



Climate Change and Sustainable Food Production: A Time for Paradigm Shift

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Abstract-

Climate change has always dominated the global agenda for sustainable development. It will accelerate the loss of the ecosystems and biodiversity that provide the foundations for human existence, including food production. Climate change is already having profound consequences. Oceans are warming and acidifying, threatening fish stocks. Longer and more intense droughts are imperiling freshwater supplies and crops. Extreme weather events that damage infrastructure, wipe out harvests and erode natural resources are hitting the livelihoods of smallholders farmers, fishers and foresters, who have contributed least to climate change. Without action, the changing climate will affect food availability and hinder access to food by disrupting the livelihoods of millions of rural people. It will cause forced migration and jeopardize the Sustainable Development Goals (SDGs). Rising sea levels and more intense storms and droughts are becoming the new normal. In addition, the imperative of reducing food insecurity and population growth amid changing dietary preferences requires increased food production at a time when natural resources are more and more constrained. Climate – Smart Agriculture (CSA) offers a wealth of opportunities in this respect, combining a focus on sustainably increasing agricultural productivity and incomes: building resilience and adapting to climate change and reducing greenhouse gas emissions, where possible. Agricultural and food system transformation is a crucial part of this action.

KEY Words- Biodiversity, SDG, CSA, Climate Change, Agriculture

Introduction-

Climate change has always dominated the global agenda for sustainable development. It will accelerate the loss of the ecosystems and biodiversity that provide the foundations for human existence, including food production. Climate change is already having profound consequences. Oceans are warming and acidifying, threatening fish stocks. Longer and more intense droughts are imperiling freshwater supplies and crops. Extreme weather events that damage infrastructure, wipe out harvests and erode natural resources are hitting the livelihoods of smallholders farmers, fishers and foresters, who have contributed least to climate change. Without action, the changing climate will affect food availability and hinder access to food by disrupting the livelihoods of millions of rural people. It will cause forced migration and jeopardize the Sustainable Development Goals (SDGs). Rising sea levels and more intense storms and droughts are becoming the new normal. In addition, the imperative of reducing food insecurity and population growth amid changing dietary preferences requires increased food production at a time when natural resources are more and more constrained. Climate – Smart Agriculture (CSA) offers a wealth of opportunities in this respect, combining a focus on sustainably increasing agricultural productivity and incomes: building resilience and adapting to climate change and reducing greenhouse gas emissions, where possible. Agricultural and food system transformation is a crucial part of this action. Climate change is a phenomenon created by multiple simultaneous processes with combined effects and the agriculture sector also contributes to this problem. Effects of climate change are in return also negatively impact the sustainability of agriculture. Present food production process has failed to become sustainable and has been negatively impacting environmental sustainability. This can be seen from the ever increasing dose of fertilizers, pesticides and insecticides in the fields for sustaining the present production of crops or to increase productivity. Overfishing and negligence of the breeding cycle of fishes is also damaging the long term suitability of marine life. Impact of the so-called Green Revolution on Indian agriculture and how it ruined the long term sustainability .

Reason for the Present Circumstances-

Climate change is a phenomenon created by multiple simultaneous processes with combined effects and the agriculture sector also contributes to this problem. Effects of climate change are in return also negatively impact the sustainability of agriculture. Present food production process has failed to become sustainable and has been negatively impacting environmental sustainability. This can be seen from the ever increasing dose of fertilizers, pesticides and insecticides in the fields for sustaining the present production of crops or to increase productivity. Overfishing and negligence of the breeding cycle of fishes is also damaging the long term suitability of marine life. Impact of the so-called Green Revolution on Indian agriculture and how it ruined the long term sustainability .

Modernity and advent of modern science gave humanity a new power over nature unprecedented in the entire human history. Which has led to constant increase in the human population and improvement in the materialistic prosperity of the common man. This has led to constant depletion of natural wealth and gradual decline of sustainability of earth. This is reflected in the domain of industrial production, urbanization and even patterns of consumption. Agricultural practices in the world have also been transformed on the basis of industrial development and modern technology. Today agricultural fields all over the world have been witnessing more and more use of pesticides, fertilizer in the production process. The groundwater table is constantly going down and down. This has challenged the entire ecological cycle. In addition to these impacts, achievement of vital national development goals related to other systems such as habitats, health, energy demand, and infrastructure investments would be adversely affected. The main reason for this is the uni-dimensional approach towards agricultural and food production which do not recognise the diversity of the ecological factors. Paragraph below clearly depicts the diversity of the Indian agricultural landscape and without recognizing it agricultural patterns are bound to fail in the long run.

