Manuscript ID:
IJEBAMPSR-2025-020610

Volume: 2

Issue: 6

Month: December

Year: 2025

E-ISSN: 3065-9140

Submitted: 06- Nov.-2025
Revised: 10-Nov.-2025
Accepted: 15- Dec.-2025
Published: 31-Dec.-2025

Address for correspondence:
Dr. Pashikanti Omkar
M.A.,B.Ed.,APSLET.,PhD., DPGCA
Associate Professor of Economics, Chitanya Deemed to Be University. Moinabad, Hyderabad, Telangana. India.
Email: omkar.eco@gmail.com

DOI: 10.5281/zenodo.18492861
DOI Link: https://doi.org/10.5281/zenodo.18492861

The Impact of Environmental changes on Agricultural production in India- Opportunities and Challenges

Dr. Pashikanti Omkar
M.A.,B.Ed.,APSLET.,PhD., DPGCA
Associate Professor of Economics, Chitanya Deemed to Be University. Moinabad, Hyderabad, Telangana. India.

Abstract

This paper examine the environmental changes and agricultural production in India it is a big problem in various states and huge impact on all living factors growing factors especially agriculture crops production levels is under threat due to environmental change in food insecure regions, especially in India and Asian countries, various extremes, drought, heat waves, erratic and intense rainfall patterns, storms, floods, and emerging insect pests have adversely affected the livelihood of the farmers. Globally environment is changing day by day and now it has become a challenge to living forms due to the very ugly fact that every nation is trying to develop without taking into consideration the environmental impact of degradation and pollution of agricultural lands, people are using plastic bags, which are environmentally dangerous products, the environment and agricultural lands are thereby being polluted, has strictly reduced its environmental and agricultural land pollution, such as, waste water and solid waste discharges and energy use, consumers have increased environmental and agricultural land pollution, the negative environmental impacts and agricultural land pollution have raised the concern of the global community and the caring media around the world, the accumulation of greenhouse gases (GHGs) in the atmosphere carbon dioxide (CO_2), methane, nitrous oxide, and other gases contributes, it imposes costs on countries around the globe, it also increases the risk of several adverse effects, economic and otherwise, including slower growth of gross domestic product, property damage from flooding and higher sea levels, and damage to ecosystems that provide food, medicines, and clean air and water. CO_2 is the most common accounting for about 80 percent.GHG emissions, the remaining 20 percent are non CO_2 gases, and nearly half of those emissions are from the agriculture sector. The sector emits mainly nitrous oxide and methane in roughly equal amounts in CO_2 equivalent units (the amount of CO_2 that would trap the same amount of heat in the atmosphere). all the sector's nitrous oxide emissions are from excess fertilizer nitrogen that is not absorbed by plants. Agricultural activity and its associated GHG emissions are widely dispersed geographically, that dispersal has implications for how those emissions might be managed but otherwise has no implications for their effect on the climate because GHG emissions ultimately mix uniformly in the Earth's atmosphere, the factors underlying the relative stability of emissions in recent decades and provides projections of agricultural emissions, GHG emissions released from broad sectors, economy manufacturing, transportation, and electric power.

Keywords: *environmental conditions, changes, problems, impact on agriculture production, issues and challenges in India as well as all over the world.*

Introduction:

This paper focused on the relatishionship between the environment changes and the agriculture development in India. It is well known that about one third of the world's land surface is under agriculture, environment has a direct influence on existence and sustainability of agriculture as it depends upon the use of natural resources, undoubtedly, agriculture has a greater environmental impact on Earth than any other single human activity, conventional agricultural farming practices will not provide the food and fibre needed by burgeoning population in the future. India is primarily an agricultural nation, with over 58 percent of its rural households relying on farming for their income.

