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Significance of Food Security and Sustainable Agriculture in India: A Geographical Perspective

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Abstract

Earth has its own complex system of life that depend on one another for nourishment and survival. Humans and wildlife both sustain on the plant derived and animal derived nutrition and food. The base of human civilization lies in the foundation of the search for food. This ensures the continuity and wellbeing of human civilisations. Each and every region on the earth's surface has its own way of procuring, cultivating and consuming food which depends on the climate, landform and socio-economic factors. The World Food Summit of 1996, aroused attention towards the very serious issue of food security, dietary adequacy and equitable access of food to the marginalised and the well offs. This created a new economic dimension of food security. India, with a dominant population, occupies a distinctive position in this global narrative: cultivation being the mainstay of economy here with nearly 75% of the population engaged in agricultural pursuits. Thus, agriculture not only provides food but also provides economic stability and rural employment. 1960s has seen a revolution in agricultural scenario in India, the Green Revolution, which has initiated exemplary changes in the agricultural scenario. But India still strides with challenges of small land holdings, fragmented lands, regionalisation of agricultural outputs, lack of irrigation facilities and the vagaries of Indian monsoon on which the whole agricultural pursuits depend. This paper examines the current state of Indian agriculture through a geographical lens, exploring its regional diversity, productive capacity, systemic constraints, and the pathways available to strengthen food security while advancing farmer welfare and ecological sustainability.

Keywords: Sustainable Agriculture, Food Security, Agricultural Production, Climate Variability, Crop Distribution, Soil Conservation, Green Revolution, Food and Agricultural Policy

Introduction

Agriculture has been placed at the forefront of contemporary development due to the convergence of a rapidly expanding global population with finite natural resources especially in India. Agriculture has been the first economic pursuit of mankind from the historical era. India has been till now a classic example of that. Globally, India ranks among the foremost producers of rice, wheat, pulses, sugarcane, cotton, and dairy products. Thus, the agricultural sector of the country generates substantial rural employment and contributes meaningfully to the national economy. However, population growth and the climatic and environmental hazards have strained the agricultural productivity. This situation demands innovative and geographically informed responses.

One of the underlining challenges of this century has been to ensure reliable access to adequate, safe, and nutritious food for all people. The challenges are twofold-sustainability and increasing productivity of food and simultaneously improving the safety and nutritional quality of what is produced. But from the time of Green Revolution, regional disparity has always been existent in the country. The geographical diversity of the country running from the alluvial plains of the Gangetic belt, the arid tracts of Rajasthan, and the plantation-rich slopes of the Western Ghats—produces the agricultural diversity as well. The current need of the hour is the integration of modern science with traditional agricultural knowledge to transform Indian farming into a more productive sector and the positive effects of this progress must reach all farming communities equally.

Objectives of the Study

1. To assess agricultural crops and food production in India.
2. To discuss the nutritious diet and food availability.
3. To analyse the spatial patterns of food security and distribution across the country.
4. To identify and evaluate policy measures aimed at strengthening food security in India.

Methodology

This study employs a mixed-method approach, drawing on both qualitative and quantitative sources of information. Secondary data were systematically gathered from a range of published resources including academic books, periodicals, newspapers, peer-reviewed journals, and online databases.

The data gathered, has been analysed with the help of representative maps and various cartographic techniques. The collected data is processed and analysed with the help of multiple methods such as tabulation and preparation of various types of charts as well.

Discussion and Results

A) Conceptualising Food Security

Food security is a concept that ensures the smooth flow of nutritious and affordable food to all. It is a fundamental right that everyone should have food to eat. There are various ways to describe what food security means.

1. Food security means that food reaches every person to be healthy and strong. There should be an uninterrupted flow of food and the citizens of the country should be able to afford it.
2. The Food and Agriculture Organisation of the United Nations articulated in 1983 that food security is realised when sufficient, safe, and nutritious food is physically and economically accessible to all people to satisfy their nutritional needs and dietary preferences for a healthy and productive life.
3. The World Development Report (1986) defined food security as “universal access to adequate food at all times, a view further extended by Statz to emphasise long-term assurance of safe and adequate national food supplies”.

