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Environmental Challenges & Issues of Indian Agriculture

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Abstract

Agriculture has always been the backbone of the Indian economy, providing livelihood to nearly half of the population and contributing significantly to national food security and rural development. However, the sector is currently witnessing an unprecedented set of environmental and structural challenges. Soil degradation, water scarcity, biodiversity loss, climate change, unsustainable farming practices, and declining farm productivity threaten the stability and future of Indian agriculture. These challenges are further intensified by demographic pressures, shrinking landholding sizes, overdependence on monsoon rainfall, and limited technological adoption. This paper explores the major environmental issues confronting Indian agriculture, examines the causes behind the deceleration of agricultural growth, and analyzes the impacts of climate change on crop production, livestock, and fisheries. The paper also discusses policy interventions undertaken by the Indian government and offers recommendations to promote sustainable agricultural development for a food-secure and environmentally resilient future.

Key words: *Deceleration of Agricultural Growth in India; Environmental Challenges; Policy Measures.*

1. Introduction

India is primarily an agrarian country where agriculture and allied sectors — including livestock, fisheries, and forestry — play a pivotal role in ensuring food and nutritional security, rural employment, and socioeconomic growth. Yet the sector faces mounting environmental challenges, particularly in the context of climate change, resource depletion, and ecological imbalance.

Agricultural progress achieved since the Green Revolution has been commendable in terms of food grain production and self-sufficiency. However, the same period also witnessed the rapid exploitation of natural resources, leading to severe environmental consequences. Issues such as groundwater depletion, excessive chemical use, soil salinity, and pollution from agricultural residues have begun affecting productivity and long-term sustainability.

Modern agriculture must therefore evolve to meet present demands without compromising future needs. Understanding environmental constraints and their socioeconomic implications is crucial for policymakers, academicians, and agricultural practitioners. This paper provides a comprehensive examination of these issues with structured sub-sections detailing major themes.

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2. Deceleration of Agricultural Growth in India:

The high agricultural growth achieved during the Green Revolution from the 1960s to the 1980s began to slow down significantly in the post-liberalization era. While technological advancements boosted initial yields, stagnation has emerged due to declining innovation, input mismanagement, and environmental stress.

a. Resource Degradation

- Continuous decline in soil organic matter due to monocropping
- Overuse of nitrogen-based fertilizers harming soil microbial health
- Land degradation from erosion, siltation, and mining activities

b. Water Crisis

- Over-extraction of groundwater for irrigation, particularly in Punjab, Haryana, Rajasthan
- Poor efficiency of canal irrigation systems
- Rising competition for water between agriculture, households, and industries

c. Fragmented Landholdings

- Average farm size shrinking to below 1 hectare
- Limited scope for mechanization and commercial farming

d. Inadequate Technological Advancement

- Slow adoption of modern farming technologies
- Poor agricultural extension services in rural areas

e. Market and Price Challenges

- Fluctuating crop prices and dependency on MSP for a few crops
- Limited access to credit and insurance facilities

2.2 Implications

- Reduced agricultural contribution to GDP
- Rising rural unemployment and disguised labour in agriculture
- Migration from rural to urban areas
- Farmers falling into debt cycles, leading to distress and poverty

3. Environmental Challenges for Indian Agriculture

Soil Degradation: Soil erosion, salinization, alkalinity, and declining fertility threaten agricultural sustainability. Excessive fertilizer and pesticide use has created soil toxicity, reduced organic carbon, and destroyed beneficial microbes.

Water Scarcity and Mismanagement: India's agriculture uses nearly 80–85% of available freshwater. Over-pumping of groundwater, inefficient flood irrigation, and low adoption of micro-irrigation systems have contributed to water stress.

Chemical Overload: High use of fertilizers, pesticides, and herbicides — particularly in intensive farming regions — has:

- Contaminated surface and groundwater
- Reduced biodiversity
- Increased soil contamination

The Green Revolution's success unintentionally encouraged chemical dependency, resulting in ecological imbalance.

Biodiversity Loss: Traditional landraces have been replaced by a few high-yielding varieties, reducing genetic diversity. Pollinators, beneficial insects, and native species have declined, threatening ecological resilience.

Climate-induced Risks: Erratic rainfall, extreme temperatures, floods, droughts, and cyclones have increased in frequency and severity, directly affecting cropping patterns, soil moisture levels, and farm yields.

Unsustainable Agricultural Practices

- Monocropping in Punjab-Haryana region
- Paddy cultivation in water-scarce zones
- Crop residue burning leading to air pollution and nutrient loss
- Overgrazing in arid and semi-arid zones

Urbanization and Land Conversion: Rapid conversion of agricultural land into urban settlements and industrial zones has reduced cultivable land and disrupted soil-water systems.

4. Impact of Climate Change on Indian Agriculture

Temperature Rise: Higher temperatures accelerate evapotranspiration and reduce crop duration, affecting crops like rice, wheat, and pulses. Wheat yield losses are prominent in the Indo-Gangetic plains.

Erratic Monsoons: India depends heavily on the monsoon system. Climate variability has caused:

- Delayed monsoon onset
- Uneven rainfall distribution
- Higher probability of drought or floods

Extreme Weather Events: Increased frequency of cyclones, hailstorms, and heatwaves has resulted in unpredictable crop losses and livelihood insecurity.

Pest and Disease Outbreaks: Warmer climate and humidity boost pest populations. Crops become more vulnerable to diseases.

Geographic Shifts in Crop Zones: Traditional crop regions are shifting northwards; some crops are becoming unsuitable in their usual areas due to climate stress.

5. Impact on Livestock and Fisheries

a. Livestock Sector Challenges

- Heat stress leading to reduced milk yield and fertility
- Emerging animal diseases
- Reduced fodder availability due to declining pastures
- Water scarcity affecting animal health

b. Fisheries Sector Challenges

- Rising sea surface temperatures altering fish breeding cycles
- Coral bleaching and ocean acidification
- Pollution and overfishing reducing marine resources
- Changing monsoon patterns affecting inland fisheries

The livelihood of coastal and inland fishing communities is severely affected, increasing socio-economic stress.

6. Policy Measures for Sustainable Agricultural Development

a. Major Government Initiatives

- National Mission for Sustainable Agriculture (NMSA)
- Soil Health Card Scheme for balanced nutrient use
- Pradhan Mantri Krishi Sinchai Yojana (PMKSY) for water conservation
- Paramparagat Krishi Vikas Yojana (PKVY) promoting organic farming
- Pradhan Mantri Fasal Bima Yojana (PMFBY) crop insurance scheme
- Mission Amrit Sarovar & watershed management programs
- Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) support to farmers.

b. Improve the Practices

- Promotion of climate-resilient farming practices
- Strengthening micro-irrigation and rainwater harvesting
- Accelerating organic and natural farming movements
- Encouraging crop diversification, especially millets
- Technological innovations: precision farming, drones, Iot sensors
- Strengthening farm cooperatives and farmer-producer organizations (FPOs)
- Improved extension services & farmer training programs

7. Conclusion

Indian agriculture is at a turning point. While it sustains millions, environmental degradation, climate pressures, and resource limitations have threatened its long-term sustainability. Ensuring food security for a growing population requires a transition from input-intensive farming to ecologically balanced agriculture. Policies must encourage conservation, technology adoption, and climate adaptation. Farmer awareness and community participation are equally essential. With the right interventions, India can build a resilient, productive, and environmentally sustainable agricultural system that supports future generations.

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