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"Impact of Climate Change on Agriculture in India"[1]

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ABSTRACT

Agriculture is one of the main sectors in India where more than 50% of the population is employed and is one of the most affected areas by climate change in the region. Farmers were used to dealing with climate and that was predictable by them but climate change it is making them harder to predicate the crop yield. A small change in the climate of an area can lead to a drastic change in the agriculture pattern of the area. 'Climate Change is a term which has gained infamy or we can say approval of many. People have started accepting that there is such a thing exists and it is necessary to minimize its impact on the earth, especially on agriculture. In a recent decade, it has put great emphasis on Food security. In India in the last century rise in surface temperature has been noticed by many scientists around the world. To protect the world we need to combat climate change with sustainable needs and resources instead of coal-powered thermal stations for electricity we can use wind or solar energy to power electricity. Coastal cities and island nations are one of the most vulnerable to Climate Change as rising sea levels are sinking them into the sea. Reforestation, Bio-gas plants are the way forward for the future generation. Resources are scarce and we need to conserve them for our future generation.

INTRODUCTION

India is a country with the second largest population in the world and with its half of the population largely dependent on farming which is seeing the biggest problem in recent decades. Indian farming is still largely dependent on monsoon rainfall and little to no alternate irrigation mode. Due to this Indian Farmers have started seeing the effect of climate change through uneven monsoon patterns, drought, heatwaves, rise in sea level, etc. Climate and Agriculture are closely associated with each other throughout the global process. A small change in the climate of an area can lead to a drastic change in the agriculture pattern of the area. 'Climate Change is a term which has gained infamy or we can say approval of many. People have started accepting that there is such a thing exists and it is necessary to minimize its impact on the earth, especially on agriculture. In a recent decade, it has put great emphasis on Food security. In India in the last century rise in surface temperature has been noticed by many scientists around the world.

In India agriculture play a key role in the economic policy of the government as well as the GDP of the country. In 2020-21 Agriculture sector share 20.2 percent of the total economy GDP. There are three lists Central list, State list, and Concurrent list. Agriculture is a subject that comes under the state list in India. So, every state has there own policies related to agriculture and fighting climate change.

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Most of the policies regarding agriculture are pro farmers in India. But Farmers are the people who suffer most due to climate change. WHO commented that "Climate Change is likely to affect approximately 250000 deaths per year by 2030 primarily due to malnutrition, malaria, diarrhea and heat stress alone. The direct health-related cost can be between USD 2-4 billion per year by 2030."[2]

REVIEW OF LITERATURE

Land-Climate interaction by the IPCC [3] - It observes that the interaction between land and climate has had extreme consequences in recent decades due to Greenhouse gases emissions and global warming. Land Surface temperature has increased by 1.5 degrees Celcius which is harmful and it has resulted in a shift in climate zone as hotter regions are cropping up polar regions are decreasing. The wildfires are becoming more and more and harming land farming.

Paris Climate Agreement: A beacon of Hope by Austin P. Hope, Timothy P, and Others[4]-

The use of fossil fuels has benefited society in many ways but not without consequences. Fossil fuels are available in limited quantities and Surface temperature increase is also the main reason for climate change. If we control human activity and instead of Fossil fuels, use sustainable resources for energy production then we may be able to control the impact of Climate Change. The first world countries like Germany, Norway, and others have pledged to increase sustainable energy by almost 50% but the researchers left out a glaring point that the countries from third-world countries like African Nations are too poor to implement all these Challenges.

Risk and Vulnerability assessment of Indian Agriculture to Climate Change by Rama Rao, C.A., Raju, and others[5]

India is one of those countries which are prone to Climate Change with evidence showing that Climate Change has impacted crops yield, livestock, fisheries, and poultries. The country is getting warmer and agriculture which is dependent on weather is more vulnerable and hard to sustain due to climate change and it also affects the livelihood of people dependent on it.

Research Objectives-

The research aims to understand the impact of climate change on agriculture in India and to understand how to combat them. What Schemes and initiatives have been provided by the government for the agriculture sector and what plans are there to combat future impacts.