How to Cite this Article:
Omkar, P. (2025). The Impact of Environmental changes on Agricultural production in India- Opportunities and Challenges. International Journal of Economic, Business, Accounting, Agriculture and Management Towards Paradigm Shift in Research, 2(6), 70–77. https://doi.org/10.5281/zenodo.18492861

The agriculture is responsible for roughly 10-12 percent of green house gas emissions, agricultural sector is accountable for 19 percent of the country's entire GHG emissions. The emissions from agriculture largely stem from enteric fermentation, soil management, crop production, manure handling, and the blazing of crop residues, agricultural practices such as land preparation, crop cultivation, irrigation, animal husbandry, fisheries, and aquaculture significantly influence GHG emissions. it is essential to adopt climate resilient agricultural production systems to improve farm productivity and mitigate GHG emissions from the agricultural, sustainable agricultural practices must achieve a balance between environmental health and economic viability to foster social and economic equity, various facets of sustainable energy and environmental conservation, primary environmental goal of sustainability is to mitigate adverse effects on both the environment. Sustainable agriculture prioritizes environmental integrity, enhances agronomic productivity, and seeks to reduce detrimental environmental impacts, it minimizes reliance on external energy sources while boosting the profitability of agricultural the sustainable agriculture has the potential to enhance farm productivity and fulfill sustainability standards to address the growing demands of humanity, all while aiding in the restoration and sustainability of landscapes, the biosphere, and global systems, main components of sustainable development include the reduction of greenhouse gas emissions, the effective utilization of renewable energy, and the enhancement of energy efficiency, GHG emissions serve as a critical metric for evaluating the environmental sustainability of agricultural practices.

To develop and adopt the agriculture farming practices that can produce the food needed to feed an increasing population and simultaneously sustain our environment on long term basis. Under most systems of agricultural production at this time, it is not a question of if, but rather when, virtually all of the natural habitat on the planet will become degraded to the point that it is no longer productive and then abandoned for future generations to find ways to rehabilitate and repair, farmers are beginning to invent, adapt and adopt a wide range of new technologies and approaches but most of them are not environment friendly. High temperature causes burning or scorching effect of blossoms, predominantly on young trees. Fruit setting stage of navel oranges is recorded to be severely affected by high temperatures during flowering. High temperature induces moisture stress condition leading to sunburn and cracking symptoms in fruit trees like apricot, cherries and apples. The temperature enhancement at ripening stage causes fruit burning and cracking in litchi plantation. Most of the vegetable crops are severely affected by flooding, particularly tomato. Another possibility of causing severe damage to crops is due to the accumulation of endogenous ethylene. If the ozone concentration reaches to >50 ppb/day, yield of vegetable crops will be reduced by 5 to 15 percent. The Food and Agriculture Organization of the United Nations (FAO) estimates that in developing countries alone at least 13 million hectares of forest are lost to agriculture each year, agriculture was the main cause of phosphorus pollution in the coastal zones of Mediterranean countries. Globally, the area of irrigated agriculture has increased steadily from 47.3 million hectares in 1930 to 352 million hectors in 2025. About 40 percent of the world's food is produced on the 16 percent of agricultural land that is irrigated. Three crops account for 58 percent of all irrigated land: rice 34 percent, wheat 17 percent, and cotton 7 percent. The efficiency of water use varies from region to region and from crop to crop. Much of the planet's methane (CH4) emissions come from the production of livestock and continuously flooded rice paddies. One estimate places total methane emissions from rice at some 10 to 15 percent of total global me hane emissions. Increasing the concentration of carbon dioxide causes partial closure of plant stomata (the small openings in plant leaves that control the flow of air), which in turn decreases evaporative cooling and can cause leaf temperatures to exceed air temperature. Agriculture can either sustain or degrade the environment (Millennium Ecosystem Assessment, 2005) has negative effects on land and freshwater, as well as the importance of agricultural landscapes in providing products for human sustenance, supporting biodiversity and maintaining ecosystem services. Negative impacts such as conversion of forests, grasslands and other habitats for agricultural use, degradation of soil quality, pollution of soil and surface water, aquifers and coastal wetlands through excessive or inappropriate use of pesticides and fertilisers, significant loss of crop and livestock genetic diversity through the spread of industrial monocultures, reducing resilience in the face of climate and other changes, the agricultural activities can have environmental impacts on land, water, and air these environmental impacts will differ based on the farm location, farm type, and the specific farming and land management practices used as well as the timing of these practices for instance, nutrients and pesticides can run off agricultural fields into surface water bodies or leach into groundwater. Increased phosphorus loading from agriculture is one of several factors that have resulted in algal blooms in both Lake Erie and Lake Winnipeg. The effects of climate change on agricultural production vary from one region to another depending on the prevailing climate of the

region, hence affects agricultural productivity differently.

