

## **A REVIEW ON IMPACT OF CLIMATE CHANGE ON FOOD INSECURITY ON AGRICULTURE**

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### **ABSTRACT**

Food Insecurity is one of the major problems in the present situation and also it is continuing from the past several generations. Impact of change in climate is the main cause for this condition. Insecurity is due to several factors such as drought, Heavy Rainfall etc. Global warming increases the temperature, mainly during night hours. It is harmful/damaging to grain filling stage which eventually leads to loss in weight of the grain of many crops. Climate change is the continual adaptation of temperature and exemplary weather patterns in a place, and also it may cause weather patterns to be less certain. Change in the climate with raised/hoisted atmospheric Carbon-di-oxide concentration and temperature sometimes known for impact of plant photosynthesis.

**Keywords:** Agriculture, Food Insecurity, Climate change

### **INTRODUCTION**

Agriculture sector in India is vulnerable to climate change. Green house gases are a major source of Climate change which contribute to the greenhouse effect (Sutherst, R.W,1996). However, the changes in climate have far reaching the impact on agricultural production, which are feasible to challenge food security in the forthcoming (IPCC Chapter 5, 2010). Change in the Climate may have harmful effects on irrigated crop yields over agro-ecological regions both because of the rise in temperature and change in water availability (Gurdeep Singh Malhi et. Al, 2020). Climate change is a transformation in analytical properties of the climate system that exists over a period of time or indefinitely- conventionally at least 30 years, it is the continual adaptation of temperature and exemplary weather patterns in a place, and also it may cause weather patterns to be less certain. These unpredicted weather patterns can make it challenging to sustain and grow crops in regions that depend on farming because the expected temperature and rainfall level may no longer be depended on and also it has also been associated with other destructing weather

events like more persistent and more severe droughts, floods, heavy rainfall, and winter storms (Asian Development Bank, 2009). Climate change is prone to contribute considerably to food insecurity in the forthcoming, by increasing the prices of food, and reducing the production of food. Food may become more valuable as climate change diminishing efforts increase the energy prices (Ramachandran, 2014). In handling food security both the characteristics of malnutrition – starvation and micro-nutrient deficiency, together with excess intake, obese, and plumpness – has necessary to be well chosen (FAO et al. 2018). In the past few decades, hidden hunger (sustained across representing Fe, Vit. A, and lack of Zn) aggravated in Africa, while it especially raised in the Asia and Pacific regions (Max Roser et.al, 2021). Elevated levels of atmospheric carbon dioxide (CO<sub>2</sub>) are also expected to lower levels of zinc, iron, and other important nutrients in crops.

### **Food Demand and Production:**

Due to the increasing population all over the world, the food production needs to be increased. Elevated levels of atmospheric carbon dioxide (CO<sub>2</sub>) are also expected to lower levels of zinc, iron, and other important nutrients in crops (International Food Policy Research Institute, 2019). Farmers worldwide will need to increase crop production, either by increasing the amount of agricultural land to grow crops or by enhancing productivity on existing agricultural lands. There is strong academic consensus that climate change–driven water scarcity, rising global temperatures, and extreme weather will have severe long-term effects on crop yields (Maarten Elferink and Florian Schierhorn, 2016). But due to the prolonged rainfalls, long periods of high temperatures that has caused drought related stress and decreases the productivity of crops. This will build up into a gradual shortage of supplies, leading to mass food shortage (IPCC Chapter 5).

The Intergovernmental Panel On Climate Change Working Group II chapter on Food Security and Food Production Systems destitute new ground by enlarging its focus on the far side the consequences of global climate totally on the production of Agriculture which includes crops, livestock and aquaculture to incorporate a food systems approach further as directive attention to malnourished people (NRCB et.al, 2016). Anyhow, it concentrated mainly on food production systems because of the ubiquity of examinations on thereon topic. It emphasized that a span of developing alteration options survive beyond all food system schemes, not only in production of food, and that aids from inherent development in food processing, packaging, transport, storage, and trade were inadequately analyzed at that time (Science Breakthroughs to Advance Food and Agricultural Research by 2030. Washington).

