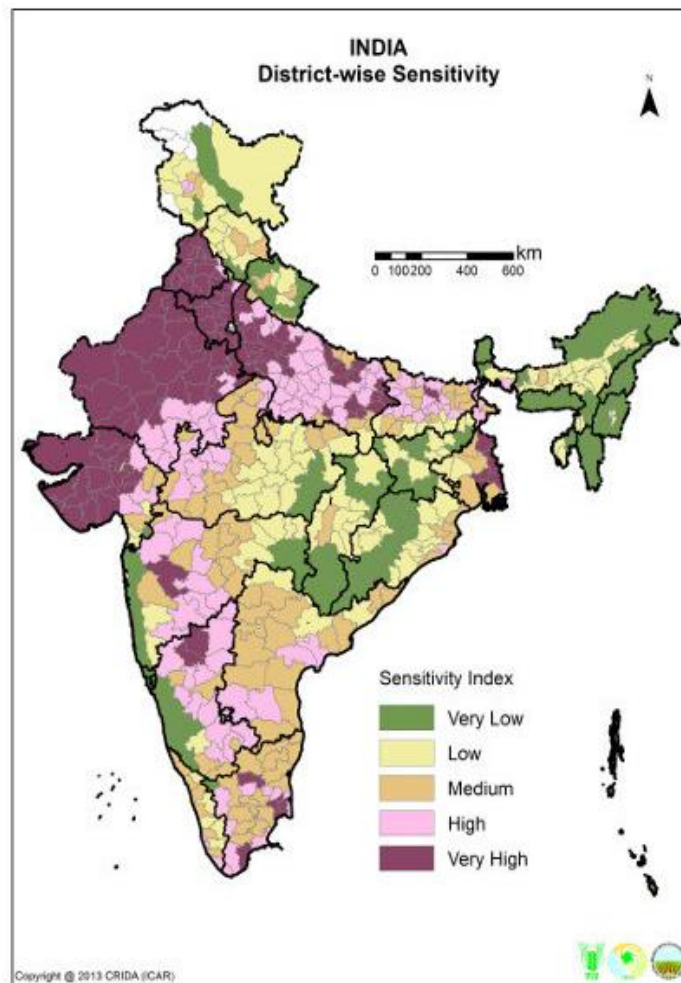
Table 2. Year wise average yield of wheat and rice at all level (Kgs per hectare) (Source-USDA, Foreign Agricultural Service)

Year	Wheat	Rice
1999-2000	2778	1986
2000-2001	2708	1901
2001-2002	2762	2079
2002-2003	2610	1744
2003-2004	2713	2077

Air pollution effect on productivity of wheat and rice as shown in the figure(1):



A May 2016 study, published in Indian Academy of Science's journal *Current Science*, analysed 38 meteorological, agricultural and social data across all of India's 572 rural districts, and created a climate vulnerability index for agriculture. The factors are subdivided into three categories--sensitivity, exposure and adaptive capacity. The maps above show how the districts ranked on these three broad categories. But assessing climate-change vulnerability is a process so complicated that even the wide-ranging datasets used by the new study may be inadequate to inform policy on climate change



V. PROBLEMS

A 2003 analysis of India's agricultural growth from 1970 to 2001 by the Food and Agriculture Organisation identified systemic problems in Indian agriculture. For food staples, the annual growth rate in production during the six-year segments 1970-76, 1976-82, 1982-88, 1988-1994, 1994-2000 were found to be respectively 2.5, 2.5, 3.0, 2.6, and 1.8% per annum. Corresponding analyses for the index of total agricultural production show a similar pattern, with the growth rate for 1994-2000 attaining only 1.5% per annum.

VI. INFRASTRUCTURE

India has very poor rural roads affecting timely supply of inputs and timely transfer of outputs from Indian farms. Irrigation systems are inadequate, leading to crop failures in some parts of the country because of lack of water. In other areas regional floods, poor seed quality and inefficient farming practices, lack of cold storage and harvest spoilage cause over 30% of farmer's produce going to waste, lack of organized retail and competing buyers thereby limiting Indian farmer's ability to sell the surplus and commercial crops. The Indian farmer receives just 10% to 23% of the price the Indian consumer pays for exactly the same produce, the difference going to losses, inefficiencies and middlemen. Farmers in developed economies of Europe and the United States receive 64% to 81%.