Scope of the study:

Day by day increases temperatures on earth it results agriculture crops, plants, animals, human life, climate change is a defining issue currently. A lot of significant longterm changes are happening in global climatic system which are visible all over the world. The direct solar radiations (enormous amount of heat/energy) striking on earth's surface is being trapped by GHGs like carbon dioxide (CO), methane (CH), nitrous 2 4 oxide (N O), hydro fluorocarbons 2 (HFCs), resulting in atmospheric temperature increase, the CO levels are at peak and its concentration has reached up to 410 ppm at present, which is a principal cause of warming effect**.** Global food security relies on sustaining the environment and the ecological processes that underpin agriculture. National policies are needed to ensure political commitment, incentives, and to build educational and institutional capacities to promote sustainable agriculture, approaches include integrated pest, crop, nutrient and soil management, land use planning, the current over emphasis on genetic engineering techniques must be balanced by approaches that are based on agro-ecology and landscape ecology as well as cultural and biological diversity.

Objectives of the Study:

1. To study the importance of agriculture production and environmental effects water scarcity soil degradation, deforestation, climate variability affecting agriculture production.
2. To analyze the sustainable development is affecting implementation and identify propose actionable strategies for areas achieve sustainable agriculture and climate adaption and suggestions.

Hypothesis of the study:

1. To study the impact of environmental changes and sustainable agriculture development in India its problems and implications.
2. To study supporting and improving rural livelihoods, maintaining agro ecological balance, the mitigating climate change and global warming, and ensuring sustainable use of land, water and other natural resources.
3. Climate change and erratic monsoons, rising temperatures significantly reduces crop yields in rainfed areas.

Methodology of the study:

The present paper focused on the environment changes and agricultural production, this paper based on the secondary data, which data collected from the different sources such as various journals, books, magazines, government publications, Government reports, research articles, news papers, and Government websites etc. The entire study focused on the sustainable development in Indian problems and implications agriculture sector production and yield of crops, per capita food grain availability and related data have been compiled from relating to selected crops on output, area, yield, fertiliser, consumption, rainfall, irrigation, and other inputs, though there are several economic factors that influence the productivity and production.

Importance of the study:

Agriculture' is the main occupation 48 percent of population agriculture and allied sectors contribute 19.9 percent of the Indian GDP (2020-21). Farming activities are carried out by the selection of crop which is specific to suit climate, soil type, resource availability, etc. the farming sector-wise effects of environmental impact climate change in Agriculture field crops an average of 30 percent decrease in crop yields is st expected by mid-21 century in south Asian countries. North Indian states are highly susceptible due to erratic changes in rainfall and temperature, an increase in temperature by 1.5° C and decrease in the precipitation of 2 mm reduces the rice yield by 3 to 15 percent. Climatic changes driven by increasing GHGs possibly affects the yield and productivity of agricultural crops from region to region. The production of maize in European countries is expected to increase by 25 percent in ideal hydrologic conditions, the drastic changes in climate alters the progressive stages of pathogens that eventually affect the growth and yields of crops severely, and also could lead to an increase in pest and insect population, ultimately devastating the overall productivity.

Working population, national income in current and constant prices and food grains in MT, in India 1950-51 to 2022-23.

Year	Working population in percentage	National income At Constant Prices	National Income At Current Prices	Food grains MT	National GHG emission in MtCO2e	CO2 Total GHG emission
1950-51	69.2	61.7	53.2	52		
1970-71	69.7	49.6	43.1	87		
1990-91	59.0	35.1	29.8	176	1229	
2010-11	54.6	18.3	18.4	241.5	1884	
2020-21	48.6	14.8	18.4	315.7	2437	

2024-25	45.8	17.8	18.3	332.2		2382535

Source: NABARD statistics in 2024-25.