B) Strategic Importance of Agriculture in India

- **Food Security:** India has a growing population of over 1.4 billion people. This poses a huge demand of food on the agricultural sector making food self-sufficiency a national imperative.
- **Employment:** Farming directly or indirectly employs an estimated 45–50% of the national workforce, rendering it central to rural livelihoods and social stability.
- **Industrial Linkages:** Agriculture provides critical raw material inputs to agro-processing industries, including sugar refining, textile manufacturing, jute processing, oilseed extraction, and animal husbandry.
- **Rural Development:** Sustained agricultural development contributes to rural poverty reduction, infrastructure improvement, and community resilience.
- **Economic Contribution:** The agricultural sector contributes approximately 17–18% to Gross Domestic Product and generates more than 50% of national employment. Thus macroeconomically, the agricultural sector has a significant role to play.
- **Global Standing:** According to ICAR, India has been divided into six agricultural cropping zones. The Green and White Revolution has put the country in the forefront in producing milk, pulses, spices, bananas, mangoes, okra, and jute, and the country ranks second globally in rice and wheat output.
- **Crop Diversity:** The diversity of landforms and weather conditions have helped much in the production of a variety of crops in India. The major crops include rice, wheat, pulses, sugarcane, oilseeds, cotton, tea, coffee, spices, and a diverse range of horticultural products.
- **Livestock & Dairy:** The cooperative dairy farming has been quite prevalent in India from 1970s and high growth trajectories are also recorded in poultry farming and fisheries.

C) Agricultural Regions and Crop Distribution

India has been delineated into six agro climate zones according to the Indian Council for Agricultural Research. These spatial units exhibit their distinctive patterns cropping according to the weather conditions and market demands, be it subsistence, commercial or plantation agriculture. The rational land-use planning and recommendations, the crop diversification and tailored agricultural policies always require such regional patterns. India has a vast stretch of land and a variety of landforms—encompassing humid coastal plains, seasonally flooded river basins, semi-arid plateaus, and highland tracts which has helped in the development of a highly differentiated agricultural system. The table below summarises the primary crop categories and their regional distribution.

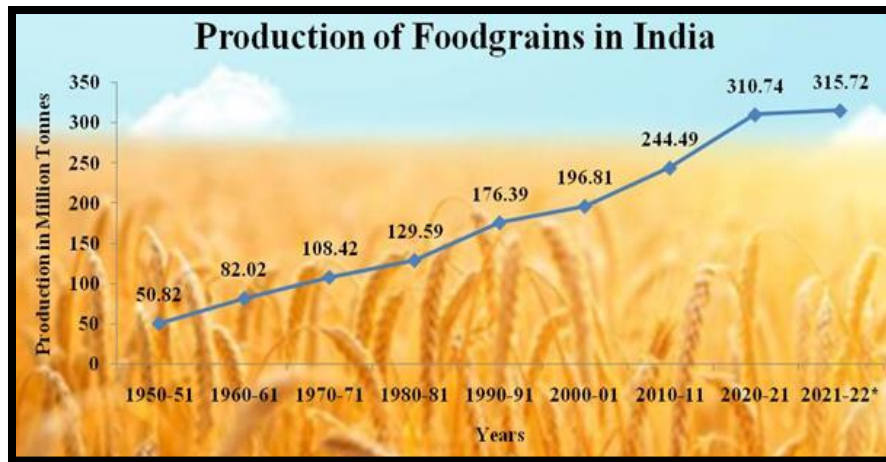
Table 01: Region-wise Major Food Crop Distribution

Types of Crops	Crops	Distribution States	Region
Food Crops	Rice	West Bengal, Punjab, Uttar Pradesh, Andhra Pradesh	Eastern India, coastal belts, deltaic zones
	Wheat	Punjab, Haryana, Uttar Pradesh	North-Western Plains
Cash Crops	Cotton	Maharashtra, Gujarat	Black cotton soil belt
	Sugarcane	Uttar Pradesh, Maharashtra	Sub-tropical plains
	Tea & Coffee	Assam, Darjeeling (Tea); Karnataka, Kerala, Tamil Nadu (Coffee)	Hill and plantation zones
Millets	Jowar, Bajra, Ragi	Maharashtra, Karnataka, Rajasthan	Semi-arid and dryland regions