The proof for fast global climate change (Intergovernmental Panel On Climate Change IV Assessment Report) is engrossing:

(1) Rise in ocean Level: International lowland rose regarding seventeen cm (6.7 in.) within the last century. The speed within the last decade, however, is regarding doubly that of the previous century.

(2) Rise in international temperature: Most of this heating has existed as of the Seventies, with the twenty warmest years having existed as of 1981 and with all ten of the warmest years occurring since twelve years.

(3) Warming oceans: The oceans have absorbed abundant of the magnified heat, with the highest 700 m (about 2300 foot.) of ocean showing warming of zero.302° F since 1969.

(4) Shrinking ice sheets: The Kalaallit Nunaat and also the Antarctic ice sheets have reduced in mass. information from NASA's Gravity Recovery & Climate Experiment show Kalaallit Nunaat lost regarding 150–250 cuboidal kilometer of ice per annum between 2002 and 2006, whereas Antarctic continent lost regarding 152 cuboidal kilometer of ice between 2002 and 2005.

(5) Declining Arctic ocean ice: each the extent and thickness of Arctic ocean ice has lessened quickly over several decades.

(6) Glacial retreat: Glaciers are withdrawing nearly all over round the world – together with within the Alps, Himalayas, Andes, Rockies, Last Frontier and continent.

(7) Ocean acidification: From the start of the economic Revolution, acidity of the surface ocean waters has been magnified by nearly half-hour. The number of carbonic acid gas absorbed by the higher layer of the oceans is increasing by regarding 2 billion tons per annum.

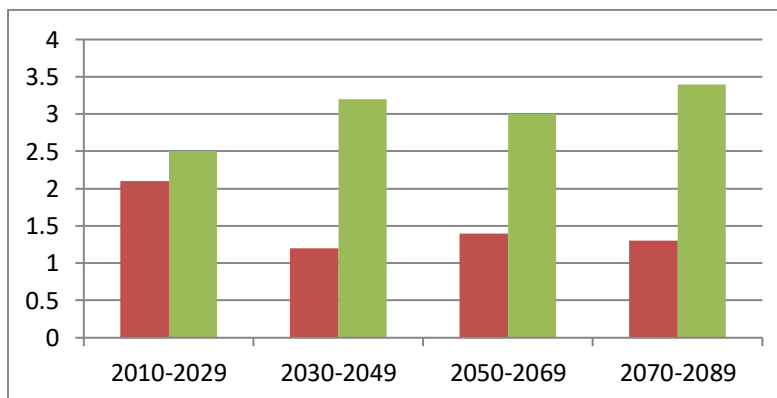


Fig. 1 Outline of projected changes in crop yields, because of temperature change over the twenty first century. The figure includes projections for various emission situations, for tropical and temperate regions, and for adaptation and no-adaptation cases combined. relatively, few

studies have thought-about impacts on cropping systems for situations wherever world mean temperatures increase by 4°celsius or additional. For five periods within the close to term and future, information (n=1090) ar planned within the 20-year amount on the horizontal axis that features the point of every future projection amount. Changes in crop yields are relative to late-20th-century levels. Information for every timeframe adds to 100%. © IPCC, 2014, fifth ASSESSMENT

### **Impact Of global climate change on Agricultural Crops:**

- (Trudie Dockerty et al.) explored the chance of decoding global climate change impacts info of agricultural landscape in metropolis through GIS based mostly visualizations.
- (Rivington et al.) argued that associate degree Integrated Assessment (IA) approach, combining simulation modeling with thoughtful method involving call manufacturers and different stakeholders, has the potential to come up with credible and relevant assessments of global climate change impacts on farming systems.
- Despite the importance of eutherian to poor individuals and also the magnitude of the changes that square measure probably to befall eutherian systems, the intersection of global climate change and eutherian in developing countries could be a comparatively neglected analysis space. terribly touch is understood concerning the interactions of climate and increasing variability in climate with different drivers of modification in eutherian systems and in broader development trends ( Adger W.N et.al ).
- (Thornton et al.) in brief reviewed the literature on global climate change impacts on eutherian and eutherian systems in developing countries. The impact of global climate change on eutherian in terms of amount and quality of feeds, heat stress, water, eutherian diseases and vectors, variety and systems and livelihoods were studied.