VII. PRODUCTIVITY

Although India has attained self-sufficiency in food staples, the productivity of its farms is below that of Brazil, the United States, France and other nations. Indian wheat farms, for example, produce about a third of the wheat per hectare per year compared to farms in France. Rice productivity in India was less than half that of China. Indian farms in some regions post the best yields, for sugarcane, cassava and tea crops.

Crop yields vary significantly between Indian states. Some states produce two to three times more grain per acre than others. The table compares the statewide average yields for a few major agricultural crops in India, for 2001-2002. Ref. (8) **TABLE(3)** as follows:

Crop	Average farm yield in Bihar	Average farm yield in Karnataka	Average farm yield in Punjab
	kilogram per hectare	kilogram per hectare	kilogram per hectare
Wheat	2020	unknown	3880
Rice	1370	2380	3130
Pulses	610	470	820
Oil seeds	620	680	1200
Sugarcane	45510	79560	65300

VIII. INITIATIVES

The required level of investment for the development of marketing, storage and cold storage infrastructure is estimated to be huge. The government has not been able to implement schemes to raise investment in marketing

infrastructure. Among these schemes are 'Construction of Rural Godowns', 'Market Research and Information Network', and 'Development / Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization'.

The Indian Council of Agricultural Research (ICAR), established in 1905, was responsible for the search leading to the "Indian Green Revolution" of the 1970s. The ICAR is the apex body in agriculture and related allied fields, including research and education.^[101] The Union Minister of Agriculture is the president of the ICAR. The Indian Agricultural Statistics Research Institute develops new techniques for the design of agricultural experiments, analyses data in agriculture, and specializes in statistical techniques for animal and plant breeding.

Recently the government of India has set up the Farmers Commission to completely evaluate the agriculture programme. Its recommendations have had a mixed reception.

In November 2011, India announced major reforms in organized retail. These reforms would include logistics and retail of agricultural produce. The announcement led to major political controversy. The reforms were placed on hold by the government in December 2011. In the summer of 2012, the subsidized electricity for pumping, which has caused an alarming drop in aquifer levels, put additional strain on the country's electrical grid due to a 19% drop in monsoon rains and may have contributed to a blackout across much of the country. In response the state of Bihar offered farmers over \$100 million in subsidized diesel to operate their pumps. In 2015, Narendra Modi announced to double farmer's income by 2022. Startups with niche technology and new business models are working to solve problems in Indian agriculture and its marketing. Kandawale is one of such e-commerce website which sells Indian Red Onions to bulk users direct from farmers, reducing unnecessary cost escalations

IX. CONCLUSION

It is estimated that India needs 320 MT of food grains by the year 2025. For a country like India, sustainable agricultural development is essential not only to meet the food demands, but also for poverty reduction through economic growth by creating employment opportunities in non-agricultural rural sectors. It is possible that climate change may force the pace of rural-urban migration (rurbanisation) over the next few decades. The ongoing agrarian crisis in rural India could be catalyzed by climate change into a migratory rout, driven by greater monsoon variability, endemic drought, and flooding and resource conflict. The study focuses on the impact of on changes in climate change indicators on production of major crops in India. The results show that in the short run the increase in temperature is expected to affect the wheat productivity but in long term the increase in temperature has positive effect on wheat productivity.

The role of Science & Technology cannot be ignored. Right kind of technologies and policies are required to strengthen the capacity of communities to cope effectively with both climatic variability and changes

REFERENCES

[1] <http://www.oecd.org/tad/sustainable-agriculture/agriculture-and-climate-change.htm>

[2] <http://www.mapama.gob.es/es/cambio-climatico/temas/mitigacion-politicas-y-medidas/agriagricycocde>

[3] Report on climatic change and agriculture(2000) MAFF

[4] https://en.wikipedia.org/wiki/Climate_change_and_agriculture

[5] http://www.ecifm.rdg.ac.uk/climate_change.htm

[6] Volume 1» Issue 4,by Manas Ranjan Senapati, Bhagirathi Behera, SrutiRanjan,Mishra,American Journal of Environmental Protection ISSN (Print): 2328-7241 ISSN (Online): 2328-7233

[7] http://assets.wwfindia.org/downloads/impacts_of_climate_change_on_growth_and_yield_of_rice_and_wheat

[8] https://en.wikipedia.org/wiki/Agriculture_in_India