

## Climate Change: What it means for Agriculture?

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### Introduction

Climate change, we mean long-term shifts in temperatures and weather patterns. These shifts can occur naturally but since the early 1800s, human activities have been the main contributor to climate change. These activities include burning fossil fuels (coal, oil, and gas), reducing forest cover, releasing chemicals into the biosphere, industrialization, and many others. Even agriculture is a significant contributor to this phenomenon.

Pesticides, fertilizers, and other toxic agricultural chemicals poison water, air, and soil ecosystems. Around 26% of the total greenhouse gas emissions are a result of agricultural practices performed all over our globe. Cows, weirdly and interestingly, also play a major role by releasing over 5.0 gigatonnes CO<sub>2</sub>-eq annually into the atmosphere. They burp and fart it out in the form of methane which is, as much as, 25 times more potent than carbon dioxide. Cow emissions, single-handedly, add up to over 62% of the total emissions of the agriculture sector.

As we all know, commercial agriculture is extremely dependent on climate. It is highly dependent on high and low temperatures, precipitation, wind patterns, amounts of sunlight, and others. Climate change alters the weather conditions and directly affects crop productivity which poses a real threat to farmers around the world. An estimate<sup>1</sup> predicts that climate change might reduce global agricultural productivity by 17% by 2050. While with an ever-growing population, we will require about 60% more food to feed the world by 2050.

Climate change also has great economic effects on the agricultural sector. Climate change increases the risks of natural disasters and the agriculture sector is highly vulnerable to these disasters. According to the Govt. of India's Economic Survey (2018), the annual loss of US\$ 9-10 billion (in the agriculture sector) was due to the adverse effects of climate change. A report<sup>2</sup> also states that net revenue is projected to decline about 17.7% and 21.28% due to climate change in 2050 and 2100 respectively without an adaptation model. And with

an adaptation model, it would be about 0.37% and 0.20% down in 2050 and 2100 respectively.

## **Impacts in the Indian Subcontinent**

### **Livestock and Poultry Sectors**

Half of the land which is desert-free and ice-free is used for agriculture and is equivalent to the areas of North America, South America, and China combined<sup>3</sup>. And 50% of this total agricultural land is used for livestock farming. Climate change affects several factors that are related to the production, reproduction, health, and adaptability of every animal. Bangladesh suffered from a great economic loss when, in 2016, livestock production decreased due to diseases, lack of forage, and heat stress.

Poulties are very sensitive to temperature-associated problems. Due to heat stress, they tend to take fewer amounts of feed which results in less body weight, egg production, and quality of meat (Deng *et al.*, 2012). Heat stress has also resulted in affecting weight, ash content, and the thickness of the eggshell (Morgan *et al.*, 2001).

### **Field Crops**

It is projected that by the mid-21<sup>st</sup> century, crop yields will decrease by up to 30% in the Indian subcontinent and other South Asian countries. North Indian states and Bangladesh are highly susceptible due to erratic changes in rainfall and temperature (World Bank, 2008). The climatic changes also give pathogens an edge which affects crop growth and yield critically and may also result in increasing insect-pest population, which, ultimately, will ravage productivity.

### **Natural Disasters**

During a drought, agriculture absorbs almost 84% of all economic losses. Indian states which are most vulnerable to droughts are Western Rajasthan, Madhya Pradesh, parts of Haryana, Southern Gujarat, Andhra Pradesh, and Karnataka.

The rising frequency and intensity of heat waves is affecting all allied agricultural sectors including poultry, dairy, and fisheries. The shortage of drinking water is becoming a crisis for humans and livestock while orchards have been drying due to a deficit in the water supply.

**Melting of glaciers** is also a situation that is worsening with time and may become a problem in North India and other Himalayan regions. If the temperatures keep rising and Himalayan glaciers keep melting, the freshwater stock for survival will be at a sublime risk. In India, these damages are mostly incurred by poor rural and semi-rural communities.