[2]Anon, Climate change. *World Health Organization*. Available at: https://www.who.int/health-topics/climate-change [Accessed September 30, 2021].
[3]Pathak, M., 2019. Climate change and land. Special Report on Climate Change and Land. Available at: https://www.ipcc.ch/srccl/ [Accessed October 7, 2021].
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Research Questions

- Impact of Climate Change on Agriculture in India
- The agricultural area affected due to Climate Change
- Climate Change Impact on India
- Preventive Strategy got Combating Climate Change
- Government Schemes for Climate Change Adaption

Research Methodology

Descriptive Research was carried out through secondary data to understand the Impact of Climate Change on Agriculture in India. Several secondary data sources(including books, research papers, journals, news articles, etc.) were referred, to have the most accurate findings to understand the impact of Climate Change.

IMPACT OF CLIMATE CHANGE ON AGRICULTURE IN INDIAN

Climate Change in the recent decade has become a defining issue and has gained global status. According to NASA "Climate change is a long-term change in the average weather patterns that have come to define Earth's local, regional and global climates. These changes have a broad range of observed effects that are synonymous with the term."[6] It means that when there is a huge change in the normal weather pattern of an area then it negatively affect the environment of the surrounding area. Climate change impact can be anywhere from heatwaves to extreme cold weather. Farming or agriculture is severely dependent on the climate and weather of the area.

In India, farmers do seasonal farming or most of the agriculture depends on the weather like Kharif crops which are generally sown at the beginning of the rainy season that is the month of April and May while Rabi crops are sown at the beginning of the winter season that is in the month between September and October. But in recent times the crop pattern has shifted in India as with uneven rainfall that leads to a drought-like situation during the farming season the farmers suffer as their crops die. Agriculture is often done on fertile lands which are generally found along the rivers and delta with climate change the surface temperature has increased which has lead to a rise in the water levels of the rivers which leads to soil erosion and flooding of the fertile land in banks of rivers.

Agriculture is one of the main sectors in India where more than 50% of the population is employed and is one of the most affected areas by climate change in the region. Farmers were used to dealing with climate and that was predictable by them but climate change it is making them harder to predicate the crop yield.

Agricultural Areas affected due to Climate Change

Agricultural areas most affected by climate change are as follows:

[6] Anon, Climate change. *World Health Organization*. Available at: https://www.who.int/health-topics/climate-change [Accessed September 30, 2021].

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- Field Crops: 30 percent of crops are expected to decrease in the coming decades. In the north Indian state of Punjab which is known as granary rice yields will decrease as rising in surface temperature levels. Agriculture is a sector which produces approximately in current times 19%-20% of Green House Gas emission which increases Climate Change. The uneven change in climate alters the reproductive and metabolic pathway of infectious agent i.e, pathogen that affects the growth and yield of crops productivity which leads drastically affect the production and it can also lead to increase insect, pets, weeds population which ultimately leads to overall total fall in productivity.
- Horticulture: High heat damages vegetables especially those which have thin skin. The scorching heat burns the budding blossoms which ultimately decreases productivity. Flooding also affects vegetables like tomatoes etc whenever there is a flood in Yamuna river nearby agriculture lands submerged which destroys the produce as well as raises the price of the commodity in the market.
- Livestock, Poultry, and Fishery Sector: Climate Change also affects the Biological factors in livestock and others. Climate Change can decrease the amount a milk-producing breed produces due to heat stress, diseases, etc. Poultries are also sensitive to change in the temperature as we have seen a rise in cases of poultry death in summer due to heat stress and diseases like bird-flu. Uneven monsoon and rising temperatures seasonal variations shifted the breeding period in West Bengal and Odisha from June to March for carp fish. The Fisheries are most vulnerable during cyclones and floods as it changes the water level and temperature in ponds which damages the fish eggs.

Climate Change Impact In India

From Kashmir to Kanyakumari and from the Himalayas to Coastal areas and From Glaciers to Deltas, India needs to be prepared to fight the effects of climate change and curtail its impact on agriculture and other necessary commodities.

Floods: In 2015 Chennai experienced one of the worst floodings in its history which destroys almost 5000 crore worth of infrastructure due to torrential rains and the same city experience a drought-like situation in which drinking water was most affected leads to large scale migration. Kerala was also affected by floods due to uneven even rainfall in 2018. This type of situation is the result of Climate Change.

Drought: In India regions like Rajasthan, Western Uttar Pradesh, Maharastra Latur region they are one those area in India which suffer severe or acute water shortages and drought. A dry region like Rajasthan suffers water shortages and regions which heavily depend on the monsoon to fulfill their main water needs are suffering due to Climate change which leads to heatwaves and uneven rainfall. Recent studies have pointed towards severe Flash draughts in the Indian subcontinent which will be more widespread as compared to others beforehand as with heatwaves and together they might negatively affect crop production as well as local economic activity.