Greenhouse gases (GHG) emitted from agricultural activities are generally not visible. The emission results from application of organic and inorganic inputs to the soil, decomposition of biomass and dead plant residues, plant respiration, livestock rearing, enteric fermentation in ruminants, manure handling and burning of crop residues. Agriculture is responsible for about 17 percent of GHG emission in India, which is almost same as its share in the country's GVA. This share will increase significantly if burning of crop residue, which is now spreading to all states, is taken into account. Similarly, bulk of water used in the country is used in agriculture, and more than 40 percent of the land area is put under agriculture. India's voluntary declaration excludes mitigation in the agricultural sector. India's average temperature rose by as bout 0.9^0C during the 2014-2025 temperature and rainfall extreme heat reduces farmer income by 4.3 percent kharif and 4.1 percent Rabi extreme rain by 13.7 percent and 5.5 percent respectively. The climate change impacts includes adjustment in sowing dates breeding of plants that are more resilient to variability of climate and adopting land water conservation measures can increase agriculture value. Nevertheless, given the scale of agricultural activities in the country, the Government of India has also adopted several initiatives to reduce the carbon intensity of agricultural production while sustaining its economic contribution through sustainable practices and increased productivity. System of Rice Intensification is being implemented in 193 districts of 25 States during 2023-24. The emissions avoided due to SRI cultivation compared to conventional rice cultivation were 0.053 MtCO2 during 2019-24. Direct seeded Rice (DSR) is one of the most efficient, sustainable, and economically viable rice production systems compared to conventional puddled transplanted rice (PTR). Using the DSR technique, a mitigation potential of 0.137 $MtCO_2$ was achieved during 2019-24. Under the Crop Diversification Program (CDP), assistance is provided for four major interventions to replace paddy crops alternate crop demonstrations, farm mechanization and value addition, site-specific activities, and contingency for awareness, training, monitoring, etc. The mitigation potential through CDP was 0.214 $MtCO_2$ during 2019-24. A Central Sector Scheme on Crop Residue Management (CRM) implemented from 2018-19. Emission reduction of 1.447 $MtCO_2$ was achieved during 2019-25 by avoiding crop residue burning using in-situ crop residue management machines. Mission for Integrated Development of Horticulture (MIDH) is a Centrally Sponsored Scheme that has been implemented since 2014-15 to promote the holistic growth of the horticulture sector covering fruits, vegetables, root & tuber crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew and cocoa. Under the MIDH, the cumulative carbon sequestered was estimated to be 1020.6 $MtCO_2$ from 2019 to 2025. Sub-Mission on Agroforestry (SMAF) scheme also known as "Har Medh Par Ped" promotes the simultaneous cultivation of trees and crops. Under SMAF, the cumulative carbon sequestration potential of 2.378 $MtCO_2$ was achieved during 2019-24. The restructured National Bamboo Mission was launched in 2018-19 with an aim to develop the complete value chain of the bamboo sector to link growers with consumers starting from planting material, plantation, creation of facilities for collection, aggregation, processing, marketing, micro, small and medium enterprises, skill development and brand building initiative in a cluster approach mode. The cumulative carbon sequestration potential achieved under the National Bamboo Mission during 2019-24 was 6.106 $MtCO_2$. The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) aims to improve on farm water use efficiency, enhance the adoption of precision irrigation and other water saving technologies (more crops per drop), and enhance aquifer recharge. The cumulative emission reduction amounted to 555.3 $MtCO_2$ from 2019-20 to 2023-24. Solarization of Agriculture Pradhana Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan (PM-KUSUM) it aims for de dieselization of the farm sector, providing water and energy security to farmers, increasing the income of farmers, and curbing environmental pollution, the cumulative CO_2 emission reduction of 0.795 $MtCO_2$ was achieved during the period 2019-24 from standalone solar powered agriculture pumps installed under component. The Government of India, since 2016, has made it mandatory to manufacture 100 percent neem coated urea as it has higher nitrogen use efficiency and lower loss of nitrogen due to inhibition of nitrification process in soil compared to pilled urea, an emission reduction of 26.81 $MtCO_2$ was achieved during 2018-24 from neem coated urea application.

