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IMPLICATION OF CLIMATE CHANGE IN INDIA

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ABSTRACT

The effect of the rising temperatures across the Earth's surface will lead to changes in average temperatures, rainfall patterns and monsoon timings. Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of year. The ongoing over-production of greenhouse gases has meant that more and more heat is being trapped in the Earth's atmosphere, is what is known as global warming. India is confronted with the challenge of sustaining rapid economic growth amidst the increasing global threat of climate change. Evidence has shown that climate change will affect the distribution and quality of India's natural resources, which will ultimately threaten the human health, agriculture and the livelihoods of the most poor and marginalized sector of the population who are closely tied to India's natural resource base.

KEY WORDS: Climate change, Sustainability, Greenhouse gases, Mitigation and Adaptation.

INTRODUCTION

In recent years there has been growing concern about degradation and pollution of environment and climate change as they impact on future development of both the developing and developed countries. In 1992, representatives of over 150 countries met at Rio in Brazil to discuss the environmental issues and their implication for future development

of the world. This meeting at Rio is called the 'Earth Summit' or the United Nation Conference on Environment and Development (UNCED). This conference clearly spelled out the linkages between natural environment and development and put forward the concept of "sustainable development". This has produced greater awareness about environmental issues

and facilitated the cooperation between different countries to reduce environmental degradation, particularly to reduce emission of green house gases such as carbon dioxide to prevent adverse climate change, that is, global warming in future which if not prevented will have disastrous consequences for the welfare and development of the population, both in developing and developed countries.

India is confronted with the challenge of sustaining rapid economic growth amidst the increasing global threat of climate change. Evidence has shown that climate change will affect the distribution and quality of India's natural resources, which will ultimately threaten the livelihoods of the most poor and marginalized sector of the population who are closely tied to India's natural resource base. More than 50 percent of workers are engaged in agriculture and allied sectors, while many others earn their living in coastal areas through tourism or fishing; indeed most of the poorest people live in rural areas and are almost completely reliant on natural resources for their food, fuel and shelter.

OBJECTIVES OF THE PAPER

- ◆ To discuss negative effects of climate change in India.
- ◆ Mitigation and Adaptation in India.
- ◆ Critical evaluation of the steps taken at global level for sustainability.

INDIA'S CHANGING CLIMATE

India's climate is both diverse and changing. The south experiences tropical climates, through to more temperate conditions to the alpine regions of the north where elevated areas receive sustained winter snowfall. Four types of climatic zones are found in India-arid, tropical, subtropical, and alpine zones. The Himalayas provide a barrier to the cold winds of continental Asia and helps the development

of the monsoon during the rainy season (June-September) when over 70 percent of the annual precipitation in India falls. This results in a warm climate across most of India throughout the year, where temperatures can exceed 40 degrees, but also fall below freezing in the deserts of the north and Kashmir.

Throughout the 21st century, India and other countries in South-Eastern Asia are projected to experience warming above the global mean. India will also begin to experience greater seasonal variation in temperature, with more warming in the winter than summer. The longevity of heat-waves across India have extended in recent years, leading to warmer temperatures at night and hotter days – this trend is set to continue. These heat-waves will lead to increased variability in summer monsoon precipitation, with drastic effects on the agricultural sector in India.

India to be 4° hotter in 40 years-The effect of climate change on India could be far worse than previously estimated. Latest projections indicate that after 2050, temperature would rise by 3-4 degree over current level and rainfall would become both heavier and less regular, posing a grave threat to agriculture. These are part of the research conducted by scientists at Pune's Indian institute of Tropical Meteorology.

CLIMATE CHANGE - INDIAN AGRICULTURE

Indian agriculture continues to remain dependant on changes in weather, in spite of many irrigation interventions. The contribution of agriculture to GDP has decreased to almost fourteen percent (2010-11), though a large population more than 50 percent is still dependent on it for their livelihoods. That makes agriculture an important sector and there is a need to understand the impacts of climate change, increasing climatic risks and possible adaptations.

According to A K Singh, Deputy Director-General (natural resource management) of the Indian Council of Agricultural Research (ICAR), medium-term climate change predictions have projected the likely reduction in crop yields due to climate change between 4.5 and 9 per cent by 2039. The long run predictions paint a scarier picture with the crop yields anticipated to fall by 25 percent or more by 2099. This will have a detrimental effect on farmer's income and purchasing power, with obvious down-the-line repercussions.