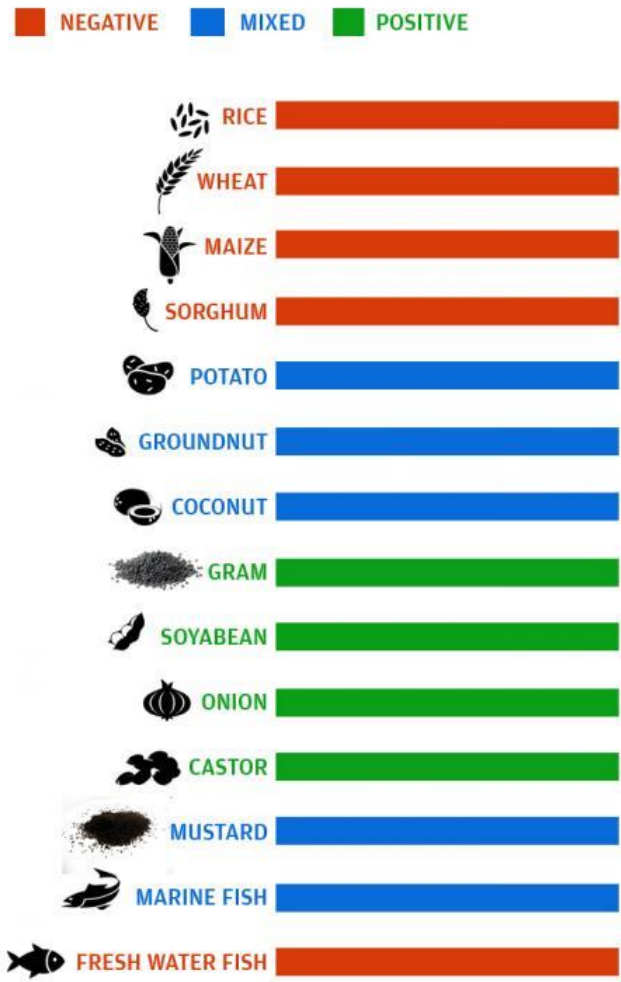
### **Government of India has initiated varied actions to mitigate affects of climate change:**

- Varieties and cultivars that ar tolerant to the abiotic stress ar developed underneath the strategic analysis part of National Initiative on Climate Resilient Agriculture.
- The technology demonstrations aim at enhancing the adjustive capability of the farmers and conjointly to survive with the climate variability within the sensitive districts to attain climate resilient agriculture. underneath National Initiative on Climate Resilient Agriculture, climate resilient technology demonstrations ar enforced in 151 climatically sensitive districts round the country.
- District Agriculture Contingency Plans are ready by the Indian Council of Agricultural analysis-Central Research Institute for Dryland Agriculture, for regarding 648 districts within the country to handle all the adverse climate.

Impact of the global climate change on Agriculture results in one 5% loss in India's value

### India - Commodity wise impacts

(from modelling)



Source: Down To Earth (DTE).

**Fig 2: In India due to climate change Rice, wheat, maize, sorghum shows negative Impact. Whereas gram, soybean, castor shows positive impact.**

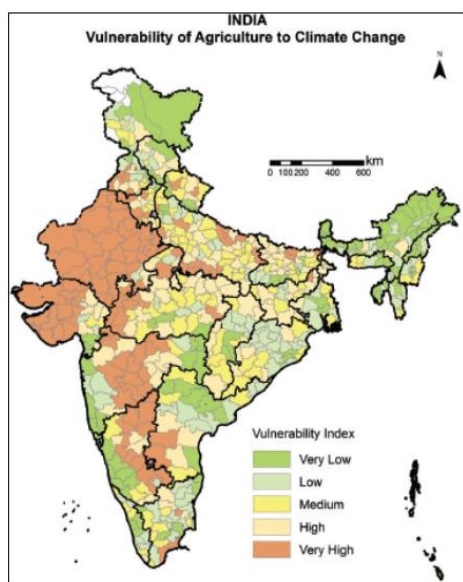
### **Impact of the Climate change on Food Security:**

“Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. (World Food Summit, 1996)

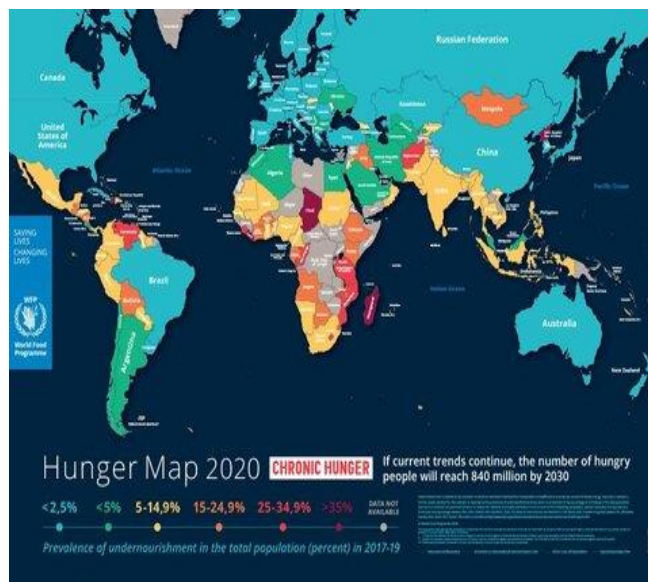
Food security is one of the main distress associated with the climate change. Changes in the climate have an effect on the food security in complicated ways. It shows an impact on the crops, livestock, forestry, fisheries and aquaculture, and can cause serious social and economic consequences in the form of reduced incomes, eroded livelihoods, trade disruption and adverse health impacts (Moors E. et al., 2013). However, it is important to note that the net impact of climate change depends not only on the extent of the climatic shock but also on the substantive vulnerabilities (FAO, 2016). According to the FAO (2016), both the biophysical and the social vulnerabilities decide the net impact of the climate change on food security.

Much of the literature on the impact of change in the climate on food security, although, has focused on just one aspect of the food security, i.e., food production. Climate change presents an additional stress on India’s long-term food security challenges as it impacts the food production in several ways. For one, it may cause compelling increases in inter-annual and intra-seasonal variability of the monsoon rainfall. According to World Bank estimates, based on the International Energy Agency’s current policy scenario and other energy sector economic models, for a global mean warming of 4°Celsius, there will be a 10% increase in annual mean monsoon intensity and a 15% increase in year-to-year variability in the monsoon precipitation. Indian agriculture, and thereby India’s food production, is highly liable to climate change largely because the sector continues to be highly sensitive to the variability in monsoon. Ultimately, about 65% of the India’s cropped area is under rain-fed. Lobell et.al (2012) found that wheat growth in Northern India is highly sensitive to temperatures greater than 34°C. The IPCC report of 2007 sounded similar concerns on wheat yield: a 0.5°celsius rise in the winter temperature is prone to reduce the wheat yield by 0.45 tons per hectare in India.





Source: Rama Rao C. A. et al., “Atlas on Vulnerability of Indian Agriculture to Climate Change”, Central Research Institute for Dry land Agriculture, Hyderabad, 2013



Source: SOFI Report 2020

### **Impact of the worldwide temperature change on Food Security:**

“Food security exists once all individuals, within the slightest degree times, have physical and economic access to decent, safe and alimentary food that meets their dietary wants and food preferences for an energetic and healthy life”. (World Food Summit, 1996) Food security is one in every of the foremost distress associated with the worldwide global climate change.