The agriculture is quite significant for quality of air, water and land, and pressure on land and water, which are the pillars of sustainability. In order to put a check on further overexploitation of water resources, the country should create a policy environment that leads to crop pattern and practices consistent with the natural resource endowment in various agro ecological zones of the country. without improving efficiency in water use in agriculture, through modern method of irrigation (drip, sprinkler and sensors), the country cannot

address the stress on water use and meet the future water requirement. Excessive population in India required food which led to agricultural development in the form of Green Revolution. However, this development had its side effect on environment also. These side effects of agricultural development on environment arise due to faulty farming activities which has resulted into soil erosion, loss of nutrients and land salination in India. Green revolution has led to over utilization of land and water resources while there has been manifold increase in the use of pesticides and fertilizers, land degradation in India which included salination, alkalization and water logging. Economic survey 2007-08 showed that out of total area of 328.7 million hectare, 141.3 million hectare is subject to water and wind erosion while 33.7 million hectare is subject to water logging, Alkali soil, acid soil, saline soil, shifting cultivation etc. Out of total area of 328.7 million hectare, 175 million hectare area is considered to be land degraded biodiversity has its important place in agriculture, medicine, food, industry etc. It is said that destruction of plants is not a threat to biodiversity rather it is the destruction of their habitat that matters. India is one of 12 mega-biodiversity countries of the world, out of 70 percent area of India, there are 46000 species of plant and 81,000 of animals which are found and they account for 7 percent and 6.5 percent of world's floura and fana respectively. But the population growth in the country has led to increased demand for food, wood, fuel, building material etc which come from forests which has ultimately posed a threat to the biodiversity in the country. Freshwater species are the most threatened since they are more susceptible to water pollution and environment change, the country's 2200 fish species, 3.6 percent are considered endangered, vulnerable and rare. moreover most of India's wetlands have become degraded due to pollution. a growing role in global warming, rising use of energy due to increased use of electronic devices such as ACs, TVs, refrigerators and so on would have its impact in climate change which would affect precipitation pattern, ocean circulation, soil moisture, sea level rise, also with rising temperature, heat stress, the global population would be more prone to health problems and all these would have vital socio-economic implications. Indian agriculture continues to be vulnerable to weather vagaries despite self-sufficiency in food grain production, and uncertainty in the prediction of those events further add to the challenges to farmers causing widespread losses of agricultural output. Heatwaves and floods have particularly caused major damage to crop production, and crop harvesting activities in India. The months of March and April 2022 witnessed an unusual increase in maximum and minimum temperatures. Northwest and central India experienced their hottest April in 122 years with average and maximum temperatures reaching 35.9 and 37.8 degC, respectively. Anti-cyclones over western parts of Rajasthan in March and the absence of western disturbances had triggered the early and extreme heat waves. The districts of Punjab, Himachal Pradesh, Jammu and Kashmir, Haryana, Madhya Pradesh, Uttar Pradesh and Rajasthan were affected resulting in yield reduction of field crops like wheat 10-34 percent , maize 18 percent , chickpea 19 percent , cowpea 9-11 percent and mustard 14-18 percent. Horticultural crops including fruit crops like mango, lemon, guava, papaya, kinnow and pomegranate; and vegetables including cole crops, cucumber, bitter gourd, okra, onion and tomato were also affected. Heat waves resulted in flower and fruit drop and reduced fruit size and resulted in yield reduction of tomato 40-50 percent cucumber and bitter gourd 30-50 percent and okra 40-50 percent. Livestock, poultry and fisheries production were severely affected by heat waves. It led to a reduction of milk yield by up to 11-15 percent in milch animals and egg production by 4-10 percent in layers. It increased the mortality up to 8 percent in broiler chicken and 3.5-4.0 percent in layers. It affected fish farming in plain areas due to water scarcity. Heavy rains in Balrampur, Uttar Pradesh from 08th to 13th Oct' 2022 led to waterlogging of 125691.79 ha crop area affecting crops such as paddy, maize, bajra, urad, and potato across the state (JRNA, 2021). In Assam, rice transplanting starts from mid-June to mid-July every year, in 2024.