Increasing temperature will lead to decreasing yields in wheat, an important crop in North India though this may be compensated by an increase in CO₂ levels. Various scenarios project that a significant impact is unlikely to be felt in wheat production by 2020. However these are mean changes and not increased climate variability. By 2050, there will be a decrease of about 10 percent in production and if the situation continues the decrease will be more severe. In countries like India where population growth rates are high, the demand for food is increasing and is far more than what is being currently produced (shown in table-1).

Table 1: Production and Demand for Food

Items	Production (million tons)	Production (million tons)	Demand of food (million tons)
Year	2000	2010	2020
Rice	85.4	103.6	122.1
Wheat	71.0	85.8	102.8
Coarse grains	29.9	34.9	40.9
Total cereals	184.7	224.3	265.8
Pulses	16.1	21.4	27.8
Food grains	200.8	245.7	293.6
Fruits	41.1	56.3	77.0
Vegetables	84.5	112.7	149.7
Milk	76.3	103.7	142.7
Meat and eggs	3.7	5.4	7.8

Source: computed from IARI statistics, 2006.

Studies show that demand is greater than supply and the impacts of climate change is projected to further reduce supply. It needs to be studied whether adaptation will ease this pressure and which type of adaptation strategy should be followed for convergence in demand and supply.

CLIMATE CHANGE - FLOODS & DROUGHT

Floods are natural feature of India's river basins. They replenish groundwater, deliver topsoil and nutrients to support agriculture in otherwise infertile regions, and sustain valuable ecosystems. Excessive flooding

poses risks to human life and is a major contributor to the poverty and vulnerability of marginalized communities. It is estimated that the flood-affected area has more than doubled in size from about 5 percent (19 million hectares) to about 12 percent (40 million hectares) of India's geographic area in the past five decades. This has occurred despite generous and rising government spending on a multitude of flood protection programs. Orissa is among the most flood-affected states in the country. Frequently it has coped with simultaneous droughts in one part of the state and extensive floods in another, as well as with cyclones and other natural calamities.

Prospects for Flood-Prone Areas under Climate Change:-

Adding to these already high risks, the climate projections suggest that temperatures, precipitation, and flooding are likely to increase, with adverse impacts on crop yields and farm incomes. Among the more substantial effects is a spatial shift in the pattern of rainfall towards the already flood-prone coastal areas. Climate change is also projected to bring a dramatic increase in the incidence of flooding. As an example of the implied magnitudes, the probability that the discharge might exceed 25,000 cubic meters per second (at the measuring station at Naraj on the Mahanadi River in Orissa), is currently low - about 2 percent. But under climate change, this is projected to rise dramatically to over 10 percent. This suggests a clear need for improved and accurate forecasting tools to guide the appropriate location and design for flood protection infrastructure and other high-value assets.

In the study districts of Puri and Jagatsinghpur, the assessment finds that rice yields could decline by 5 percent to 12 percent and profits by 6 percent to 8 percent under climate change. With the dominance of rice and high levels of pre-adaptation to floods, there is little that can be done to build flood resilience through adjustments in cropping patterns and farming practices. There is a need to further strengthen current flood protection initiatives and develop a proactive, comprehensive, and anticipatory flood management strategy.

The report (29 May, 2009) one of the first of its kind in South Asia, finds that climate change will have a serious impact on India where about 1/3 of the land is already drought or flood prone. Looking at two drought prone regions in Andhra Pradesh and Maharashtra, and one flood prone region in Orissa, the report finds that climate change can have the following serious impacts:

In Andhra Pradesh, dryland farmers may see their incomes plunge by 20 percent.

In Maharashtra, sugarcane yields may fall dramatically by 25-30 percent.

In Orissa, flooding will rise dramatically leading to a drop in rice yields by as much as 12 percent in some districts.

Other climate hotspots in India - such as the fragile Himalayas, the biodiverse Western Ghats, the vast coastal areas, and the prolific agricultural lands of the Gangetic plains will need to be looked at in subsequent studies.

In the arid regions of Andhra Pradesh, the yields of all the major crops - rice, groundnut, and jowar - are expected to decline, although groundnut is expected to fare better than others. Under a modest to harsh climate change scenario - a substantial rise in temperatures (2.3° C - 3.4° C) and a modest but erratic increase in rainfall (4 percent to 8 percent) - small farmer incomes could decline by as much as 20 percent. Agriculture as it is practiced today will no longer be able to sustain large populations on small rain-fed farms.