D) Foodgrain Production Trends

The most extensive and diverse agricultural systems are found in India. This sector generates nearly 40% of the total national employment and contributes between 16 and 18% to GDP. India's climatic and soil heterogeneity supports cultivation of an exceptionally broad range of crops. A notable structural feature of Indian agriculture is the dominance of smallholder farming: more than 85% of farmers work in land holdings measuring up to two hectares. As such, agriculture remains both resilient and vulnerable because it is a mainstay of economy but it is mostly dependent on monsoon rains for production.

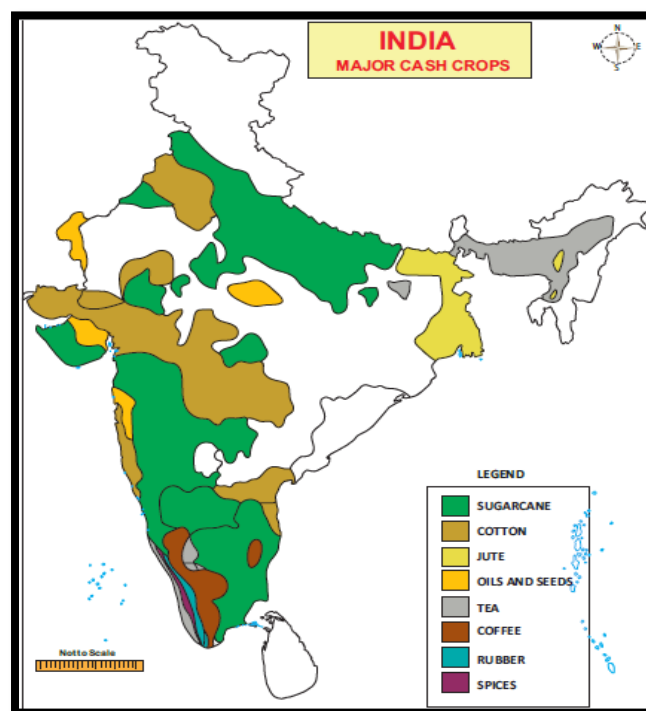
Graph 01: Production of Food grains in India from 1950-51 to 2021-22



There has been a tremendous development in case of irrigation in India after the Green Revolution in the field of agriculture. There has been conservation of water through irrigation and water conservation techniques that have led to the successful realisation of the goals of the first and second green revolutions. Tube wells are used for irrigation purposes in Punjab, Haryana, Uttar Pradesh, mostly in northern India. High sources of irrigation are found in Punjab, Uttar Pradesh, Bihar through canal irrigation and tanks are used in South India especially in Tamil Nadu and Karnataka. Drip and sprinkler irrigation are found in arid and semi-arid regions of Rajasthan and Gujarat respectively for water conservation.

Foodgrain production in India has shown an upwards trend during the last decades. India's total foodgrain production has increased to about 357.7 million tonnes in 2024-2025 due to a record production of rice, wheat and maize. From approximately 252 million tonnes of food grain production recorded in 2015-16, there has been substantial increase till 2024-2025 agricultural year. The compound effects of high yielding variety of seeds, mechanization, irrigation facilities and management techniques have helped much to give it a boost.