India's National Action Plan on Climate Change National Action Plan on Climate Change (NAPCC)ϖ outlines existing and future policies and programmes addressing climate mitigation and adaptation. The Plan was launched in the year 2008 andϖ identifies eight core National Missions through 2017 and directs Ministries to submit detailed implementation plans to the Prime Minister's Council on climate change. Energy Efficiency National Mission on Sustainable Knowledge for Climate Change. Intended nationally determined contributions (INDCS) Plan submitted to UN govt. during COP-21 at Paris Indian government pledged reduction of carbon emissions relative to its GDP by 33 percent to 35 percent from 2005 levels by 2030 India also pledged that 40 percent of the country's electricity would come from non fossil fuel based sources, such as wind and solar power by 2030 India increased solar power capacity goal for 2030 from 20 GW to 175 GW Difficulties in Reduction of Emission by India Six most emissions intensive industrial sectors steel, cement, aluminium, fertilizers, papers and power, which account for over 60 percent of India's CO2 emissions shows

many of them are actually operating at global best levels. India's cement industry is one of the most efficient globally due to its use of modern technologies and lending materials (fly ash and slag). Urea plants, specially gas based ones are today defining best practices. 80 percent of Aluminium industry is already using best smelting technology, remaining is converting as they cannot compete due to high energy cost. India's coal based thermal power plants are more efficient than the global average, which is energy inefficient and polluting, paper sector is suffering with problems of small size, multiplicity of raw material, technological obsolescence and multi-product nature of plants. More paper in India will be produced from waste paper and market pulp, instead of sequestering carbon through the social and farm forestry. At 8 percent GDP growth rate for the next 20 years means production in all sectors, other than fertilizer (Urea), more sectors in India will operate at best technique levels or what can be practically achieved, everything will depend upon how ambitious we are in deploying low carbon/renewable technologies. India's voluntary commitment to reduce emissions intensity of its GDP by 20-25 percent by 2020 in comparison to 2005 level can be met at a high cost, but not enough to be left undoable, when the emissions intensity of the sectors starts to stagnate, even if India installs 100,000 MW of solar energy, coal will still have to provide close to 60 percent of the total power generation. India also faces the challenge to provide affordable power to a huge number of people, who are still not connected to the grid the bottom line, therefore, is that reducing emissions in an 8 percent growth trajectory. Despite the above factors, there has been a consistent increase in the production of both food grains and horticultural production in India. This indicates the importance of developing climate-resilient crop varieties, appropriate farming systems, social security and welfare measures, and other interventions as part of development and ongoing climate adaptation. Some of the policy measures undertaken to address the risks of climate variability and climate change include, Several pre existing strategies and policies are also important in addressing the climate and socio-economic risks faced by the Agriculture and allied activities sector. Sustainable integrated organic farming systems to improve organic farming systems and to enhance the farmer's incomes, to improve soil health and reduce environmental pollution, 59.1 lakh ha area has been brought under organic farming by 2021-22. The Rainfed Area Development (RAD) scheme focuses on integrating farming systems with activities such as agroforestry, horticulture, livestock, fishery, and apiculture, enhance the productivity, increase income opportunities for farmers, and minimize risks associated with climatic variability, such as droughts, floods, and extreme weather events. National Innovations on Climate Resilient Agriculture (NICRA) is a network project of the Indian Council of Agricultural Research (ICAR) launched in Feb 2011. The aims to enhance the resilience of agriculture to climate change and climate vulnerability through strategic research and technology demonstration, the research on adaptation and mitigation covers crops, livestock, fisheries, and natural resource management seed varieties/hybrids of rice, mungbean, maize, tomato and lentils tolerant to pests, diseases and extreme weather conditions were developed and released, monitoring pest attacks and plague the android mobile application "eLocust3m" was implemented in 2020, which resulted in effective desert locust control, towards strengthening of ground control fleet for locust control new vehicle-operated ULV sprayers with advanced features have been procured during 2020.