India's land surface may be classified as (a) the Great Mountain Wall of the North; (b) the Northern Plains; (c) the Great Southern Peninsular Plateau; (d) the Coastal Plains; and (e) the Islands. India's unique geography produces a spectrum of climates yielding a wealth of biological and cultural diversity. Land areas in the north have a continental climate with high summer temperatures with cold winters when temperatures may go below freezing. In contrast are the coastal regions of the country where the temperature is more even throughout the year and rains are more frequent. There is large variation in the amounts of rainfall received in different parts of the country. Average annual rainfall is less than 13 cm in the Thar desert, while at Cherrapunji in the North- East it is as high as 1080 cm. The different climate regimes of the country vary from humid in the North- East (about 180 days rainfall in a year) to arid in Rajasthan (20 days rainfall in a year). A semi-arid belt in the peninsular region extends in the area between the humid west coast and the central and eastern parts of the country. The most important feature of India's climate is the season of concentrated rain called the "monsoon". The Southwest (SW) monsoon (May - September) is the most important feature of the Indian climate. India is a land with many rivers. The twelve major rivers spread over a catchment area of 252.8 million hectares (Mha) cover more than 75 percent of the total area of the country. Rivers in India are classified as Himalayan, Peninsular, Coastal, and Inland drainage basin rivers. The land use pattern is influenced by diverse factors such as population density, urbanization, industry, agriculture, animal husbandry, irrigation demands, and natural calamities like floods and droughts. Despite stresses, the area under forests has increased in recent years due to proactive reforestation and afforestation programmes of the Government of India. Presently 23 per cent of the total land area is under forest and tree cover, while 44 per cent is net sown area. The remaining one-third is roughly equally distributed between fallow land, non-agricultural land, and barren land. ¹

Sustainable agriculture will be based on Agro-climatic conditions of a particular region which would include nature of soil, rainfall and temperature. Any crop which does not formulate a harmonious relationship with its ecology cannot be called sustainable. Time has come for India to build this sustainability criteria for agricultural practices in the different agro-climatic zones. Present government support for crops like paddy and rice in the Punjab , Haryana and Western UP needs to be changed.

¹ "India | UNDP Climate Change Adaptation." <https://www.adaptation-undp.org/explore/india>. Accessed 10 Oct. 2021.

Need to for New Paradigm –

Ecological perspective which lately gained more traction has helped in regaining focus on correcting the present model of growth. That is the reason why the new concept of Sustainable Development has gained more importance in the world. It started with the creation of *Brundtland Commission on Sustainable Development* and culminated in the first World Earth Summit in Rio De Janeiro in 1992. Since 1990, the international community has convened 12 major conferences which have committed Governments to urgently address some of the most pressing problems facing the world today. Taken together, these high profile meetings have achieved a global consensus on the priorities for a new development agenda for the 1990s and beyond. This continuum of conferences represents a remarkable achievement for the United Nations system. Through the conference process the entire international community has come together to agree on shared values, on needs of village societies that stem from their internal class composition, with different interests, adaptive capacities, and livelihood choices.²

For the more than 800 million Indians who live in rural areas and depend on climate-shared goals and on strategies to achieve them. This effort shows one of the United Nations system's greatest strengths: the ability to move from consciousness-raising to agenda-setting to agreement on action by Member States to follow-up on conference commitments and to effective assistance for the countries that need help in realizing their commitments. Taken individually, each conference marked the culmination of many months of consultations among Member States, UN experts and non-governmental representatives, who reviewed vast amounts of information and shared a broad spectrum of experiences in child welfare, environmental protection, human rights, the advancement of women, productive employment, reproductive health and urban development, and the links of these to peace, development and human security. Each conference forged agreements on specific issues in a new spirit of global cooperation and purpose. Every meeting has demonstrated the universality of concern regarding the issues in question. All were convened with the strong support of the UN General Assembly, currently the voice of 185 Member States, and the recognition that the end of the cold war presented the opportunity - indeed, the necessity - to revitalize international cooperation on development issues. All addressed problems of a global magnitude which Member States recognized had grown beyond their individual capacities to solve and which needed a concerted international effort. All of them reflect the work of Member States and a growing number of other actors in the field of international development, particularly non-governmental organizations (NGOs). All of them actively sought out media attention, capturing the imaginations of millions of people around the world and greatly enhancing awareness and understanding of the issues in the public at large.³ There has been a conscious effort to reduce the dependence on Hydrocarbon-Carbon fuels. More priority is being given to the use of clean and renewable sources of energy. This new ecological approach is also transforming the human approach towards agriculture.

