



ENVIRONMENT CHANGE AND ITS IMPACT ON AGRICULTURE

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ABSTRACT:

Environment change has emerged a major challenge for sustainable human settlement. It has adverse impact on wild life, agriculture, incidence of diseases, local weather, rise in sea level, more heat waves etc. India is highly vulnerable to climate change as its economy is heavily depends on climate sensitive sector like agriculture. People in India, especially the poorest, are vulnerable to the impact of climate change because the nation's economy is so closely tied to natural resources. More than 56 per cent of workers are engaged in agriculture and allied sectors. Most of India's poorest people live in rural areas, almost totally reliant on natural resources for their food, shelter and incomes. Climate change affects agriculture in complex ways. The climate change will affect crop yields and cropping pattern due to direct effects of changes in atmospheric concentrations of green house gases in general and CO₂ in particular. It affects food production directly through changes in agro- ecological conditions and indirectly by affecting growth and distribution of incomes, and thus demand for agricultural produce. Agricultural outcomes are determined by complex interactions among people, policies and nature. Crops and animals are affected by changes in temperature and precipitation, but they are also influenced by human investments such as irrigation systems, transportation infrastructure, and animal shelters. However, uncertainties about where climate change will take place and how farmer will respond make it difficult to move forward on policies to combat the effects of climate change. If humanity along with the other flora and fauna has to survive on this planet, all nations – developed and developing must make sincere efforts to mitigate the effects of climate change. Today it is the poor who experience the deathly impact of climate change. Tomorrow it will be humanity as a whole who have to face consequences of climate change.

KEYWORDS: *climate change , crop yields and cropping pattern , policies.*

INTRODUCTION:

Agriculture is the income provider for more than sixty five percent of the population. Although the contribution of the agriculture to Indian GDP has gone down considerably in the last few years this sector continues to be the largest economic sector in India. Agriculture outcomes are determined by complex interactions among people, policies, and nature. Crops and animals are affected by changes in temperature and precipitation, but they are also influenced by human investments such as irrigation systems, transportation infrastructure, and animal shelters. However uncertainties about where climate change will take and how farmers will respond make it difficult to move forward on policies to combat the effects of climate change. Today agriculture contributes about 14 percent of annual GHG emissions, and land –use change, including forest loss, contributes another 19 percent with the developing world accounting for about 50 percent of agricultural emissions and 80 percent of land-use

change and forestry emissions. This paper reviews the impacts of climate change on agriculture and food security and suggests some strategies to mitigate the problem.

ENVIRONMENT CHANGE

Environment change is perhaps the biggest challenge facing the world today. Weather is the condition of the atmosphere at a particular place and time. It is characterized by parameters such as temperature, humidity, rain and wind. Climate is the long term pattern of weather conditions for a given area. Climate change is the most important global environmental challenge facing humanity with implications for natural ecosystem, agriculture and health. Climate change refers to a statistically significant variation in either the means of climate or in its variability, persisting for an extended period. Environmental change might be because of common inside procedures or outside compelling, or to tenacious anthropogenic changes in the organization of the climate or in land use.

Climate variability and climate change are resulting in a more severe occurrence of extreme events, such as droughts, floods and cyclones, which affect the poor most, and jeopardize agricultural production and livelihoods of rural communities. The impacts on countries like India are likely to be significant as about 20 percent of India's GDP is attributable to the agricultural sector which employs 57 percent of the total workforce.

EFFECTS OF CLIMATE CHANGE

The component of natural eco- system are very much sensitive to change in weather and climate, particularly to extreme weather events, decrease soil moisture, temperature change and increase in carbon dioxide in atmosphere. So vegetation and agriculture are likely to be affected from such changes in weather and atmosphere. Increase in CO₂ level may result in an increase in food production .It is predicted that a two fold increase in carbon dioxide will lead to a 10 - 15 percent increase in dry matter production provided all other factors remain constant.

In spite of innovative advances, for example, improved assortments, hereditarily changed life form, and water system frameworks, climate is as yet a key factor in agrarian profitability just as soil properties and characteristic networks. The impact of atmosphere on horticulture is identified with fluctuation in neighborhood atmospheres instead of in worldwide atmosphere designs.

Then again, agrarian exchange has developed as of late and now gives critical measures of nourishment on a national dimension to real bringing in nations just as agreeable pay to sending out ones. The universal part of exchange and security regarding nourishment infers the need to likewise consider the impacts of environmental change on a worldwide scale. Increasingly good consequences for yield will in general depend to a huge degree on acknowledgment of the possibly valuable impacts of carbon dioxide on harvest development and increment of effectiveness in water use. Decline in potential yields is probably going to be brought about by shortening of the developing time frame.

