THE RESEARCH JOURNAL OF ENVIRONMENT, CULTURE AND DEVELOPMENT (T.R.J.E.C.D.)
A Monthly International Journal of Multidisciplinary Research, Peer Reviewed-Refereed & Impact Factor - 4.8
ISSN : 2349-3313, Vol. : 10, No. : 8, January 2025, Conference Special Issue English 2nd

Environmental Development: Food and Agriculture

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Environmental development refers to the process of promoting sustainable and responsible use of natural resources while minimizing negative impacts on the environment and ecosystems for a healthier as well as resilient planet and world. Food and agriculture are closely linked to the environment and development in several ways, including: Environmental impact.

The environmental impacts of agriculture are well documented. Agriculture is the dominant use of land and this use will continue to grow as the food demand grows. Currently it is estimated that 35 - 40% of available land is used for agriculture including to raise livestock. Conversion of land for agriculture is estimated to account for 80% of global deforestation. Between 30 - 35% of global greenhouse gas (GHG) emissions come from agriculture, and crop irrigation accounts for 70% of the world's freshwater withdrawals. Fertilizers and pesticides used in agriculture often end up in water bodies leading to eutrophication of lakes and rivers - killing aquatic life. Industrial-scale agriculture reduces biodiversity and depletes soil nutrients leading to more demand for converting natural landscapes to agriculture use.

Agriculture and food systems are major drivers of environmental degradation and climate change:

- **Land use :-** Agriculture uses half of the world's habitable land.
- **Water use :-** Agriculture requires large amounts of fresh water, which can pollute rivers, lakes, and oceans.
- **Greenhouse gas emissions :-** Agriculture is responsible for about one-quarter of the world's greenhouse gas emissions.
- **Biodiversity loss :-** Agriculture and food systems are the main cause of biodiversity loss.

Our food production, processing and distribution systems are intricately linked with the environment. Sunlight, water, nutrients and a diversity of plants, animals and microbes all have fundamental roles in agricultural production and — ultimately — global food security. Agricultural biodiversity comprises the diversity of genetic resources and species used in agriculture directly or indirectly, including species that support production (e.g., soil organisms and pollinators) and broader ecosystems within which agriculture takes place. As the global food demand rises due to the growing population, the environmental costs of agriculture are placing an unsustainable burden on the finite resources of our planet.

Agriculture plays vital role in the process of economic development of less developed countries like, India. Besides providing food for the nation, agriculture absorbs labor, provides saving, contributes to the market of industrial goods and earn overseas exchange

India is a major player in the global agriculture sector. It has the world's largest cattle herd, the largest area planted for wheat, rice, and cotton, and is the world's largest producer of milk, pulses, and spices. However India is the most populous country in the world with 144 crores. It is the seventh largest country in the world with an area of 3.288 million sq kms. It has a long coastline of over 7,500 kms. India is a diverse country where over 22 major languages and 415 dialects are spoken. With the highest mountain range in the world, the Himalayas to its North, the Thar Desert to its West, the Gangetic delta to its East and the Deccan Plateau in the South, the country is home to vast agro-ecological diversity. India is the world's largest producer of milk, pulses and jute, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It is also one of the leading producers of spices, fish, poultry, livestock and plantation

crops. Worth $ 2.1 trillion, India is the world's third largest economy after the US and China. About 55–65% of the population of India is directly or indirectly dependent on agriculture.

India's climate varies from humid and dry tropical in the south to temperate alpine in the northern reaches and has a great diversity of ecosystems. Four out of the 34 global biodiversity hotspots and 15 WWF global 200 eco-regions fall fully or partly within India. Having only 2.4 percent of the world's land area, India harbours around eight percent of all recorded species, including over 45,000 plant and 91,000 animal species.

India is currently the world's second largest producer of several dry fruits, agriculture-based textile raw materials, roots and tuber crops, pulses, farmed fish, eggs, coconut, sugarcane and numerous vegetables. India's food and agriculture development includes:

- **Export competitiveness :-** India is the world's 9th largest exporter of agricultural and related products. In 2021, India's agricultural and related products had a global trade surplus of $11.8 billion. Leading exports include basmati rice, prawns, shellfish, carabeef, spices, and refined sugar.
- **Diversification :-** India's agricultural production has diversified over the past few decades. The share of traditional exports like tea and coffee has declined, while the share of meat exports has increased.
- **Horticulture :-** Horticulture is the growing of fruits, vegetables, and ornamental plants. This intensive form of agriculture has seen tremendous growth in India.
- **Self-sufficiency :-** India is broadly self-sufficient in grain production, with relatively low food grain imports.
- **Trade :-** Much of India's trade is with economies within a relatively short shipping distance. However, India imports wheat and sugar from more distant sources such as Russia and Brazil.
- **Annual growth :-** In 2023, the annual growth rate for agriculture, forestry, and fishing in India was 1.4405%.
- **Food Future Foundation :- n**The Food Future Foundation envisions a sustainable, resilient food system for India by 2030.

