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Impact of Climate Change on Indian Agriculture: Challenges and Adaptive Strategies

Babaloo Kumar[1], Dr.MEENAKSHI SHARMA[2]

[1]Research scholar , [2]Professor
[1]Political Science, [2]Head of Political Science(HOD)
[1,2]Gokul Das Hindu Girls College, moradabad U.P
[1]babalookumar23@gmail.com, [2]smeenakshi140@gmail.com

Abstract:

This Research Paper impact of climate change on Indian Agriculture :challenges and Adaptive Strategies. Climate change has emerged as a critical challenge for Indian agriculture, which is heavily dependent on monsoon rains and sensitive to climatic variations. Rising temperatures, shifting rainfall patterns, and increased frequency of extreme weather events pose significant threats to crop yields, food security, and rural livelihoods. This paper examines the effects of climate change on various aspects of Indian agriculture, including crop productivity, soil health, and water resources. It also evaluates regional vulnerabilities, assesses socio-economic impacts, and explores potential adaptive strategies and policy measures.climate change also impact on Biodiversity of india which limit the Area of Diversity. Due to Rise in temperature snow is melting and sea level is down.

1. Introduction :

India, home to over 1.46 billion people, relies heavily on agriculture, which employs nearly half the workforce and contributes around 18.3% to the GDP. Climate change, characterized by global warming, erratic rainfall, and extreme weather events, has begun to influence agricultural productivity and threatens the food and nutritional security of the country. Climate change also impact on Human Behaviour, Biodiversity of Ecosystem, Human Health, Tourism, poverty and Displacement, coastal communities etc. India First time Interduse Nation Action Plan on Climate change(NAPCC) On June 2008. It consist of Eight National Missions such as National solar mission etc.National Agricultural Mission focused on overall productivity of Agriculture. And Aim to increase Quality of Productivity. Crop Pattern also effect on productivity of indian Agriculture.

Keywords- Climate Change, Rainfalls Vulnerability,Rise in Temperature, Crop Pattern, Adaptive Techniques,Biodiversity effect etc.

2. Climate Trends in India.

Over the past century, India has witnessed:

(A)A rise in average surface temperature by approximately 0.7°C.

(B)Increased frequency of droughts and floods.

(C)Irregular and intense monsoon patterns.

(D)Sea level rise along coastal regions.

3. Impact on Crop Production.

3.1 Temperature Rise.

- A 1°C rise in temperature could reduce wheat production by 4-5 million tonnes.Rise in temperature also change in crop pattern and Reduce overall production of grains.
- Heat stress affects rice pollination and grain filling, reducing yield.
- Due to rise in temperature impact on labour.

3.2 Rainfall vulnerability.

- Delayed or deficient monsoon impacts sowing and harvesting cycles.
- Floods destroy standing crops, while droughts hinder seed germination.

3.3 Regional Disparities.

- Punjab and Haryana (wheat-rice belt) face groundwater depletion and heat stress.
- Eastern states are more vulnerable to floods like a udissa, arunachal Pradesh etc.
- Southern India experiences shifting cropping patterns due to variable rainfall.

4. Impact on Livestock and Fisheries.

(a)Heat stress reduces milk yield in cattle and buffaloes.

(b)Marine fisheries face risks from ocean acidification and sea temperature rise.

5. **Socio-Economic Consequences**

(a)Farmer income variability and indebtedness rise .samll domestic income also effected.

(b)Food inflation increases due to supply shortages. It's impact total productivity of grains.

©Marginal and small farmers are most vulnerable.it's effected MSME.

6.Adeptive Techniques.

6.1 Technological interventions.

- Development of climate-resilient crop varieties (drought and heat-tolerant).
- Precision farming and water-efficient technologies (drip irrigation).

6.2 Agricultural Practices.

- Integrated farming systems and agroforestry.
- Improved crop calendar and early warning systems.

6.3 Policy and Institutional Support

- Government initiatives like the National Mission for Sustainable Agriculture (NMSA).

- Crop insurance schemes like a PMBSY, soil health card, KCC etc.
- Investment in rural infrastructure and irrigation. And focused on solar system.

7. **Role of Research and Innovation**

- Need for regional climate modeling and impact assessment.
- Promotion of public-private partnerships for innovation in agri-tech.
- Digital platforms for disseminating climate advisories.

8. **Conclusion.**

Climate change poses an unprecedented threat to Indian agriculture. While the impact is complex and region-specific, the need for a robust, multi-pronged adaptation strategy is urgent. Collaboration between scientists, policymakers, farmers, and industry stakeholders is essential to ensure sustainable and climate-resilient agriculture.Government takes innovative technology to reduce effiect of climate change.

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