Over the long haul, the climatic change could influence agribusiness in a few different ways:

- Productivity, as far as amount and nature of yields.
- Agricultural practices, through changes of water use (irrigation) and agricultural inputs such as pesticides and fertilizers.
- Environmental impacts, specifically in connection of recurrence and force of soil waste, soil disintegration, decrease of yield assorted variety.
- Rural space, through the misfortune and addition of developed grounds, land theory, land renunciation, and pressure driven courtesies.
- Adaptation, creature may turn out to be pretty much aggressive life form, for example, people may create criticalness to grow progressively focused life forms, for example, flood safe or salt safe assortments of rice.

The global warming is likely to affect the following phenomena, which will ultimately affect the agro- ecosystem.

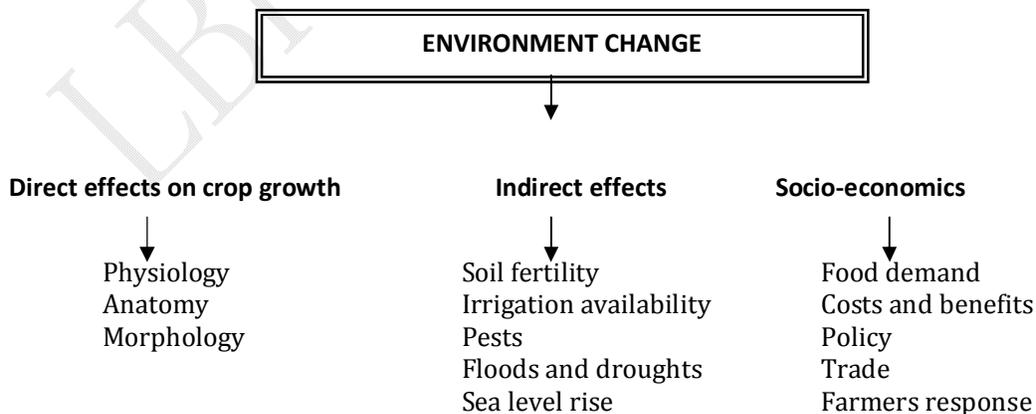
- Evaporation will increase
- Water and soil temperature will rise
- Soil water will become insufficient.
- Cultivable areas will be enlarged.
- The incidence of insect pests, diseases and weeds becomes higher.
- Snowing period will shorten.
- The deterioration of soil fertility will be quickened.
- The activity of microorganisms will increase.
- The decomposition of organic matter and fertilizers will be promoted.
- Soil and shore erosion will be quickened.

Fast environmental change, notwithstanding, could hurt agribusiness in numerous nations, particularly those that are as of now experiencing rather poor soil and atmosphere conditions, in light of the fact that there is less time for ideal regular choice and adjustment.

IMPACTS ON AGRICULTURE

Agriculture will be impacted by climate change in several ways. India is a large country with 15 agro-climatic zones, with diverse seasons, crops and farming systems. For a majority of people in India, to this day, agriculture is the main source of livelihood. Agriculture is the most vulnerable sector to climate change as it is inherently sensitive to climate variability and climate change will leave its impacts on Indian agriculture in various direct and indirect ways. This obviously means an impact on the lives and livelihoods of millions of Indians. For instance, it is reported that about two-thirds of the sown area in the country is drought-prone and around 40 million hectares is flood-prone. The poorest people are likely to be hardest hit by the impacts of climate variability and change because they rely heavily on climate-sensitive sectors such as rain fed agriculture and fisheries. They also tend to be located geographically in more exposed or marginal areas, such as flood plains or nutrient-poor soils. The poor also are less able to respond due to limited human, institutional and financial capacity and have very limited ability to cope with climate impacts and to adapt to a changing hazard burden.

Declining agricultural productivity in the face of climate change and competition for limited water resources in India could have far reaching consequences. With nearly 70 percent of India’s population living in rural areas and around 60 percent of the labor force engaged in agriculture, sustaining increases in agricultural productivity and efficient use of land, water, and energy resources will have a large impact on the livelihoods of hundreds of millions of people. Indian farmers face a difficult task of meeting the food needs of a growing population while coping with decreased areas of arable land, increasingly scarce water supplies, and greater intensity and frequency of extreme weather events. New agricultural technologies and practices can help develop more adaptable crops that produce significantly higher yields while helping to mitigate food shortages and volatile pricing.