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Cyclones: Cyclones are another major indicator that shows Climate change impact. Generally in India, there are one to two major cyclones but with climate change, cyclones are formed outside the normal months. Cyclones are one of the costliest disasters and deadliest too in India. Cyclones like Hud-Hud in 2014 which was intensity 4 storm brought disaster to Vishakhapatnam in its landfall and the coastal city of puri in Odisha was almost completely destroyed when extreme severe cyclone Fani made its landfall almost 1 million people were shifted to safer grounds and agriculture in the nearby area took hit as seawater damaged the fertile land. In the year 2020 cyclone Amphan brought damages to West Bengal and Odisha with Sunderbans Farmers taking a major hit as saline water destroyed their agricultural land. Cyclone Gulab in 2021 which originated in the Bay of Bengal was the first to travel across from east to west in India and become Cyclone Shaheen in the Arabia Sea. The severity of cyclones has increased as well as the numbers of them hitting coastal areas of India which destroy farming and fisheries and also cause soil erosion.

Heatwaves: The intensity of heatwaves are increasing all across India and affecting not only crops but also fisheries and Poultries too. The rising surface temperature has an adverse impact on agriculture as polar caps are melting at a much-increased pace.

Preventative Strategies for Combatting Climate Change

The consequence of climate change is increasing natural disasters which place the Indian agriculture sector in a vulnerable position. It places many lives and livelihoods of different communities at risk. Adaption is necessary to fight climate change, it simply means to adjust farming practices or to modify the practices to better suit the needs. Mitigation is also necessary as it is a means to improve technological findings and inputs to reduce GHGs into the atmosphere. Mitigation is needed to combat climate change without or reduce economic impact urgently.

Awareness building is necessary to fight Climate Change amongst farmers as well as Policymakers. The agricultural sector is already suffering from land degradation and water pollution due to the use of chemicals as pesticides and fertilizers. Water management is necessary to combat climate change as more than 50% of Indian farmers are dependent on rainfall for cultivation. Water needs to be conserved through community ponds and rainwater harvesting be necessary.

To combat Climate Change on the need to adopt ‘adaptation to mitigation’ as it needs to reduce farmers' risk, favorable government policy, agriculture extension, and risk management are needed. The Indian Council of Agriculture Research (ICAR) under the Ministry of Agriculture and Farmers Welfare has established several infrastructures at the district level to study the impact of climate change as well as to help farmers.

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Government Schemes For Climate Change Adaptation

- National Mission on Sustainable Agriculture: It was structured around National Action Plan on Climate Change in the year 2014-15 and is aimed at improving the productivity of soil and water conservation for dry and rainfed land.
- Pradhan Mantri Krishi Sinchayee Yojna (PMSKY): The scheme was launched to give priority to water conservation during farming and to make water available to farmers in dryland.
- Pradhan Mantri Fasal Bima Yojna (PMFBY): It was launched in 2016 to reduce the burden and farm risks from the farmers. It was done for farmers' welfare to protect them from any disaster.
- Green India Mission (GIM): It was launched in the year 2014 to restore and enhance decreasing forest cover in India.

Many more schemes have been launched by the government of India for Climate Change protection and farmers' welfare. The schemes are there to spread awareness about the impact to protect farmers from the adverse effect of climate change.

Analysis

Climate Change is present and has started its large-scale adverse effect globally. The first world countries are number one producers of greenhouse gases, burning fossil fuel to produce electricity, for gas and heat. They are also those countries that are able to combat Climate Change impacts more efficiently as they have financial and technological resources to employ sustainable resources. But we have seen the countries like India are launching initiatives to combat climate change much better as we have included grassroots level farmers from Gram Panchayats.

Conclusion

The rising temperature in recent decades has made climate change a known global persona. Climate change is changing the world with rising sea levels, melting glaciers, forest fires, deforestation, burning fossil fuels, vanishing rainforest, etc. Agriculture is equal to food security if agriculture is not good then an entire nation can suffer from Hunger and Poverty.

To protect the world we need to combat climate change with sustainable needs and resources instead of coal-powered thermal stations for electricity we can use wind or solar energy to power electricity. Coastal cities and island nations are one of the most vulnerable to Climate Change as rising sea levels are sinking them into the sea.

Reforestation, Bio-gas plants are the way forward for the future generation. Resources are scarce and we need to conserve them for our future generation.

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