The drought-prone belt in Maharashtra offers a striking contrast. Climate projections indicate a significant though variable increase in rainfall (20 percent to 30 percent) along with higher temperatures (2.4 C to 3.8 C). As a result, yields of several dryland crops will rise, including millets such as jowar and bajra, boosting the incomes of small rain-fed farmers by about 8-10 percent. Yields of sugarcane, however, which is generously subsidized and widely grown on irrigated farms in arid regions, are expected to decline considerably - by nearly 30 percent. Encouraging a shift from sugarcane to less water-intensive crops will shield farmers from the impacts of climate change and help conserve fast-depleting groundwater.

CLIMATE CHANGE- POPULATION DISPLACEMENT

India's population is currently in excess of 1.22 billion people and predictions state that by 2050, the population will have grown by another 500 million. This increase in population will undoubtedly lead to a strain on resources, especially when coupled with the impacts of climate change. The widespread effect that climate change is expected to have on agriculture and rural livelihoods will lead to greater migration from rural areas to urban, further straining resources in these centres.

The term 'environmental refugee' has now been coined for those populations who are displaced by environmental events/disasters which are linked directly with climate change. Whole communities are forced to migrate, often inland, from coastal areas. Indeed, according to the Intergovernmental Panel on Climate Change (IPCC), sea-level rise is the greatest threat and challenge for sustainable adaptation within South Asia. The consequences in terms of flooding of low lying deltas, retreat of shorelines, salinisation, and changes in the water table, cause very serious concern for the well-being of local populations.

Case Study: Sundarbans, West Bengal:-

The Sunderban Islands in West Bengal are sinking. 7,000 people have already been displaced and by 2030, it is anticipated that over 70,000 people from this area will be exposed to the risk of losing their homes and livelihoods due to sea level rise, increased cyclone intensity and flooding. These environmental refugees are forced to reside in refugee colonies where poor sanitation and limited water supply can lead to the spread of disease and further health implications. In addition to the widespread community displacement, the mangrove forests, which are the largest of such forests in

the world and are well known for their biodiversity and habitat for threatened species (including the Royal Bengal Tiger), will have diminished by over 75% in the next 20 years due to climate change.

CLIMATE CHANGE - HUMAN HEALTH

According to the United Nations Industrial Development Organization (UNIDO), climate change is likely to have a greater impact on India compared to other countries similarly positioned, on account of the unique combination of its geography, diverse population characteristics and extremely high carbon-related energy dependence. Climate change is bound to affect the basic requirements for maintaining health - clean air and water, sufficient food, adequate shelter, and freedom from disease given the already high level of poverty, low nutritional levels and poor public health infrastructure in the country. The impact of climate change on water availability is likely to be one of the most significant for the health of populations. Higher temperatures are hastening rates of evaporation of surface water thereby reducing the availability of fresh water. Lack of fresh water compromises hygiene and hence increasing incidence of diarrheal disease. On the other hand, too much water, in the form of floods, causes contamination of freshwater supplies. Extreme events like sea level rise coupled with stronger storm surges and coastal flooding can be followed by outbreak of diseases such as Cholera. The burden of waterborne infectious disease in India is enormous. A report from the Ministry of Health and Family Welfare estimates that nearly 40 million people are affected by waterborne disease every year. That places a large burden on both the health sector and the economic sector. As a consequence, approximately 73 million workdays or US\$600

million are lost each year. Although the World Health Organization (WHO) estimates that 900,000 Indians die each year from drinking contaminated water and breathing polluted air, the Indian Ministry of Health estimates 1.5 million deaths annually among 0- to 5-year-old children.

MITIGATION AND ADAPTATION

'It is not too late to cut greenhouse gas emissions to sustainable level without sacrificing economic growth, rising prosperity and climate security are not conflicting objectives'. Historically, responsibility for climate change lies with rich, industrialized countries and it is these countries that must take the lead in cutting greenhouse gas emissions. However, it is imperative that all nations use fossil fuels in a sustainable manner and endeavour to become to become low carbon economies. Global warming is a truly global problem and must be addressed as such.