Environmental change and farming are interrelated procedures, the two of which occur on a worldwide scale and throughout the following century may effectsly affect crop generation and sustenance accessibility. It is speculated that by 2050, there would not be any glacier in the world. The melting of ice would result in frequent floods significant rise in sea level. Floods will destroy standing crops, forest fire will be a common phenomenon in drought- affected areas, more water will be necessary for irrigation, cultivable will become infertile, and rainfall at regional level exhibits an increasing or decreasing trend. These changes will in turn cause deterioration of existing eco-systems. Climate change is affecting India in a big way and its impacts are many and serious – erratic monsoon, migration of agriculture zones, spread of tropical diseases, sea level rise, change in availability of fresh water, floods, droughts, heat waves, storms, hurricanes etc. Abrupt climate change could make large areas of the country uninhabitable. The impact of climate change on agriculture could result in problems with food security and may threaten the livelihood activities upon which much of the population depends. Climate change can affect crop yields (both positively and negatively), as well as the types of crops that can be grown in certain areas by impacting agricultural inputs such as water for irrigation, amounts of solar radiation that affects plant growth as well as the prevalence of pests. The general impacts of worldwide atmosphere changes on horticulture may help to legitimately foresee and adjust cultivating to boost farming creation.

FOOD SECURITY

Climate change will have an adverse impact on food security. Food cost will increase as food availability (cereals, livestock products, fish) will decrease. Disadvantaged regions and socially and economically backward people will be affected more. Food security would be further exacerbated by loss of cultivable land and nursery areas for fisheries, by inundation and coastal erosion in low lying areas. Predictions based on modeling studies indicate that substantial losses are likely in rain-fed wheat in South and South East Asia. A 0.5°C rise in winter temperature would reduce wheat yield by 0.45 tonne per hectare. Bundelkhand region in India is the worst sufferer of climate change. There has been acute draught and distress including starvation deaths for last 3-4 year. 25 percent people did not have two-square meals and only 5 percent had nutritionally balanced food.

PREDICTED CLIMATE CHANGE IMPACTS ON CROPS

The climate change will affect crop yields and cropping pattern due to direct effects of changes in atmospheric concentrations of green house gases in general and carbon dioxide in particular. For example, an increase of temperature from 1 to 4°C can reduced grain yield of rice by 0-49%, potato by 5 to 40%, green gram by 13-30% and soybean by 11-36%.Climate change can shorten Rabi season and decrease yield. Vulnerability to disease and pest increases. High temperatures affect the quality of produce. Increase in temperature can reduce 1000grain weight and the amylase content and also adversely affected grain elongation and aroma in basmati. Increase in temperature cause distress to dairy animals affecting milk production. Studies indicated that India loses 1.8million tones of milk production due to climate stresses.

The impact should be higher on C3 crops such as wheat and rice than on C4 plants like maize and grasses. The predicted changes to agriculture vary greatly by region and crop. Findings for wheat and rice are reported here:

WHEAT PRODUCTION

- It is estimated that we could lose 3.9 million tones of wheat due to climatic change by 2020, 11.7 million tones by 2050 and 23.5million tones of wheat by 2080.
- It is discovered that increments in temperature (by about 2°C) diminished potential grain yields in many spots. Locales with higher potential profitability, (for example, northern India) were moderately less affected by environmental change than territories with lower potential efficiency (the decrease in yields was a lot littler);

- Climate change is additionally anticipated to prompt limit changes in territories appropriate for developing certain yields.
- Reductions in yields because of environmental change are anticipated to be increasingly articulated for downpour bolstered crops (rather than flooded crops) and under restricted water supply circumstances in light of the fact that there are no ways of dealing with stress for precipitation fluctuation.
- The contrast in yield is impacted by benchmark atmosphere. In sub tropical conditions the decline in potential wheat yields ran from 1.5 to 5.8%, while in tropical territories the diminishing was moderately higher, proposing that hotter locales can anticipate more noteworthy harvest misfortunes.

RICE PRODUCTION

- Overall, temperature increments are anticipated to lessen rice yields. An expansion of 2-4°C is anticipated to result in a decrease in yields.
- Eastern areas are anticipated to be most affected by expanded temperatures and diminished radiation, bringing about generally less grains and shorter grain filling terms.
- By differentiate, potential decreases in yields because of expanded temperatures in Northern India are anticipated to be balanced by higher radiation, diminishing the effects of environmental change.
- Although extra CO₂ can profit crops, this impact was invalidated by an expansion of temperature.