Recognition of Agro-Climatic Zones-

Recognition of Agro-Climatic Zones has now become more important for understanding the nature of agriculture in an area. If agriculture practices of particular areas put too much stress on the nature of water or soil content of the fields then that agricultural practice is against the logic of Agro-Climatic Zone. For example, production of Paddy in Punjab and Haryana puts much stress on the ground-water level because of the use of tube-wells to guzzle out water from the land. This also requires a lot of electricity to run those tube-wells which further increases the input cost of agriculture. Plantation of sugarcane Maharashtra is also agro-climatically negative agricultural practices. Maharashtra being a rain deficit area as far as the natural availability of water for the sustainability of sugarcane crop is concerned. Plantation of this crop in Maharashtra over a long period of time led to water –deficiency. Recently the government is taking practical steps to reduce the plantation of such crops to stop the creation of regular drought-like situations. In the context of India, plantation of sugarcane should be restricted to the Flood-plains of north India and water abundant Eastern India. The United Nations General Assembly has adopted Sustainable Development Goals (SDGs) in 2016 which will guide the national development efforts for the next 15 years. The 2030 Agenda for Sustainable Development is another term to refer to this road map for the global community to tackle climate change.⁴ There are at least 5 out of 17 SDGs which

² "Class and climate-change adaptation in rural India - Wiley Online" 4 May. 2021, <https://onlinelibrary.wiley.com/doi/full/10.1002/sd.2201>. Accessed 10 Oct. 2021.

³ "UNCED, Earth Summit - Sustainable Development Goals - the"

<https://sustainabledevelopment.un.org/milestones/unced>. Accessed 10 Oct. 2021.

⁴ "Transforming our world: the 2030 Agenda for Sustainable." <https://sdgs.un.org/2030agenda>. Accessed 10 Oct. 2021.

cannot be attained without the sustainability and success of agriculture. Climate change and the increasingly erratic nature of weather makes it even more crucial to have Climate Smart Agriculture (CSA). This is the reason that the Food Agricultural Organization has declared CSA as one of the 11 Corporate Areas for Resource Mobilization under the FAO's Strategic Objectives to ensure global food availability and livelihood sustainability.

Climate -Smart -Agriculture –

According to the Food Agriculture Organization of the United Nations (FAO) Climate smart agriculture is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. The CSA aims to tackle three main objectives; sustainably increasing agricultural productivity and incomes; adopting and building resilience to climate change; and reducing greenhouse gas emissions.⁵ The CSA will help sustainable food security by transforming the present model of agriculture. The CSA will develop a collaborative approach for this task by communities at the local level and governing authorities and intelligentsia at state and international level. Climate Change, Agriculture and Food Security (CCAFS) is a global agriculture research partnership for a food secure future. This global agricultural research partnership involves different research institutions to search for climate sustainable agricultural practices.

In India the **National Institute of Rural Development and Panchayati Raj** (NIRDPR) which is also the UN-Economic Social Council for Asia Pacific center for excellence in India has become the main institution to conceptualize and materialize Climate Sensitive Agriculture. For the more than 800 million Indians who live in rural areas and depend on climate-sensitive sectors for their livelihoods—agriculture, forests and fisheries—the future looks alarming with the prospect of declining crop yields, degraded lands, water shortages and ill health.

For the more than 800 million Indians who live in rural areas and depend on climate-sensitive sectors for their livelihoods—agriculture, forests and fisheries—the future looks alarming with the prospect of declining crop yields, degraded lands, water shortages and ill health. The Intergovernmental Panel on Climate Change (IPCC) *Special Report* published in 2018 emphasized that populations engaged in agriculture are the most exposed to the impact of climate change.¹ India, as a predominantly agricultural society, with two-thirds of its population living in rural areas, is particularly vulnerable. In 2018, the World Bank's *South Asia's Hotspots* report suggested that climate change may cost India 2.8 percent of its GDP by 2050. A more recent study by the Council on Energy, Environment, and Water (Mohanty, 2021) shows India to be the fifth most vulnerable country globally in terms of extreme climate events with over 75% of Indian districts considered “hotspots of extreme climate events” (Mohanty, 2021). Despite the significance of this issue, empirical research into understandings of the complex economic and social relations with climate adaptation at local levels are largely absent, with most research focused at the levels of international governance or national policies. Such research is top-down, as are the policies that flow from it, which in turn ignores the diversity-sensitive sectors for their livelihoods—agriculture, forests and fisheries—the future looks alarming with the prospect of declining crop yields, degraded lands, water shortages and ill health.⁶

