



AN EMPIRICAL EVIDENCE ON IMPACT OF GLOBAL WARMING IN INDIA'S AGRICULTURE PRODUCTION

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Abstract

India is a large country with all types of climates and different kinds of soil requiring different types of farming. Most of the agricultural land in India is dependent on rainfall for irrigation. Some parts of the country are drought prone, the other parts are prone to flooding. For many years, parts of the country have been struggling against drought and at the same time, agricultural lands in other parts of the country are submerged due to floods. In such a condition country like India, the effect will be extreme. Climate is changing naturally at its own pace, since the beginning of the evolution of earth, 4–5 billion years ago, but presently, it has gained momentum due to inadvertent anthropogenic disturbances. Global warming and climate change refer to an increase in average global temperatures. Natural events and human activities are believed to be contributing to an increase in average global temperatures. This is caused primarily by increases in “greenhouse” gases. In India, agriculture and allied activities constitute the single largest component of Gross Domestic Product (GDP) contributing nearly 25% of the total. The tremendous importance of this sector to the Indian economy can be gauged by the fact that it provides employment to to-thirds of the total workforce. The share of agricultural products in exports is also substantial, with agriculture accounting for 15% of export earnings. Agricultural growth also has a direct impact on poverty eradication, and is an important factor in employment generation.

Keywords: *Floods, CO₂, Kharif, Rabi, Greenhouse gases, GNP, GDP.*

Introduction

Climate change is not only a major global environmental problem, but it is also an issue of great concern to a developing country like India. Climate is changing naturally at its own pace, since the beginning of the evolution of earth, 4–5 billion years ago, but presently, it has gained momentum due to inadvertent anthropogenic disturbances. Global warming and climate change refer to an increase in average global temperatures. Natural events and human activities are believed to be contributing to an increase in average global temperatures. This is caused primarily by increases in “greenhouse” gases such as carbon dioxide (CO₂), methane (CH₄) (which is 20 times as potent a greenhouse gas as carbon dioxide) and nitrous oxide (N₂O), plus three fluorinated industrial gases: hydro fluorocarbons (HFCs), per fluorocarbons (PFCs) and sulphur hexafluoride (SF₆). Water vapour is also considered a greenhouse gas. The Club of Rome Report 1972 officially raised global warming as an international issue and, in 1985, World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) officially declared carbon dioxide as the principal cause of global warming. Global warming not only causes a change in average temperature and precipitation but also increases the frequency of floods, droughts, heat waves, and the intensity of typhoons and hurricanes following the change in temperature and precipitation patterns. The impacts of climate change are also shown in various other forms throughout the world, including the rise of sea level, decrease in glaciers, northward movement of plant habitats, changes in animal habitats, rise of ocean temperature, shortened winter and early arrival of spring. Global warming is projected to have significant impacts on conditions affecting agriculture, including temperature, carbon dioxide, glacial run-off, precipitation and interaction of these elements.

Climate Change and Indian Agriculture

In India, agriculture and allied activities constitute the single largest component of Gross Domestic Product (GDP) contributing nearly 25% of the total. The tremendous importance of this sector to the Indian economy can be gauged by the fact that it provides employment to to-thirds of the total workforce. The share of agricultural products in exports is also substantial, with agriculture accounting for 15% of export earnings. Agricultural growth also has a direct impact on poverty eradication, and is an important factor in employment generation.

Assessment of the effects of climate changes could considerably affect the food supply and access through their direct and indirect effects on crops, soils, livestock, fisheries and pests. On the other hand increase in temperature, can reduce crop duration, increase crop respiration rates, affect the equilibrium between crops and pests, hasten nutrient mineralisation in soils, decrease fertiliser use efficiencies, and increase vapour-transpiration among others. Uncertainty in precipitation causing droughts and floods has been responsible for many famines, rural poverty and migration despite development of impressive irrigation potentials. These environmental changes, particularly temperature increase and sea level rise, could also affect fisheries directly and indirectly through changes in the availability of feed. Similarly, by increased temperatures the changes



in fodder and water availability may affect production of meat and milk. Indirectly, there may be considerable impact on agricultural land use due to snow melt, availability of irrigation, frequency and intensity of inter- and intra-seasonal droughts and floods, soil organic matter transformations, soil erosion, decline in arable areas (due to submergence of coastal lands), and availability of energy. All these changes would have tremendous impact on agricultural production and, hence, on the food security of any region. Several important socio-economic determinants of food supply such as government policies, capital availability, prices and returns, infrastructure, land reforms, and inter- and international trade are also expected to be influenced and altered by environmental changes.