Map 01 Major Crop- Cultivated Areas in India



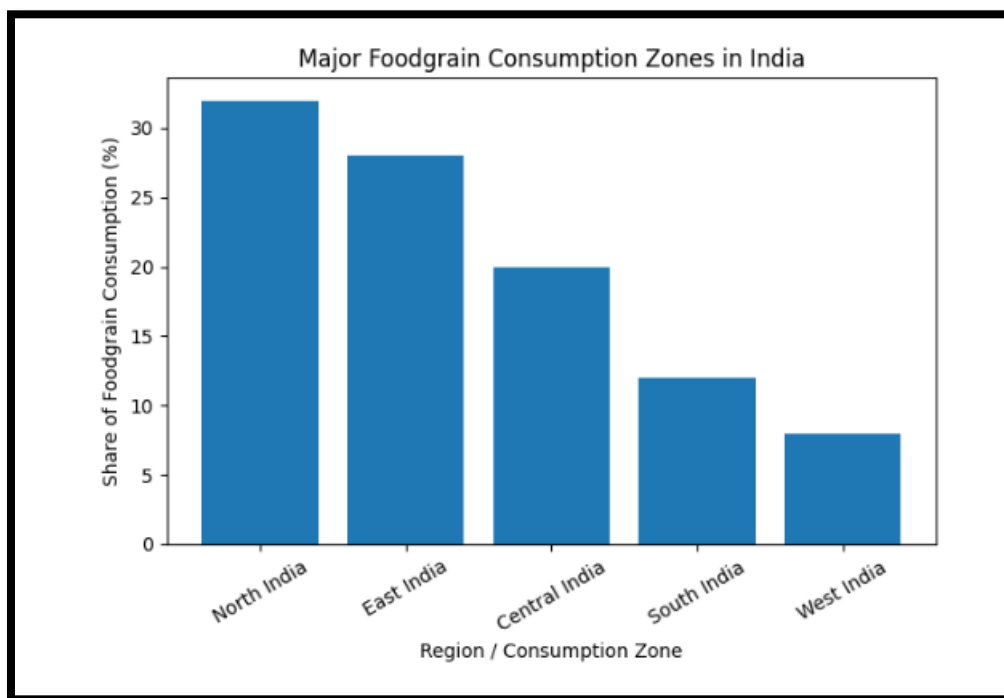
E) Nutritional Dimensions of Food Security

In addition to being sufficient in calories, food security includes the nutritional composition of one's diet. The problem of malnutrition, both deficiency and imbalance, is very prominent in India. Here, almost one-third of the children fall under the underweight category. Diversity of diets play a key role in overcoming nutrition related issues. Diets are devoid of variety and includes insufficient amounts of vegetables, fruits and proteins can negatively affect one's nutritional status, especially of women and children from poor socio-economic backgrounds. The average daily protein consumption of India stands about 47 grams which is significantly less than the protein consumption of developed countries. Therefore, a conscious effort should be made to include proteins in one's diet through sources like legumes, milk products, grains and meat. Micronutrients—including iron, zinc, and vitamin A—are also essential in our everyday diet. Their presence in one's diet include contributes to stronger immunity, improved child growth and fewer instances of diet related ailments.

F) Food Distribution Mechanisms

The structure of the food distribution by the government in India is primarily focussed on the Public Distribution System (PDS), which distributes wheat, rice, pulses, edible oils, and iodised salt to families living in all states and union territories. The National Food Security Act enacted by India in 2013 serves as the legal basis for this entitlement system, reaching up to 75% of rural and 50% of urban families. The Indian Government has been steadily expanding its mandate of the PDS to include millets as well. Supplementary feeding programmes under the Integrated Child Development Services support pregnant women, lactating mothers, and young children with cooked meals and take-home rations, though implementation quality varies significantly across states. Regulatory standards set by the Food Safety and Standards Authority of India (FSSAI) seek to ensure that essential micronutrients are adequately present in the food supply, contributing to the broader goal of improved public nutrition. By 2024, the government aimed to extend fortified rice distribution across all PDS channels, mid-day meal schemes, and welfare programmes.

Graph 02: Major Food grains Consumption Zones in India



G) Food and Agriculture: A Geographical Reading

A geographical perspective on food and agriculture foregrounds the spatial organisation of production systems, the environmental factors that shape agrarian outcomes, and the regional disparities that define food access. Geography reveals not merely where food is grown, but why certain areas specialise in particular crops and how the interplay of physical terrain, climatic patterns, soil types, and human infrastructure collectively governs agricultural possibility. India's food distribution system—linking surplus production zones in Punjab, Haryana, and Andhra Pradesh to deficit consumption areas in eastern and central India—exemplifies the geographical complexity of food logistics. An efficient and equitable distribution network is a prerequisite for translating agricultural abundance into genuine food security for all citizens.