Climate-Smart Agriculture and the World Bank Group -

The World Bank Group (WBG) is currently scaling up climate-smart agriculture. In its first [Climate Change Action Plan](#) (2016-2020), as well as the forthcoming update covering 2021-2025, the World Bank committed to working with countries to deliver climate-smart agriculture which would fulfill the triple goals of increased productivity, enhanced resilience, and reduced emissions. In 2020, 52 percent of World Bank financing in agriculture also targeted climate adaptation and mitigation.

The WBG portfolio will also increase its focus on impact at scale and be rebalanced to have a greater focus on adaptation and resilience. To enable these commitments, we are screening all projects for climate risks, and will continue to develop and use metrics and indicators to measure outcomes, and account for greenhouse gas emissions in our projects and operations. These actions will help our client countries implement their Nationally Determined Contributions (NDCs) in

⁵ Official website of FAO.

⁶ "India | UNDP Climate Change Adaptation." <https://www.adaptation-undp.org/explore/india>. Accessed 10 Oct. 2021.

the agriculture sector, and will contribute to progress on the [Sustainable Development Goals](#) (SDGs) for climate action, poverty, and the eradication of hunger.

The World Bank Group also backs research programs such as the [CGIAR](#), which develops climate-smart technologies and management methods, early warning systems, risk insurance, and other innovations that promote resilience and combat climate change.

The [Climate-Smart Agriculture \(CSA\) Country Profiles](#) bridge a knowledge gap by providing clarity on CSA terminology, components, relevant issues, and how to contextualize them under different country conditions. These profiles are also a methodology for assessing a baseline on climate-smart agriculture at the country level (both national and sub-national) that can guide climate-smart investments and development. The World Bank has also developed more than 10 [Climate-Smart Agriculture Investment Plans](#) (CSAIPs) for [Bangladesh](#), [Zimbabwe](#), [Zambia](#), [Lesotho](#), [Mali](#), Burkina Faso, Ghana, [Cote D'Ivoire](#), Morocco, and The Republic of Congo. The CSAIPs identify CSA investments totaling more than US\$2.5 billion, with the potential to benefit over 80 million people across the covered countries.

The Bank's support of CSA is making a difference across the globe:

In [Bangladesh](#), a project aims to boost the resilience of livestock farmers by improving animal health and addressing climate mitigation by improving emissions intensity and improving production efficiency, including improvements in feeding strategies, animal health, breeding, manure and waste management, as well as low-emission technologies for activities such as milk chilling and transport.

In China, a suite of projects representing US\$755 million of World Bank investments supports resilient and lower-emissions agriculture practices and institutions. [One project](#) has helped expand climate-smart agriculture through better water-use efficiency on 44,000 hectares of farmland and new technologies that have improved soil conditions, and boosted production of rice by 12% and maize by 9%. More than 29,000 farmers' cooperatives have reported higher incomes and increased climate resilience through this project. Another recently [completed proj](#) Find out more about CSA basics, planning, financing, investing, and more in the [online guide to CSA](#) developed in collaboration with the Research Program on Climate Change, Agriculture, and Food Security (CCAFA) of the CGIAR.

Zero Budget Natural Farming

Presently ever increasing input cost of agricultural production is one of the leading reasons behind the farmers indebtedness and financial stress. Zero Budget Natural Farming has been conceptualized to reduce the cost of inputs in the agricultural production process. Zero Budget Natural Farming (ZBNF) is a set of farming methods, and also a grassroots peasant movement, which has spread to various states in India. It has attained wide success in southern India, especially the southern Indian state of Karnataka where it first evolved. The movement in Karnataka state was born out of collaboration between Mr Subhash Palekar, who put together the ZBNF practices, and the state farmers association Karnataka Rajya Raitha Sangha (KRRS), a member of La Via Campesina (LVC).

