CLIMATE CHANGE AND RURAL DEVELOPMENT: THE CHALLENGE FOR AGRICULTURAL DYNAMICS

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INTRODUCTION

First there were the Industrial and Agrarian Revolutions and then, in our time, the Information Communication Technology Revolution. However, all the achievements made in those revolutions may well be rendered meaningless by what might be termed the Climate Change Revolution. It is imperative that we recognize the problem of climate change, especially in India where the majority of the population is rural and depends directly on climate sensitive sectors (agriculture, forests and fisheries) and natural resources (water, bio-diversity, mangroves, coastal zones etc.) for their sustenance and livelihoods.

IMPACT OF CLIMATE CHANGE IN RURAL INDIA

Our culture has always emphasized not picking flowers, fruits or leaves after sunset or cutting down trees without a good reason. Before eating, we used to feed part of our food of birds and even ants. Thus what our culture has taught us since time immemorial is to respect nature and let there be harmony between different living species. But in the name of achieving development, we have closed our eyes and exploited natural resources to whatever extent is possible, leading to environmental degradation, which in turn has led to what we call climate change.

Climate Change, according to the World Bank, is a change of climate that is attributed directly or indirectly to human activity, a change that alters the composition of the global atmosphere and that is a change in addition to natural climate variability observed over comparable time periods.[1] Climate change is basically caused by the accumulation of greenhouse gases like carbon dioxide, methane, sulphur dioxide, chloro fluoro carbons etc., in the lower atmosphere. This is because of excessive anthropogenic/ human activities as opposed to those occurring naturally in bio-physical environments.

The major challenges faced by people living in rural areas are lack of drinking water, inadequate food, little or no electricity, poor health facilities and insufficient roads. The one factor which influences all the above factors is climate change. In recent times everybody has been talking about climate change and its impact in general, but no one emphasizes its impact on people living in rural areas, although the majority of the population throughout the world lives there. In India, 68% of the population lives in villages.

As Mahatma Gandhi rightly said, "The universe is contained in the self; so is India contained in the villages". We need to look at the challenges faced by rural people at present and those they are likely to face in the future because of the effects of climate change on their social, economic and cultural fabric. Already, the benefits of the increasing economic growth of our country are not distributed equally among people and areas, particularly rural areas. We depend on the environment for food, water, air, fuel etc., which are all essential for our survival. However, this is more of a concern to those living in rural areas as their livelihoods also depend on it.

Rural people work in agriculture, fisheries and forests, as well as carrying out non-farm activities such as weaving and carpentry. Out of these, agriculture and forestry contribute most of the income of the rural population. More than 55% of the country's consumers draw their livelihood directly from agriculture as cultivators and agricultural laborers. Moreover, rural non-farm workers, such as rural artisans and rural service providers, also

depend on the growth of farmers' incomes.[2] There has been a lot of desperate migration of these poor villagers to the towns and cities in search of ways to make a living and this will increase when the land is no longer productive or severe drought, flood and other extreme weather conditions make it impossible to earn a living by farming. In peninsular and coastal areas, as the sea level rises, many areas will be submerged, which will also increase migration both within the state and to the neighbouring states. This will have political implications too, as these climate migrants will put pressure on an already existing lack of infrastructure and basic amenities.

FOOD PRODUCTION AND CLIMATE CHANGE

The present state of food inflation in our country is mainly due to side factors like supply and demand. The supply of agricultural commodities is affected by factors like droughts, floods, extreme climate and other natural vagaries and it fluctuates across regions and years. A good example is the heavy rainfall in Vidarbha region this year, compared to the last 5 to 8 years when the region experienced serious drought and there were many cases of farmers' suicides. Suicide-prone districts are increasing day by day and will increase still further the impact of climate change. Already in the present budget, Rs 96 crores has been allocated as a special package for the farming population in 31 suicide-prone districts.