The present government taken positive concern and measures to protect environment and climate and also the existing Government's national plans on energy efficiency agriculture, renewable energy, water, and others, this Mission was structured under the National Action Plan on Climate Change (NAPCC) and made operational during 2017-18. It aimed to synergize resource conservation, enhancing or restoring the soil fertility, thereby, improving productivity with focus on soil health management, Integrated Farming System (IFS), integrated animal component and Water Use Efficiency (WUE) specifically in drylands or rainfed agriculture areas, objective of enhancing resilience of Indian agriculture to adverse climate changes by adopting innovative technologies, mainly for supporting concrete adaptation activities dealing with mitigating the adverse effects of global climate change in sectors such as agriculture, water, forestry, animal husbandry. Pradhan Mantri Krishi Sinchayee Yojna (PMSKY) was planned and formulated to give more priority on water conservation and its management in agriculture with the vision to extend the area under irrigation from 1st July 2015. The motto of this scheme is 'Har Khet Ko Paani' to improve water use efficiency, 'More crop per drop' to provide end-to-end solutions in water source creation, distribution channels and its management. This Scheme was introduced on 14th January, 2016 in order to reduce the agricultural distress and farmer's welfare without affecting substantial hikes in the Minimum Support Prices on agricultural produces during monsoon fluctuations or any other natural calamity by providing full insured amount on crop losses. This Mission was started in Feb' 2014 and outlined under NAPCC. The objective of this mission was to protect, restore and enhance the diminishing forest cover in India, and to fight

climate change with adaptation and mitigation measures. It is an extended component of Soil Health Management (SHM) launched in 2015 under NMSA with the objective of supporting and promoting organic farming through adoption of organic village by cluster approach, which in turn result in improvement of soil health. Agricultural contingency plans are technical documents comprising integrated information on field crops, livestock, horticulture, poultry and fishery and technological solutions for all weather-related problems for the respective farming activities, these are useful to plan earlier towards sustainable agriculture system during weather aberrations and extreme climatic conditions. NICRA is a Network Project of the Indian Council of Agricultural Research (ICAR) started in Feb' 2011 with the department of agriculture and allied sectors has been providing assistance to the state sustainable development of processing and marketing facilities, and enhancement of production and profitability of livestock and fisheries enterprises artificial insemination besides marketing and promotion agripreneurship ecosystems in India, the total fish production in India is estimated at 12.61 Million Metric tonnes. Similar advances were made in poultry sectors. Ridges and furrows- retains soil moisture and maintains proper drainage, sub soiling enhances soil moisture and nutrient availability, conservation furrows percolated rain water is conserved in plant root zone, trench cum bunding allow percolation of rain water and retain moisture at the root zone for longer period, broad bed furrows improves drainage and conserve soil moisture, zero tillage utilizes residual soil moisture, adds organic matter and reduces cost of cultivation, crop intensication with conserved soil moisturesunhemp seed production in rice fallows conservation and effective utilization of residual soil moisture, compartmental bonding, improves soil structure and enhances soil organic matter content, pusa hydrogen absorption and retention of soil moisture slow release for longer period, pani pipe technology reduces the number of irrigations and recharges the ground water, significant and sustained increase in farmers income and the transformation of agriculture require a paradigm shift in the entire approach towards agriculture, changes in archaic regulations and liberalisation of the sector are a must for creating an enabling environment for a modern and vibrant agriculture, well coordinated action and strategy between the centre and the states is needed to ensure that agriculture marches to the next stage of development along with the other sectors, its causes and impacts are one of the most emerging issues in science and technology domain. India, a tropical country, is facing its impacts through droughts, floods, cyclones, heat waves, hailstorms, and coastal salinity which have become threats to sustainable development. About 60 percent of the Indian population is directly or indirectly associated with agriculture and sub-sectors, and major Sustainability Development Goals (SDGs) are expected to be met from this sector. Increasing global temperature due to the emission of enormous amount of GHG from various sources is the cause of climate change and impacts. Extreme temperature and its erratic events disrupt the activities of all the existing lives on the planet by means of severe damage or loss assessment of the impacts and a comprehensive understanding of the benefits of adaptation options over combating the uncommon incidents of climate change is pivotal in the current scenario to sustain life, so far in the journey of Indian agriculture, climate adaptation strategies have shown positive impacts, still much more needed in the light of emerging, preparation of nations to compensate these changes requires intensive and inclusive steps for mitigation by adaptation of innovative practices, commitment to achieve the goal of sustainable agriculture and to create eco friendly environment within our community must be strengthened by the adaptation strategies, large-scale climate awareness is a must, and should be taken forward by multi ministerial platforms, nevertheless, continuous monitoring and evaluation of the adaptation measures ease the understanding level, and also enables further needed alterations of such measures, impacts of several national and state-level climate action programmes and policies by academic institutions should be taken up and need based changes be made based on these impact studies. The major problem is reduced food losses should be considered as one of the greatest climate change mitigation action, besides creating awareness accounting of food losses should be taken up by ministry of agriculture and farmers welfare and rural development with civil supplies, ministry of civil aviation and other ministries related to food production and distribution, differential and better incentive mechanisms to the farmers and practitioners overall objectivity of future agriculture in India and elsewhere, is to have food production stability and its enhancement despite of climate change with its impacts with enhanced efficiency and lower carbon foot print, lack of data on the rate of adaptation and the existing knowledge level imposes further limits on evaluation of global climate change/environmental impact and its future risks, specific research is necessary to develop innovative way of adaptive measures and co benefits of mitigation for reduced GHG emission in the sector, national adaptation fund sponsored projects need to be region specific, package of climate adaptive technologies implemented under these projects should be monitored by the experts and needful guidance to be taken periodically for better implementation,