India is the world's second largest producer of wheat and rice, as well as many other agricultural products. The oldest evidence of agriculture in India is from the site of Mehrgarh in north-west India, which dates back to around 7000 BCE.

While agriculture in India has achieved grain self-sufficiency but the production is, resource intensive, cereal centric and regionally biased. The resource intensive ways of Indian agriculture has raised serious sustainability issues too. Increasing stress on water resources of the country would definitely need a realignment and rethinking of policies. Desertification and land degradation also pose major threats to agriculture in the country.

The social aspects around agriculture have also been witnessing changing trends. The increased feminisation of agriculture is mainly due to increasing rural-urban migration by men, rise of women-headed households and growth in the production of cash crops which are labour intensive in nature. Women perform significant tasks, both, in farm as well as non-farm activities and their participation in the sector is increasing but their work is treated as an extension of their household work, and adds a dual burden of domestic responsibilities.

India also needs to improve its management of agricultural practices on multiple fronts. Improvements in agriculture performance has weak linkage in improving nutrition, the agriculture sector can still improve nutrition through multiple ways: increasing incomes of farming households, diversifying production of crops, empowering women, strengthening agricultural diversity and productivity, and designing careful price and subsidy policies that should encourage the production and consumption of nutrient rich crops. Diversification of agricultural livelihoods through agri-allied sectors such as animal husbandry, forestry and fisheries has enhanced livelihood opportunities, strengthened resilience and led to considerable increase in labour force participation in the sector.

Organic and natural farming provides chemical fertiliser and pesticide-free food grains and other crops, improves soil health and reduces environmental pollution. India has 44.3 lakh organic farmers, the highest in the world, and about 59.1 lakh ha area was brought under organic farming by 2021-22. Sikkim voluntarily adopted going organic, and the process of getting the total cultivable land of 58,168 hectares under organic farming commenced at ground level in 2010. It became the first State in the world to become fully organic, and other States, including Tripura and Uttarakhand, have set similar targets.

The Government has been promoting organic farming by implementing two dedicated schemes, i.e., Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for North Eastern Region (MOVCDNER) since 2015 through cluster/ Farmer Producer Organisations (FPOs) formation. PKVY Scheme is being implemented in a cluster mode (with min. 20 ha size). Financial assistance of ₹50,000 per ha for three years is provided to the farmer, out of which ₹31,000 is given as incentives for organic inputs provided directly through Direct Benefit Transfer (DBT). Under PKVY as of 16 November 2022, 32,384 clusters totalling 6.4 lakh ha area and 16.1 lakh farmers have been covered. In addition, as part of the Namami Gange Programme, a 1.2 lakh ha area has been covered under organic farming. MOVCDNER is dedicated to promoting organic farming of niche crops of the North East Region through FPOs. Under the MOVCDNER, 177 FPOs/FPCs have been created, covering 1.5 lakh farmers and 1.7 lakh hectares. Promotion of natural farming began in 2019-20, when Bhartiya Prakratik Krishi Paddhati (BPKP), a sub-scheme of PKVY, was launched to assist farmers in adopting traditional indigenous practices for encouraging all forms of ecological farming, including Zero-Budget Natural Farming (ZBNF). The scheme focuses on capacity building, training, handholding, and on-field demonstration of natural farming through champion farmers. Under the BPKP, 4.09 lakh ha of land have been brought under Natural farming in 8 States (Andhra Pradesh, Chhattisgarh, Kerala, Himachal Pradesh, Jharkhand, Odisha, Madhya Pradesh and Tamil Nadu).

Despite high growth in production and yield of crops, people living in BPL are still higher in comparison to other countries.

Agriculture and Environment :- Sustainable agriculture has positive impacts on the environment, such as maintaining surrounding biodiversity, fertilizing soils, and creating habitats.

However, intensive and ecologically inconsiderate agriculture can damage nearby aquatic ecosystems, release GHGs like carbon dioxide and methane, and contaminate soils with agrochemicals. Intercropping involves planting different species in the spaces between rows of crops, while crop rotation is the planting of different species alternately in the same field. Climate change and global warming make agriculture more difficult too. Disease spreads faster, migrating invasive species are dangerous, and livestock expends more energy in the heat. The environment is beneficial to agriculture, as ecosystems provide stable foundations for agricultural development and pollinators benefit crop populations. Sustainable agriculture aims to implement methods of growing crops and livestock that are reproducible in the long term while also having minimal environmental effects.