The *neoliberalization* of the Indian economy led to a deep agrarian crisis that is making small scale farming an unviable vocation. Privatized seeds, inputs, and markets are inaccessible and expensive for peasants. Indian farmers increasingly find themselves in a vicious cycle of debt, because of the high production costs, high interest rates for credit, the volatile market prices of crops, the rising costs of fossil fuel based inputs, and private seeds. Debt is a problem for farmers of all sizes in India. Under such conditions, 'zero budget' farming promises to end a reliance on loans and drastically cut production costs, ending the debt cycle for desperate farmers. The word 'budget' refers to credit and expenses, thus the phrase 'Zero Budget' means without using any credit, and without spending any money on purchased inputs. 'Natural farming' means farming *with* Nature and *without* chemicals.⁷ UNO is celebrating 2019 to 2028 as **the UN Decade of Family Farming**. This signifies the pivotal role the family farmers will play in ensuring the food security and production of the world and empowerment of the family farms will be essential for the eradication of poverty and malnutrition too. **UN Declaration on Rights of Peasants and Other People Working in Rural Areas (UNDROP)** this treaty recognizes the rights of peasants and laborers working in the agricultural field. Sustainable Development Goal of zero poverty and zero hunger will not be fulfilled until the farming households are not strengthened. The UNDROP its article 9 demands

⁷ "Zero Budget Natural Farming in India | FAO." <http://www.fao.org/family-farming/detail/en/c/429762/>. Accessed 10 Oct. 2021.

that ownership of plant genetic resources should vest with the farmers. This treaty recognizes peasants right on water , seeds ,respectable livelihood and ownership of land .⁸

PERMACULTURE A New Approach Towards Land Management- permaculture is an innovative framework for creating sustainable ways of living . It is a practical method of developing ecological harmonious, efficient and productive systems that can be used by anyone ,anywhere.⁹ Permaculture is a holistic philosophy which includes all aspects of life-style like food ,shelter ,energy and other material needs like clothing etc. Permaculture espouses the philosophy of minimal consumption towards the materialistic resources in life. Growth and production should be based on the sustainability of nature which would ensure justice to the future generations. Permaculture approach has very low input cost and this approach will be very helpful for the small- marginal farmers and rural communities with low incomes. permaculture is based on working with the science of ecology which is a conceptual understanding of the relationship between soil , groundwater and vegetation to sustain the fertility of the land.

Sustainable Fishing-

Sustainable fishing must be based on the life -cyclical nature of the oceanic and freshwater wildlife and it should take into consideration of fishing upon the long term survivability of the fishes. Aquatic species of fish and invertebrates constitute an important component of food security . Sea food is the source of protein and other nutrients for the local community. For thousands of years, people have fished to feed families and local communities. *Demand for seafood and advances in technology have led to fishing practices that are depleting fish and shellfish populations around the world. Fishers remove more than 77 billion kilograms (170 billion pounds) of wildlife from the sea each year. Scientists fear that continuing to fish at this rate may soon result in a collapse of the world's fisheries. In order to continue relying on the ocean as an important food source, economists and conservationists say we will need to employ sustainable fishing practices.*¹⁰

Decimation of the population of bluefin tuna by commercial fishing is a classical example of how modern fishing technologies like *purse seining* and *longlining* can endanger the existence of any species within a few decades. Commercial fishing without understanding the logic of sustainability usually leads to overfishing. Overfishing takes away the capacity of regeneration from any species due to fishing of a large chunk out of its population. Beluga sturgeon of the Caspian sea are facing an existential threat due to global demand for its eggs for consumption which is cutting the possibility of having new calves. Overfishing in the fresh water can also devastate the species of a lake or river. There is a need to develop a regulatory framework for fishing which would take into consideration species' life cycle , its migration and its role in the larger ecosystem.

Conclusion-

Climate Change has become the biggest shock to humanity and now it is challenging the very existence of human life. Food security has become one the most important challenges for the survival of the Humanity. Human activities like agriculture , animal husbandry and fisheries are now to be conducted within the framework of climate sustainability. Government policies and incentives should be in sync with climate sustainability and such crops should be supported by the state. The use of fertilizers and expensive seeds are also problems in the path of Sustainable agriculture practices.

⁸ "UNDROP - La Via Campesina." <https://viacampesina.org/en/tag/undrop/>. Accessed 10 Oct. 2021.

⁹ "What is permaculture?." <https://www.permaculture.co.uk/what-is-permaculture>. Accessed 10 Oct. 2021.

¹⁰ "sustainable fishing | National Geographic Society." 31 Jul. 2019,

<https://www.nationalgeographic.org/encyclopedia/sustainable-fishing/>. Accessed 11 Oct. 2021.