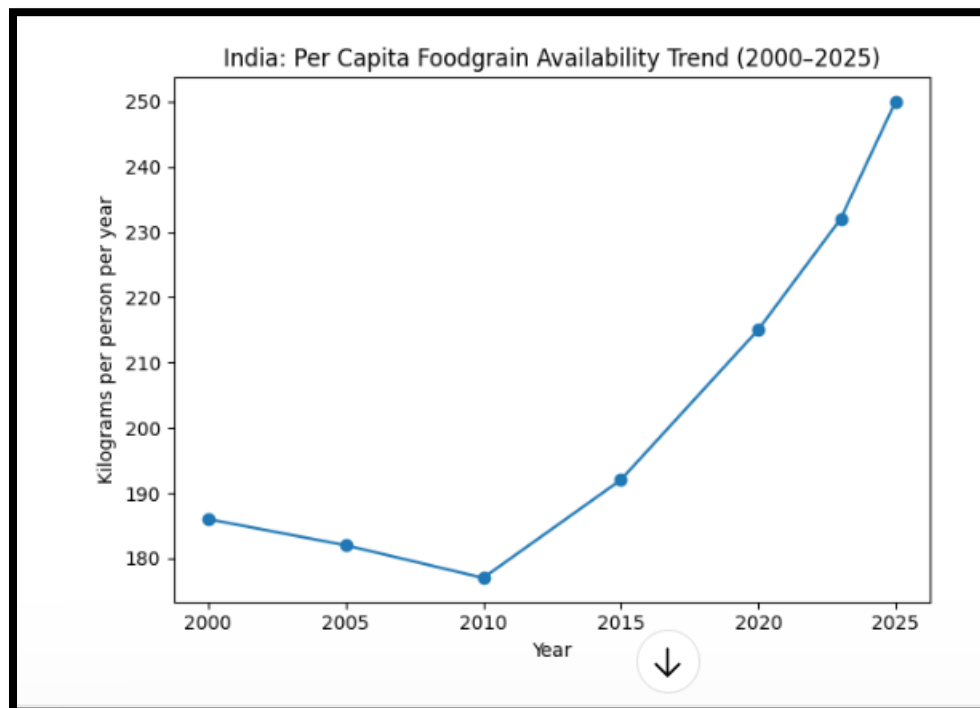
H) Regional Dimensions of Food Security

Geographically speaking, food security in India is profoundly uneven. Regions with fertile soils, reliable water access, and developed transport infrastructure tend to register food surpluses, while remote or ecologically fragile areas frequently experience chronic deficits. Geographers and policy planners use spatial analysis tools to identify regions exposed to drought, flooding, or severe soil degradation and to design targeted interventions accordingly. The persistence of food insecurity in specific tribal belts, rain-shadow zones, and flood-prone deltas reflects these underlying geographical vulnerabilities.

I) Food–Population Balance

The ratio of food availability to population size serves as a key indicator in geographical studies of food security. When agricultural output is greater than the demand of the population, a surplus food will be available for export in that particular nation. In contrast, when production is less than required, it implies that the nation depends on foreign food sources. During the period between 2000 and 2010, India's average availability of food grains was slightly reduced due to rapid population growth rates, but post 2015, the trend saw a significant upsurge due to increased production related to population growth.

Graph 03: Per Capita Foodgrain Availability Trend In India (2000–2025)



J) Key Challenges Confronting Food Security

- **Population Pressure:** The rapid growth of Indian population poses an unrelenting strain on the agricultural industry, as the growing population makes it more challenging to provide enough food despite many individuals being in agriculture.
- **Poverty:** Due to high level of poverty within the nation, it becomes increasingly difficult for families to access food because of their economic status despite there being enough food physically available.
- **Climate Variability:** Changes in climate and weather conditions such as drought and flood due to climate change have altered crop cycles, thus lowering productivity in certain areas and having a chain effect on livestock, forests, fisheries and aquaculture.
- **Imbalanced Distribution:** There are significant disparities in the distribution of food between cities and rural areas due to the inequities in the food distribution system.