Importance of Agriculture to the Environment :- When agriculture is carried out in an environmentally-friendly way, it can positively impact the environment. The importance of agriculture to the environment is based on:

- **Soil fertilit y :-** One of **sustainable agriculture**'s main goals is to improve **soil fertility**. This can be done by innovative methods of planting crops, such as intercropping, crop rotation, **cover cropping**, and the use of compost. Healthy **soils** lay a solid foundation for producers of surrounding ecosystems.

- **Ecosystem preservation :-** in many regions, ecosystems struggle to flourish in harsh climatic conditions. But with effective agricultural practices, the foundations of the ecosystems (such as pastures and crops) can be sustained.

- **Habitat creation :-** considerate agriculture, which invites species to build ecosystems

around farms, is a fantastic way of creating habitats. For example, cultivating hedgerows and wildflower meadows around farms can attract many **pollinators**, and leaving waterlogged patches in between fields can improve connectivity between **aquatic ecosystems**.

- **Global producer populations :-** planting crops in agriculture increases global producer populations, meaning there is more carbon dioxide absorbed from **the atmosphere** by photosynthetic producers.

- **Ecological succession :-** many species fail to thrive in certain areas because they depend on an early stage of landscape (such as open meadows for **pollinators**). These habitats cannot be maintained naturally and will overgrow, so agriculture allows selective species to thrive in more areas.

Positive Environmental Impact on Agriculture :- The environment often provides the foundations for agriculture, and without the very unique and amazing environment that the Earth possesses, farming would be much more tedious! Here are some examples of the positive environmental impact on agriculture:

- **Producer dispersal :-** over millions of years, the planet's producers have been expanding the areas they inhabit through seed dispersal. This has allowed agriculture to happen worldwide because land filled with photosynthesising producers is always fertile. Producers form the basis of the ecosystem and attract animal life, forming a cycle of life and decomposing matter which fertilises the soil.
- **Greenhouse gases :-** despite having a bad reputation, greenhouse gases are crucial in maintaining a temperate climate. Greenhouse gases absorb infrared radiation reflected from the Earth's surface and re-emit this radiation back towards Earth, warming the planet. Without them, any productive agriculture would be basically impossible in consistently freezing conditions.

- **Pollination :-** pollinators (e.g. bees, butterflies, moths) are essential in sustaining functional **agroecosystems**. They maintain plant biodiversity by pollinating flowering plants and also play a role in pollinating a variety of crops, such as peppers, tomatoes, and aubergines.

Such kind of details may raise queries of performance of Indian agriculture, sustainable farm practices, food security and how well Indian farmers dealing with climate change. By using large-scale data at national and state level, input-output analysis was carried out in two periods, viz., post- green revolution period and economic reform periods. The results show that production of food and non-food crops has tremendously increased over the period and nowadays India has surplus food stock to deal with any future food crisis. However, the dark side of the green revolution also observed.

First, technological change in the mid-eighties caused significantly shift in land utilization in favor of food grain crops such as wheat and rice at the cost of the area under coarse cereals, pulses and oilseeds. This shift was combined effect of differential rate of technological change among the crops.

Second, irrigation bias of new technology causing shift, of land away from dry crops in favor of irrigated crops and the associated policy price-support system as well as market intervention by the government for certain crops.

Third, distortions in cropping pattern were reflected in the relatively abundant supply of the same crops (like wheat of which government has surplus stock) and acute shortages of others (like pulses and oilseeds which had to be imported at the huge cost in terms of foreign exchange).

Fourth, the input cost has increased many folds. High yielding food grain technology along with fertilizer and irrigation needs more investment in agriculture. With least coverage of institutional credit sources, green revolution pushed in poverty and credit trap to the marginalized Indian farmers.

Fifth, emphasis on the agricultural development policy (green revolution) was more on raising the yield of a particular crop per unit of land rather than increasing the total output per unit of land from all crops growth in a year.

Sixth, change in land use pattern. It is examined the inter-state disparities in cropping pattern and agriculture growth. Study found that size of land holding has basic factor affecting the structure of cropping pattern across the states. The state with higher agricultural growth rates was having a relatively higher average size of holding except Uttar Pradesh, Punjab and Haryana.

Lastly, shift from traditional to unsustainable farm practices. It is argued that traditionally, Indian farmers were small plots of land protected by windbreaks and tree cover. The practices of crop rotation and leaving the field fallow for long periods of time allowed the soil to retain nutrients. However, farmers were then influenced by the green revolution and large farmer who had changed to modern method, such as mono-cropping, in which they cultivated only one type of crop rather than multiple crops, as is done in traditional farming. While mono-cropping allows farmers to grow more of a certain crop that usually of higher market value. It has negative effects on the soil as well. A farmer who applies a mono-cropping system tend to leave their fields fallow for a shorter period of time.

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