India is a large country with diverse climate. Most of the agricultural land in India is rain dependent and two-thirds of the country dependent on monsoon rains. Some parts of the country are drought prone, the other parts are prone to flooding. For many years, parts of the country have been struggling against drought and at the same time, agricultural lands in other parts of the country are submerged due to floods. In such a condition country like India, the effect will be extreme.

Projected Effects of Global Warming on India

Agriculture sector alone represents 23 per cent of India's Gross National Product (GNP), plays a crucial role in the country's development and shall continue to occupy an important place in the national economy. It sustains the livelihood of nearly 70% of the population. It seems obvious that any significant change in climate on a global scale will impact local agriculture, and therefore affect the world's food supply. Climate change will also have an economic impact on agriculture, including changes in farm profitability, prices, supply, demand, trade and regional comparative advantages. The magnitude and geographical distribution of such climate induced changes may affect our ability to expand the food production area as required to feed the burgeoning population of more than 10,000 million people projected for the middle of the next century.

- Amongst the key impacts will be the faster retreat of Himalayan glaciers, frequent floods and decrease in crop yields. Yield reductions are predicted in wheat and rice due to temperature rise in key growing regions.
- The Ganges will become dry as glaciers are melting and dam across the river have reduced the flow of water. It is a holy river for millions of Hindus therefore religious sentiments will hurt.
- Sea levels will increase and the Sunder bans in the Ganga valley delta will submerge.
- The potential impacts on the productivity of most cereals would decrease due to increase in temperature and CO₂, and the decrease in water availability. There will be a projected loss of 10-40% in crop production by 2100 if no adaptation measures are taken. A one degree Celsius increase in temperature may reduce yields of major food crops by 3-7%. The length of the growing period in rain fed areas is likely to decrease, especially in peninsular regions.
- Kharif (autumn) crops will be impacted more by rainfall variability while Rabi (spring) crops by rise in minimum temperature. Wheat is likely to be negatively impacted in Rabi due to terminal heat stress. Rice will be affected both by temperature and water availability. Legume crops such as soybean and groundnut are likely to benefit due to increased temperature/CO₂ if water availability is not limited. Milk yield in livestock will be impacted during heat waves. There will be changes in the breeding season in marine fisheries with a shift in seasonal catches. There will be a significant negative impact on commercial poultry due to heat stress. There will also be more opportunities for rainwater harvesting due to high intensity rainfall but greater loss of topsoil due to erosion.
- Rice yields will fall in North West India.
- Western India will suffer from a rise in sea level waters.
- Apple crop yields will decrease further and the farmers will have to relocate to higher land resulting in further destruction of forests and higher animal encounters with humans.
- In Kerala the productivity of the forests will fall.
- Productivity of most crops in India will fall from 10 to 40 percent by 2100.
- A one degree C increase in temperature will reduce the yield of soybeans, wheat, groundnuts from 3 to 7 percent.
- Milk yields will decrease by 1.5 million tons by 2020.
- In coastal Orissa, the sea has come inland 2.5 Kilometres towards the Kanakpur and Satvaya region, causing about a 56 percent loss of its mangrove vegetation.

These are the projected problems that India will suffer from in the future and substantially already has. Since the Indian population is increasingly becoming dependent on wheat and rice, Greenhouse gases impact on these crop production will definitely affect the food security of the nation thus, global warming and change in climate and its impact on agriculture is a serious concern for India, which is mitigating the risks through 'food security' for every household.



Agriculture Situation in India

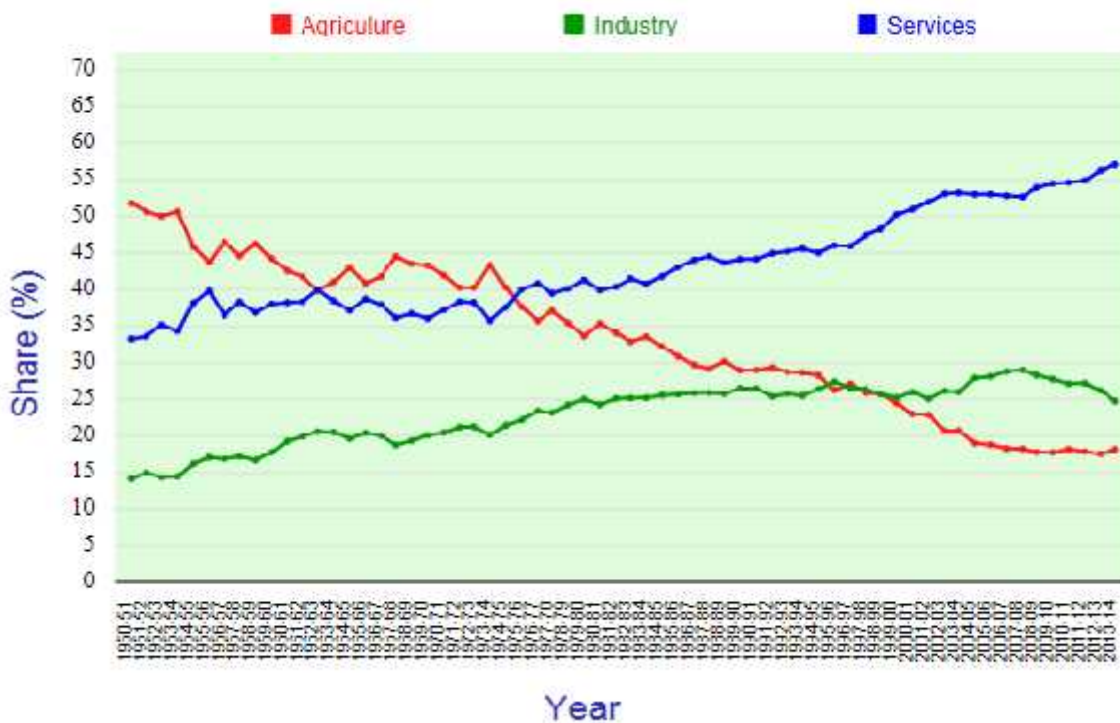
Table: 1.1, Growth of GDP at Factor cost by Economic Activity (at 2004-05 prices)