With the rising prices of commodities like pulses, wheat, cereals and vegetables which is one consequence of climate change, life will become harder for the common masses and in particular, the nutritional status of rural people will suffer. According the World Bank president Robert B. Zoellick, a doubling of food prices over the last three years could potentially push 100 million people in low-income countries deeper into poverty. As per the Food Agriculture Organization commodities price data, the prices of three important cereals, namely, rice, wheat and maize, increased respectively from $334, $247, and $161 per tonne in 2007 to $638, $354 and $ 212 per tonne in 2008 (up to April 2008), recording an average increase of 91, 44 and 32 percent, respectively.[3] Climate change is not the only reason for food inflation; there are other reasons such as speculative activity in the market, changes in diet patterns, increase in the growth of population and the purchasing power of the people.

There will be problems of food security in the country in the near future, as it will not be possible to feed the growing population, because the productivity of agricultural land will be affected by climate change. Of a total land area of 328 million hectares, 156 million hectares is cultivable land. Besides this, 69.41 million hectares of forest lands provide plentiful natural herbal and medicinal plants to practise ayurvedic enterprises. The net cropped area is 142 million hectares with 190 million hectares as gross cropped area. Around 54.68 million hectares is net irrigated.[4] The present United Progressive Alliance (UPA) government at the centre intends to make a law on food security, providing the right to food for everyone below the poverty line. We have already seen that population is going to affect us in the future; there is also talk at government level that this law will be first implemented in only 150 of the most disadvantaged districts and then afterwards uniformly implemented, because of constraints in the food grains production front. Even providing food for more than 8 crores of people below the poverty line, the majority of whom are from rural areas, is currently a problem for the government; what will be the situation when the population grows further and agriculture is affected by climate change? Our country is already way off track in achieving the United Nations Millennium Development Goals. The very first goal, halving poverty and hunger by 2015, seems to be far away. According to Millennium Development Goals Indicators, the population below the national poverty line was 36.0% in 1994, which decreased to 28.6% in 2000. For urban areas it was 32.4% in 1994 and in 2000 24.7%. In rural areas it was 37.3% in 1994 and 30.2% in 2000.

But whether the above data reflecst the true picture is questionable, if we consider the data of various committees set up by the Government Of India in recent times such as the Arjun Sen Gupta Committee which said that 77% of the population has a purchasing power below 20 rupees. The Suresh Tendulkar

Committee says that 37% of the population live below the poverty line. The D.P Wadhwa Committee has recommended that people earning less than 100 rupees per day be treated as below the poverty line. The percentage of people suffering poverty and hunger has not reduced much in rural areas compared to urban areas, and is increasing day by day. We must also take into account the reduction in the growth of agriculture and allied activities from 4.9% in 2007-08 to 1.6% in 2008-09 and 0.2% in 2009-10. Even if we look at the current scenario, budget year (2010-11), its contribution is still negative and there is very little optimism about it. The rate of growth in food grains is lower than the average rate of population growth was between 1990 and 2007; it was 1.25 for food grains and 1.9% for population.

Trends in yield of food grains- crop, kg/ha

Items	1950-51	2001-02	2007-08
Food grains	522	1734	1854
Pulses	441	0607	0638
Rice	688	2079	2203
Wheat	633	2762	2785
Oil seeds	481	0913	1086

Government of India (2009-10), Economic Survey, Ministry of Economic Affairs, New Delhi[5]

HOW AGRICULTURE CONTRIBUTES TOWARDS CLIMATE CHANGE

Agriculture is the source of livelihood for many Indians, but it also contributes to anthropogenic greenhouse gas emissions. It contributes 28% of total greenhouse gas emissions, out of which ruminants contribute 65%, followed by rice cultivation 23% and application of nitrogenous fertilizer 10%. (See the table below)

Greenhouse gas inventory for Indian agriculture (2000)

Source	Methane (Tg)	Nitrous oxide (Gg)	Carbon dioxide (Tg)
Ruminant	10.1	-	252.0
Rice cultivation	3.5	-	87.3
Manure	0.1	0.1	2.5
Crop residue	0.2	4.0	4.9
Soil	-	132.3	39.4
Total	14.7	137.3	386.1

Tg-million tonnes; Gg-thousand tones
Annual Report of Indian Council Agricultural Research; 2009-10[6]