THE COPENHAGEN EXPERIENCE

Amidst buzzing expectations, rallying protestors, leaked emails and draft Danish texts, the much awaited 15th United Nations Climate Change Conference (COP15) took place at Bella Center in Copenhagen from the 7th to the 18th of December, 2009. The conference with participants from 192 countries representing governments, business community and civil society was aimed to evolve a successor to Kyoto protocol the first phase of which expires in 2012. The core issue such as the cut in GHG emission by developed and developing nations and the financial assistance to poorer nations of the world to cope with climate change were discussed and quite expectedly a consensus was not reached.

After much deliberations and discussions the Copenhagen Accord was reached which was drafted by the US, China, India, Brazil and South Africa on December 18. It was “recognized”, but not “agreed upon”, in a debate of all the participating countries the next day, and it was not passed unanimously. The document recognized that climate change is one of the greatest challenges of the present and that action should be taken to keep any temperature increase to below 2°C. The document is not legally binding and does not contain any legally binding commitments for reducing CO₂ emissions. Although the Heads of States participating in the conferences were cautious enough to use words like ‘pleased’ and ‘meaningful’, the futility of the whole exercise was widely evident in their measured optimism.

“As serious as it is, climate change is just one of a host of challenges that will reduce grain yields for smallholder dry land farmers of the future,” caution William D Dar, Director General, ICRISAT. Climate change is not a possibility but a real threat, the signs of which are apparent from the untimely rains, drought, flood and declining crop productivity. The Intergovernmental Panel on climate change (IPCC) concluded in its most recent assessment that “At lower latitudes, especially in seasonally dry and tropical regions, crop productivity is projected to decrease for even small local temperature increase (1-2°C), which would increase the risk of hunger”.

With the changing climate, the crop will be facing newer challenges. The scientific communities who are sensitized with the issue are on the path to realize their goal of evolving varieties which are resistant to draught and other calamities. Agriculture uses 70 percent of world fresh water. Draught resistant crops that are more efficient users of water are under development which will help in improving productivity even by conserving valuable resource like water. It will also help in mitigating the effects of global warming to certain extent.

MITIGATION STRATEGIES

Agriculture is one of the major sources of greenhouse gas emissions. Climate change has been a cause of serious concern if the agricultural sector has to grow in the context of country's overall economic growth, to respond to rural households' livelihood, country's food security and poverty alleviation. There are several agricultural practices which can be fine tuned to reduce the emission of green house gases from the agricultural fields. Agricultural scientist can play a significant role by designing suitable long term experiments to continuously monitor fluxes of water, energy, nutrients, gas exchange and salts in major crops and cropping systems in a changing scenario of climate for devising location specific strategies.

Some of the strategies to negate the impacts of climate change on agriculture are:

- 1) Improve management of rice production through judicious use of organic manure, fertilizers, irrigation water, nitrification inhibitors, fertilizer placement and their scheduling.
- 2) Improved management of livestock population especially ruminants and its diet.
- 3) Increase soil organic carbon through minimal tillage and residue management
- 4) Improved energy use efficiency in agriculture through better designs of machinery, and by resource conservation practices.
- 5) Change land use by increasing area under bio-fuels, agro-forestry- but on the cost of food production.
- 6) Devising agronomic practices which may moderate the predicted climate changes and promotion of conservation agriculture practices such as zero tillage, bed planting, residue management and crop rotation.
- 7) There is a need to develop contingency plans to cope with weather related aberrations such as cold, heat wave and drought. These contingent plans should be such that can be practically implemented on a short notice/ warning.

CONCLUSION

Climate change is the major, overriding environmental issue of our time and the single greatest challenge facing environmental regulators. It is a growing crisis with economic, health and safety, food production, security and other dimensions. The changing temperature and rainfall pattern and increasing carbon dioxide level will undoubtedly have important effects on global agriculture and thus on food security . Appraisal of the impacts of environmental change on horticulture may help to legitimately envision and adjust cultivating to augment agrarian creation. Understanding the relationship between climate change and agriculture is an essential first step towards enacting effective and efficient solutions. Climate change will have dramatic consequences for agriculture. Developing economies and the poor would be the hardest hit because they do not have the resources to cope up with the changes.

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