Sector		Growth			Percentage share in GDP		
		2011 -12	2012-13(IR)	2013-14(PE)	2011-12	2012-13(IR)	2013-14(PE)
1.	Agriculture, Forestry & fishing	5.0	1.4	4.7	14.4	13.9	13.9
2.	Industry	7.8	1.0	0.4	28.2	27.3	26.1
3.	Services	6.6	7.0	6.8	57.4	58.8	59.9
4.	GDP at factor cost	6.7	4.5	4.7	100	100	100

IR: 1st Revised Estimates; PE: Provisional Estimates
Source: Central Statistical Office

As per the Estimates of the Central Statistics Office (CSO), the growth in Gross Domestic Product (GDP) at factor cost at constant (2004-05) prices is placed at 5.7 per cent in the first quarter of 2014-15, which is the highest recorded in nine quarters, with agriculture, industry and services registering growth rates of 3.8 per cent, 4.2 per cent and 6.8 per cent respectively. The GDP growth was estimated at 4.7 per cent for the full year 2013-14.

Sectorwise contribution of GDP of India (1950-2014)



Source: Planning commission of India.

Table: 1.2 India's Agricultural Commodities Growth Rates of Area, Production and Yield.

Crops/ Groups	Crop	1990-91 to 1999 -2000			2000 -01 to 2011 to 11		
		A	P	Y	A	P	Y
Rice		0.70	2.09	1.36	-0.39	1.32	1.47
Wheat		1.62	4.52	2.87	0.57	1.39	0.73
Maize		0.85	2.24	1.37	2.68	7.12	4.13
Coarse cereals		-2.42	-0.08	2.03	-0.13	5.0	4.64
Total Cereals		-0.12	2.29	2.38	-0.09	1.82	1.69



Gram	0.88	3.86	2.97	4.31	6.39	1.19
Tur	-0.45	1.89	2.03	2.58	1.89	-0.65
Total Pulses	-0.91	1.06	1.82	2.30	4.02	1.21
Total Foodgrains	-0.27	2.19	2.43	0.34	1.95	1.37
Groundnut	-2.25	-2.40	-0.30	-1.08	13.13	12.76
Soyabean	11.01	16.37	4.67	4.15	8.31	4.17
Oilseeds	0.75	2.53	1.76	1.27	7.00	5.18
Sugarcane	2.25	3.16	0.91	1.95	2.12	0.03
Cotton	1.42	0.93	-0.54	2.66	12.12	9.15

Note: A: Area, P: Production, Y: Yield

Source: Directorate of Economics & Statistics, Ministry of Agriculture

The table shows that there is a Increase in the growth rates of yields in the two periods, is however in groundnut and cotton. Whereas, the crops cultivation like rice, wheat, cereals, pulses production was not significantly increased. It is noted that the total area of crop cultivation not significantly progressive.

Conclusion

Agricultural production is very much dependent environmental variables and is also an important agent of environmental change. Hence it is critical to examine the possible consequences of global warming on agriculture sustainability and food security. The role of climate as a determinant of agriculture has long been recognised. It is only in the last decade, however, that the reciprocal effect has come to light: the role of agriculture as a contributor to climate change. Clearing forests for fields, burning crop residues, submerging land in rice paddies, all releases greenhouse gases to the atmosphere. All research study has given only their negative results on global warming. Obviously, there should not be any positive attitude especially in agriculture production might not expect high yield in coming years.

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