There have been huge indiscriminate uses of pesticides, chemicals etc. in agricultural practices which have led to serious environmental problems like water pollution, soil degradation and less nutrient food. Consider for example, the role of nitrogen-based chemical fertilizer. Farmers are using so much that our lakes, rivers and estuaries are becoming poisoned by excessive nitrogen (and phosphorous) runoff, leading to eutrophication, marine dead zones, and the massive destruction of vulnerable and vital marine eco systems. Moreover, the nitrogen inputs, while essential for food production, are also a source of nitrous oxide emissions, one of the three main greenhouse gases leading to manmade climate change.[7] India's forest occupies 22% and most land not under agriculture. Some 275 million rural poor depend on it for part of their livelihoods but in recent times there has been a trend of deforestation by conversion and habitat fragmentation of hard wood and coniferous forests, tropical rainforests, woodlands,

chaparral and shrub lands and native grass lands into farming fields and pastures, including clear cutting and slash-and-burn methods, all of which contribute towards climate change[8] as the loss of forest reduces the planet's natural carbon sink.

The Green Revolution which took place in the 1960s in two important states, Haryana and Punjab, led to huge production in food grains, which was productive in the short term but in the long term, it is not ecologically sound as the unlimited use of land, water and more importantly various pesticides and chemical fertilizers has led to ecological distress, which we are presently seeing in these states. Even various unsound ecological public policies adopted by the central and state government such as providing subsidies on various chemical fertilizers and diesel, supplying free electricity or charging a reduced amount have led to ecological degradation. There is also the practice of burning agricultural crop waste such as rice straw and sugar cane stubble and other crop residues, all of which result in the release of carbon dioxide into the atmosphere.

RECENT INITIATIVES OF THE INDIAN GOVERNMENT IN THE CONTEXT OF CLIMATE CHANGE

On 30th June 2008, the Government of India released the National Action Plan on Climate Change (NAPCC), in which eight National Missions are given. They are (A) National Solar Mission, (B) National Mission on Enhanced Energy Efficiency, (C) National Mission on Sustainable Habitat, (D) National Water Mission, (E) National Mission for Sustaining the Himalayan Eco-system, (F) National Mission for a Green India, (G) National Mission for Sustainable Agriculture and (H) National Mission on Strategic Knowledge for Climate Change. The National Mission for Sustainable Agriculture is important in the context of this article. The proposed mission will focus on four areas crucial to agriculture in adapting to climate change, namely (1) dry land agriculture, (2) risk management, (3) access to information, and (4) use of biotechnology. It will also identify and develop new varieties of crops, especially thermal resistant crops and alternative cropping patterns capable of withstanding extremes of weather, long dry spells, flooding and variable moisture availability. Information technology, geospatial technologies and biotechnology, new credit and insurance mechanisms will be devised to facilitate the adoption of desired practices.[9]

The 13th Finance Commission has recommended grants of 15,000 crores to every state to encourage them to adopt renewable energy sources, improve their water management systems and conserve forests. The amount has been divided into three installments. The first two have been sanctioned and released to respective states, while the third and final installment will depend upon the states' performance in the previous two installments. The Gujarat government recently formed a new Climate Change Department, which was the first such department in Asia and sixth in the world. A Climate Change Trust Fund has also been set up, whose function is to conduct the research, development and commercialization of green technology. The main focus will be to study the effects of climate change on agriculture, health etc.

Recently, before the Copenhagen Conference held in Denmark in December 2009, the Indian Government announced that by 2020, it will reduce its emissions' intensity by 20-25%. In this context, India released its first Greenhouse Gas Emissions inventory since 1994 showing a 30% fall in the emissions' intensity of the G.D.P from then until 2007. However, the inventory also shows that emissions grew 58% from 1.25 billion tonnes in 1994 to 1.9 billion tonnes in 2007. The forestry sector acted as a carbon sink, sequestering 177 million tonnes of greenhouse gas emissions. In per capita terms, emissions rose from 1.4 tonnes to 1.7 tonnes without taking forestry compensation into account.[10]