Amendment within the climate has an effect on the food security in difficult ways during which. It shows an impact on the crops, livestock, forestry, fisheries and cultivation, and should cause serious social and economic consequences within the kind of reduced incomes, worn livelihoods, trade disruption and adverse health impacts. However, it is necessary to note that net impact of worldwide temperature change depends not solely on the extent of the climatically shock however conjointly on the substantive vulnerabilities. In keeping with the global organization agency (2016), each the biophysical and thus the social vulnerabilities decide net impact of the worldwide global climate change on food security. Much of the literature on the impact of amendment within the climate on food security, although, has centered on only 1 side of the food security, i.e., food production. Global temperature change presents an additional stress on India’s

semi permanent food security challenges because it impacts the food production in some ways within which.

For one, it should cause compelling will increase in inter-annual and intra-seasonal variability of the monsoon downfall. in step with International Bank for Reconstruction and Development estimates, supported the International Energy Agency's current policy situation and different energy sector economic models, for a worldwide mean warming of 4°Celsius, there will be a tenth increase in annual mean monsoon intensity and a V-day increase in year-to-year variability within the monsoon precipitation. Indian agriculture, and thereby India's food production, is extremely liable to global global climate change mostly as a results of the planet continues to be sensitive to the variability in monsoon. Ultimately, concerning sixty fifth of the India's cropped space is beneath rain-fed. Lobell et.al (2012) found that wheat growth in Northern Bharat is extremely sensitive to temperatures bigger than 34°C.

The IPCC report of 2007 measured similar considerations on wheat yield: a zero. 5° celsius rise within the winter temperature is susceptible to reduce the wheat yield by zero.45 tons per area unit in Bharat.

### **STRATEGIES TO MITIGATE IMPACT OF CLIMATE CHANGE IN AGRICULTURE AND FOOD SECURITY:**

The different adaptation strategies being formulated and developed at individual, organizational, and institutional level to avert the negative impacts of the climate change are as under-

- Effective climate-smart agricultural production
- Livelihoods diversification/alternatives
- Resources decentralization under local governance
- Fossil fuel alternatives such as biofuels
- Infrastructure development
- Mass awareness toward climate change
- Natural hazard anticipation and early warning systems
- Insurance schemes and policy suggestions
- Research and development activities for development & dissemination of crop varieties suitably adapted to local areas
- Wise applications of genetic materials
- Vernacular knowledge use/gender considerations
- Promotion of integrated farming systems and agroforestry
- Improvement in infrastructure facilities: water harvesting techniques, storage and small-scale irrigation, etc.



- Improvement in water and soil management practices
- Adaptation to livelihood strategies and farming operation systems.

## CONCLUSION

The 3rd Assessment Report revealed by the Intergovernmental Panel On Climate Change in 2001 states, 'there is new and stronger proof that almost all of the warming discovered over the last fifty years is due to human activities'. There square measure several convincing facts for the impact of global climate change on numerous parts of part like air, water, plants, animals and people in general, which, if not acted upon, might cause catastrophes. Climate modification influences the air quality, will increase the dominance of blue-green algae in water bodies, and affects quality of the drinkable, a modification within the hydrological cycle, inferring on the watercourse geophysics, vary limits of plant species, adverse impacts on life. Climate change, the result of "Global Warming" has began to reveal its outcomes worldwide. the first determinant of agricultural productivity is "climate" that bears the direct impact on international food production. though life cycle of grain and seed crops square measure possible to progress a lot of rapidly; however with increasing temperatures and variable downfall, crops might begin to expertise failure, significantly underneath low and variable precipitation patterns. Thanks to modification in climate, northward shifting of plant species, range, and pastures, cropland weeds is adversely touching placental operations, grazing and crops. Increase in close temperature of the world is probably going to hamper production of the placental throughout summer season. Ruminants square measure far more inclined, as they're not provided shelter to beat negative effects of the global climate change. because the climate of a selected country/region regulates the character and properties of the crop and vegetation, agriculture sector is that the a lot of liable to global climate change. period of the many crops together with their various yield is probably going to be reduced thanks to increase in mean seasonal temperature. However, the adverse effects of climate changes square measure low for economic activities together with agriculture that make sure the convenience and accessibility of food to folks.

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