- **Biofuel Demand:** The growing biofuel industry has resulted in the agricultural lands being used for fuel rather than food crops, leading to issues within certain crop markets.
- **Governance and Corruption:** Leakages in the PDS, including diversion of subsidised grain to open markets and irregular functioning of fair-price shops, undermine the intended reach of food security programmes.
- **Storage Infrastructure:** Inadequate post-harvest infrastructure means substantial quantities of grain are stored under inadequate conditions, leading to avoidable losses from moisture, pests, and fungal contamination.
- **Lack of Knowledge:** There is insufficient knowledge among farmers concerning advanced agricultural techniques and irrigation practices that could increase productivity throughout the nation.
- **Surveillance:** Current nutritional intervention initiatives suffer from insufficient oversight, thus resulting in limited efficacy and monitoring of their success.

K) Strategies and Measures for Enhanced Food Security

Improvement of food security will have to come through an integrated plan that deals with all three aspects, production, distribution and consumption, simultaneously. Expansion of crop diversity and farming systems can help in building more resilient rural populations while improving the variety of their diets. The food systems approach to food security, in which micronutrients crop are made a part of the provisioning system, is a potent approach alongside traditional approached based on yield gains.

The change in consumer behaviour and awareness generation among local populations will be a key for achieving a more varied and a nutrient rich diet profile among consumers. Shortening the chain from farmer to consumer through farmer's market and other similar systems will not only increase efficiency but will also ensure that farmers benefit better from their produce. Crop science research will be important for sustaining agricultural productivity in the future based on the vagaries of nature and monsoon upon which the agricultural pursuits depend.

A legislative foundation for giving subsidy in crops has been already enacted in the National Food Security Act, enacted by the Indian Parliament in 2013. This covers a large proportion of the national population. There was a severe crisis of food and the agricultural sector was not self-sufficient post-independence. The crisis management in the 1950s and 1960s was done through Green Revolution, which enabled the country to achieve broad cereal self-sufficiency. Nevertheless, food security and nutritional adequacy remain incompletely realised goals: India continues to face significant hunger challenges, ranking among the more food-insecure countries in Asia, with poverty serving as the primary structural driver of persistent undernourishment.

Innovative strategies such as community gardens for nutrition in schools, Anganwadi centres, and urban public spaces can serve as promising ways to increasing the diversity of diet at the grassroot level, especially for children and mothers who are pregnant and breastfeeding. Some illustrative examples of utilizing indigenous food cultures to ensure diversity and nutrition in their diets can be seen in the North-Eastern regions of India. The Pradhan Mantri Garib Kalyan Anna Yojana, is an interesting example where the government was able to quickly respond to and deliver food to 800 million people through a monthly distribution of ration grains during the Covid 19 pandemic. The food security initiative has been continued further as the country realises the need for continuous institutional efforts towards food and nutrition security for all Indians.

Conclusion

The relationship between Indian agriculture and the physical geography of the nation is profound, and any attempt at improving food security needs to understand this geographical relationship completely. Land use planning in a way that brings together the climatic suitability of the land, capabilities of the farmers, infrastructure considerations is key to developing any inclusive and efficient agricultural policy. Indian agriculture now stands at the juncture where sustainable ecological practices and intensive farming need to be balanced using technologies, institutional buildings and active farmer participation.

India's geography, politics and infrastructure determine the food distribution mechanism. It is important to improve logistics, reduce losses due to inefficiencies and distribute food efficiently among deficit areas. At the end of it all, while there will always be challenges in ensuring the availability of adequate food, it is imperative that everyone gets to have proper, nutritious food irrespective of the location, social status and economic class. This challenge needs to be addressed in the days to come.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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