The Planning Commission has also set up a group of experts whose main function is to develop a strategy for adopting a low carbon economy, which can be implemented from the 12th Five Year Plan. Forestry related activities have been included under the Mahatma Gandhi National Rural Employment Guarantee Programme, which will help reforestation. The Indian Space Research Organization also plans to launch a satellite in 2010 and 2011, to monitor greenhouse gases in the country. In the budget for 2010-11, the government has

taken 4-pronged strategies to boost agriculture production (1) agriculture production; (2) reduction in wastage of produce; (3) credit support to farmers; and (4) a thrust to the food processing sector. Commenting on this four-pronged strategy, the renowned farm scientist Dr. Swaminathan said that 'Mr Pranab Mukherjee for the first time in recent years has laid out a roadmap for agricultural recovery and progress based on integrated attention to the conservation of the ecological foundations essential for sustainable agriculture, cultivation based on the principles of conservation and climate-resilient farming, consumption with attention to food safety and quality and farm-centric commerce.' 200 crores has been allocated for climate-resilient agriculture. Gains made in the Green Revolution areas must be sustained through conservation farming, involving concurrent attention to soil health, water conservation and the preservation of bio-diversity.[11]

SUGGESTIONS FOR OVERCOMING CLIMATE CHANGE

(1) To solve food security problems, we need to have access, interdependence and knowledge-sharing of important crops which make up the majority of human consumption, both internally among different states or institutions and externally to help make genetic diversity and other important related information available to all.

(2) The emphasis should be on mitigation, by developing high yielding varieties of seed and drought resistant ones, which can withstand the adverse impact of climate change and lead to food security.

(3) Farmers need to monitor and limit their use of pesticides and other chemical fertilizers, with more focus on using bio-fertilizer and bio-pesticides in their fields, with the application of traditional knowledge, which is more beneficial in some areas than technology-led agriculture practices.

(4) Adaptation to climate change will require co-ordination among different ministries/departments like agriculture, environment and health at state and central level. Partnerships among communities, scientists and other stakeholders are also necessary.

(5) The use of barren land, which is available in every state. There is currently no productive activity on these lands. Further non-proliferation of barren land and converting it to productive purposes can be a panacea for the ills of rural India at a time of adversely changing climate. A good example is from the Brinda village in Jharkhand's Gumla district, where farmers have converted 60 acres of barren area into lush agricultural land through co-operative farming.[12]

(6) In the budget for 2010-11, the government has allocated Rs 400 crores to prepare eastern regions of the country (comprising Bihar, Jharkhand, Chhattisgarh, Eastern Uttar Pradesh, Orissa and West Bengal) to implement a green revolution in their states, as they were left out of the first phase in the 1960s. The farmers and the governments in these states have to take into account the words of Dr M.S.Swaminathan when he addressed farmers in January 1968, about converting the Green Revolution into an Evergreen Revolution by mainstreaming the principles of ecology in technology development and dissemination. Further, he pleaded for avoiding the temptation to convert the Green Revolution into a Greed Revolution. If the Green Revolution is not properly managed, new ecological problems will arrive.[13]

(7) More awareness and education regarding climate change among rural people is necessary. This can be done with the help of Village Knowledge Centres empowered by Information Communication Technology, set up by the Government Of India in every village with trained local staff. Along with this, some traditional knowledge, wisdom and practices followed by indigenous peoples since time immemorial from their forefathers will help in understanding and adapting to climate change.

CONCLUSION

Climate change is a global and regional environmental problem faced by humanity with strong implications for rural populations. For developing countries like India, the aim of achieving 9% or double digit G.D.P growth, will not take place without achieving 4% growth in agriculture on a sustainable basis over the medium term. For that, we need to take into account the effect of climate change on rural areas, particularly on agriculture, which can promote inclusive growth, enhancing rural income and sustain food security. Also, it is

our moral responsibility to our children and future generation to provide them with a world which is clean and safe to live in. Now the time has come to follow the values and lessons provided by our long tradition and teach the world community about ecologically sustainable development. As Mahatma Gandhi rightly said 'The earth has enough to satisfy people's need but will never have enough to serve their greed'.

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