In India, over 40 percent of households are still without electricity. Research indicates that the demand for energy will increase across India over the 21 century, potentially to one fifth of the world energy consumption by 2100. Presently India uses fossil fuel in abundance. In fact around 80 percent of India's electricity generation comes from fossil fuel. However, the burning of these fuels is highly inefficient and this is the largest contributor to the excessive emission of greenhouse gases. Indeed, India must also address the issue of energy security in the long term; presently India is largely dependent on imported sources for primary energy, which is not sustainable.

Societies and communities dependent on natural resources need to enhance their capacity to adapt to the impacts of future climate change, particularly when such impacts could lie outside their experienced coping

range. This argument is illustrated by an example of present-day collective action for community-based coastal management in Trinidad and Tobago. The case demonstrates that community-based management enhances adaptive capacity in two ways: by building networks that are important for coping with extreme events and by retaining the resilience of the underpinning resources and ecological systems. Although much adaptation to climate change is anticipatory, some also takes place in response to the impacts of single extreme events.

Further, some climate change impacts, such as a significant and rapid rise in sea level, are likely to significantly alter the resource systems and their ecosystem services. The processes needed to adapt to catastrophic system changes would involve a major restructuring of the economy and society. Clearly, these are dangerous thresholds in the climate system that needs to be avoided. There is, in effect, no substitute for the significant mitigation of emissions at the present time. Adaptation to both gradual and significant changes should involve encouraging the evolution of new institutions that are sensitive to the resilience of the ecosystems they are managing.

INTERNATIONAL ACTION AS A KYOTO PROTOCOL

The UN framework convention on climate change (UNFCCC) aims to stabilize greenhouse gas emission "at a level that would prevent dangerous anthropogenic interference with the climate system". This level should be achieved within a time-frame that allows ecosystem to adapt to climate change, ensure that food production is not threatened and enables economic development to proceed in a "sustainable manner" agreed in Reo in June

1992; the convention came into force in March 1994. The convention places the initial onus on the industrialized nations and 12 economies in transition to reduce their emission, and finance developing countries search for strategy to limit their own emission in way that will not winder their economic process.

The convention is a flexible framework, clearly recognizing that there is a problem. The first addition to the treaty, the Kyoto Protocol, set target for reduction in emissions, Adopted in 1997 it came into force in February 2005, Seven year after the Kyoto Protocol was negotiated the commitment agreed to became legally after countries representing at least 55 percent of greenhouse gases emission by the Industrialized world had ratified the Protocol. Countries are committed to reducing their greenhouse gas emission to the combined average of 5.2 percent below their 1990 level by a target Date between 2008 and 2012. The reduction under the Kyoto Protocol are considered a first step, as EU Environment Minister recommended that reduction of between 60 percent and 80 percent by 2050 will be needed to avert more serious climate change impact.

WARSAW CONFERENCE (COP19)

On 23 November 2013 The UN Climate Change Conference in Warsaw ended, keeping governments on a track towards a universal climate agreement in 2015 and including significant new decisions that will cut emissions from deforestation and on loss and damage. In Warsaw, a milestone was passed after 48 of the poorest countries of the world finalized a comprehensive set of plans to deal with the inevitable impacts of climate change. With these plans, the countries can better assess the immediate impacts of climate change and what they need in the way of support to become more

resilient. Developed countries, including Austria, Belgium, Finland, France, Germany, Norway, Sweden, Switzerland have also paid or pledged over 100 million dollars to add to the Adaptation Fund, which has now started to fund national projects. Governments completed work on the Climate Technology Centre and Network (CTCN) so that it can immediately respond to requests from developing countries for advice and assistance on the transfer of technology. The CTCN is open for business and is encouraging developing countries to set up focal points to accelerate the transfer of technology.

CONCLUSIONS

International Cooperation is needed to mitigate global climate change. International negotiations on climate change policy began in earnest in 1992 at the Rio Earth Summit organized by the United Nations. The result of the summit was the United Nations Framework Convention on Climate Change (UNFCCC), which was signed and ratified by the countries in the world. The goal of the UNFCCC was to stabilize emissions of greenhouse gases at 1990 levels by the year 2000 through voluntary measures taken by individual countries. In the subsequent decade, few substantive policies were implemented, and global emissions of greenhouse gases rose considerably. Climate change is a serious environmental risk that will likely grow in importance over the coming decades. There is still an opportunity for climate change policy to take an efficient and practical form, but leadership will be needed to keep the opportunity from being lost. Because climate change is a truly global problem it requires global solutions, involving cooperative actions by all countries.

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