action plans should be drawn and collected to be promoted by all the Ministries at the village as a unit, be it the ministry of water resources, animal husbandry and fishery, earth sciences, environment, forestry and climate change along with ministry of agriculture farmer's welfare and rural development.

Conclusion:

It concludes my paper India is a developing country it should take more serious action related to environment and agriculture policies are needed, particularly, for improving agricultural infrastructure, strengthening research and development of new technologies. The Government of India had taken the decision to bring two important Ministries such as Agriculture and Rural Development headed by a single minister. This is another important step contributing that climate change adaptation technologies are implemented in holistic way at the village level as adaptation process is community driven, with aggregating two important ministries, larger synergy is possible in implementing climate adaptation technologies at the ground level, and expected to strengthen further the overall climate adaptation process in agriculture and allied subsectors in India, establishment and implementation of new laws and regulations should be enhanced for the development and transfer of new technologies in the field of agriculture which are environment friendly.

Acknowledgment

I express my sincere gratitude to all those who have directly or indirectly contributed to the successful completion of this work. I am thankful to my institution for providing the necessary academic support and facilities.

I extend my heartfelt thanks to my colleagues and peers for their valuable guidance, cooperation, and encouragement throughout this study. I also acknowledge the scholars and researchers whose works have been referred to, as they provided essential insights and support for this research.

Financial support and sponsorship

Nil.

Conflicts of interest

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

References:

1. Environmental economics latest edition.
2. Agricultural economics latest edition.
3. OECD. 2017. Economic Survey of India.
4. Pratiyogitha Darpan 2022.
5. Indian Journal of Agronomy 68 (2): 115__125 (June 2023)
6. Indian economy 2022-23.
7. Indian economic survey and statistics 2023.
8. Ahluwalia, V.K & Malhotra, S. 2006. Environmental Science, Anne Books India, Delhi.
9. Bajracharya, S.R., Mool, P.K. and Shrestha, B.R. 2007.
10. Impact of Climate Change on Himalayan Glaciers and Glacial Lakes- Case Studies on GLOF and Associated Hazards in Nepal and Bhutan, International Centre for Integrated Mountain Development (ICIMD), Kathmandu.
11. FAO. 2012. Climate change adaptation and mitigation in agriculture. Course: climate change and food security. Rome.
12. Handbook. 2018. Schemes, programmes and missions promoting agricultural development and farmer's welfare.