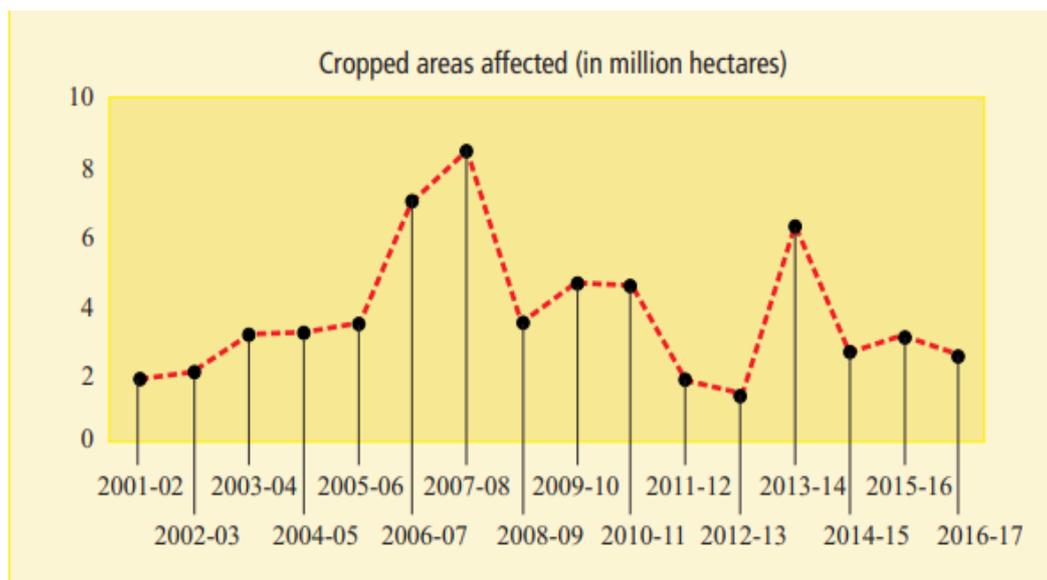


Figure 1: Year-wise damage due to natural disasters (India)

## Climate-Smart Agriculture (CSA)

The World Bank defines CSA as an integrated approach to managing landscape (cropland, forests, livestock, and fisheries) in such a way that addresses interlinked challenges of food security and accelerating climate change.

CSA focuses on achieving three things:

1. Better agricultural productivity and increased incomes,
2. Adapt and enhance resilience to climate change,
3. Thinning out greenhouse gas emissions.

Achieving CSA is no cakewalk, Food and Agriculture Organization (FAO) suggests five steps to attain it. The first step focuses on addressing climate change, identifying key vulnerabilities in the agricultural sector, and estimating possible GHGs reduction in the adoption process. Secondly, it suggests making relevant policies and investments which facilitate developing agriculture, climate change, food security, and land use. The third step suggests that the local governing authorities should empower, enable, and motivate farmers in achieving CSA.



The fourth step aims to enhance investments and explore new funding opportunities to nullify the deficit in finances. The final step aims to implement these ideas and concepts at the field level.

In a perfect world, CSA policies and practices should contribute to broader economic growth, should integrate with disaster management strategies, and must produce nutrient-rich food for everyone.

## What are we doing?

In India, the government has taken several initiatives to combat this enemy which is heating our blue planet. India was one of the first countries to adopt these climate-friendly and awareness strategies. The National Action Plan on Climate Change (NAPCC), launched in 2008, embraces current and future policies and programs dealing with climate mitigation and adaptation. The initiatives which are implemented to help the agricultural sector are:

- **National Mission on Sustainable Agriculture (NMSA).** Started in 2014-15 and focuses on resource conservation, soil health management, efficient use of water.
- **Green India Mission (GIM).** Started in 2014 under NAPCC. It aims to restore and enhance forest cover in India.
- **National Water Mission (NWM).** This mission ensures integrated water resource management helping to conserve water sources, minimize water wastage, and better distribution. It is currently developing a framework that will increase water use efficiency<sup>4</sup> by 20%.
- **National Livestock Mission.** Commenced 2014-15. It aims to develop livestock in sustainable ways which ensure protecting the environment, animal biodiversity, and provide farmers with better livelihood.
- **National Mission on Himalayan Studies.** This mission was launched to support studies on the conservation and development of natural, socio-economic, and ecological assets of the Himalayan region in India.
- There are many other initiatives too that are launched by the GOI that are contributing to the cause in one way or another. Some of them are Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Paramparagat Krishi Vikas Yojana (PKVY), Sub-Mission on Agroforestry, and more.



Some of the results which these policies have provided are overwhelming. For instance:

- The irrigation policies have generated food of 24 million tonnes and reduced GHG emissions by 7Mt (CO<sub>2</sub>-eq).
- In the livestock and fisheries sector, milk production and fish production (about 13Mt in 2018) is continually increasing significantly.
- Insurance policies have provided relief to lakhs of farmers.
- Fertilizer policies have helped in adding over 14Mt of grain production and avoided conversion of 11.5Mha of forestland into cropland.

## Conclusion

About 70% of the Indian population is associated with agriculture or its allied sectors. It is a livelihood for some and others it is a source of additional income. For India as a whole, it is 20.2% of its total economy<sup>5</sup>. India is facing threats in the form of hailstorms, heat waves, floods, droughts, and cyclones due to the rise in global temperature. Extreme temperatures and fluctuating weather conditions are tough and disrupting for every living being on earth. So far, the steps taken by us in adapting to this changing climate have shown positive impacts but more remains yet to be seen.

## Credits and References

ICAR (Indian Council of Agricultural Research) and FAO (Food and Agriculture Organization) have been my primary source of data.

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