Socio-economic Impacts of Climate Change in Odisha: Issues, Challenges and Policy Options

Gouranga Ch. Mohapatra

BGVS, Odisha

Climate change IN Odisha

Climate change of Odisha has special relevance due to **its location and geophysical conditions coming under tropical zone** and is characterized by high temperature, high humidity, medium to high rainfall, and short and mild winters. Odisha has a **coastline of 482kms which is 8% of** India's coastline of 7500kms including island territory. The vulnerability of coastal Odisha **impacts 7168 villages, 20 towns, 10.60 lakh households and 58 lakh people within 25 kilometres** of the coastline. The coastline has been divided into the coastal zone from **Subarnarekha mouth to the Mahanadi Mouth** in the North which covers Balasore, Bhadrak, Brahmani Baitarani Delta, and Hukitola Bay; and coastal zone from **Mahanadi Mouth to the Rusikulya** Mouth in the South which covers Ersama, Puri and Ganjam. Coastal characteristics differ from region to region but widespread **erosion** has been noted on around **187 km of the 482 km long coastline**. The coast line that is prone to climate-mediated cyclones, coastal erosion and water resources dependent on monsoons. Odisha is placed at the head of the Bay of Bengal where weather is formed. So, even a slight change in the sea's behaviour can have an immediate impact on the coast. The Bay is the centre of low pressures causing heavy rains and cyclones in the sub-continent

Major Calamity in Odisha

- In the last century, India subcontinent experienced more than 1,035 cyclonic disturbances of which 905 were found in the eastern coast, including 263 cyclonic disturbances in Odisha. Around 26% of the total cyclonic disturbances of the Indian subcontinent affect Odisha coast while 13% affect Andhra and 14% in West Bengal.
- During 1804-2001, both cyclones and floods have occurred for 126 years in the state (Bhatta, 1997; Chittibabu, 2004), and in particular, outbreak of floods has been reported for nine consecutive years during 2001-2011.
- State had faced 17 big calamities, including four severe cyclones, since 2000.
- The severe cyclonic storms of 1909, 1910,1912,1914,1967,1971,Super cyclone 1999, Phailon in 2013, Hudhud in2014, Titili in 2018, Fani in 2019
- Odisha is one of the most flood prone states in country. Rivers like Mahanadi and its tributaries with other 34 rivers have the potential to cause severe floods (out of a total geographical area of 15,571 lakh hectares, 1.40 lakh hectares are very flood prone).
- While cyclones and floods are wreaking havoc, continuous of droughts are causing huge crop loos and making farmers penury. While normal rainfall in the state on the basis of 50 years average of annual rainfall from 1950 was 1,503 millimeter with 73 rainy days, it is gone drastically over last 50 years. Decline in rainfall has resulted in draught and it some time affecting the entire state. Odisha suffered one of its worst droughts in 2001. It affected the lives of 11 million people in more than two-thirds of the state's districts
- Several districts of Odisha also come under the earthquake zones, As per recent categorization, Odisha falls between Zone I and Zone II of Seismic Zone.
- In addition, the State is also affected by disasters like heat waves in 1998 killed around 1500 people, , lightning accidents, pest attacks and forest fires," regularly.

Impacts of Climate Change in Odisha

- Individual or simultaneous storms, heat-waves, lightening events, vector diseases
- Changes in the climate pattern
- Atmospheric temperature is going up
- Low pressure is becoming a regular phenomenon
- Frequent floods and droughts since 1998
- Rise in sea level and the Bay of Bengal expanding towards the coastal landscape. The 2000 land records indicate that Satabhaya area has been reduced to 155 sq. km. where seven villages being swallowed by the sea.
- Poor human health
- Erratic rainfall
- Modified biodiversity
- Change in vegetation

Economic impact of climate change in Odisha

- The economic impact of climate change in Odisha is observed in each sector of the state—be it agriculture, food, fisheries and animal resources, forests, water resources, health, industry, or mining
- “During the drought year of 1996-97, the economic growth of the state turned negative (-4.85%). Post the devastating Super Cyclone of 1999, Gross State Domestic Product growth rate was -1.72% in the succeeding year,” It observes similarly, post two consecutive cyclones and floods in 2013 and 2014, the growth rate fell to 1.8% in 2014-15, in comparison to a high growth rate of 9.3% in 2013-14.

According to Economic survey

Climate Change and Agriculture

- Agriculture holds a predominant position in the state's economy. About 85% of the state's population lives in rural areas and depends on agriculture. This sector contributes about 26% to the Gross State Domestic Product. With almost 60% of land under rain-fed agriculture and with water-dependent rice, as its main crop. Further, paddy fields in the coastal areas are prone to frequent erosion, salinization and inundation.

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- Super cyclone in 1999 caused two million tons of rice crop damage, and devastation of 17,000 sq. kms of agricultural lands in the state. In total it caused a damage of 18.43 lakh hectare crops in the state (Nayak, 2009)
- According to Disaster Management Plan for Odisha, 2013-14, around 9.19 lakh hectares of cropped areas were extensively damaged by the floods between 2001 and 2008
- As per the reports of special Relief Commissioner, 82.48 lakh hectares of cropped areas were damaged while 10,305 people had lost their lives due to floods, cyclones and droughts between 1999 and 2008.
- In 2013, due to Phailin cyclone about 12,92,967 hectares of agriculture, horticulture and perennial were loss (GoO, 2013).

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- In 2014, due to Hudhud about 2,47,557 hectares of agriculture area affected.
- In recent Fani 60% of paddy crop have been totally damaged. About 20% of harvested paddy have also been destroyed due to damages to the houses where they were stored. 80% vegetable totally damaged. 3290 no. of Community Lift Irrigation Projects have been damaged in 7 districts.
- Other problems such as pest and disease outbreaks are increased due to climate variability.
- It has been observed that in the last 50 years, the food production has decreased by 40% in the state (Odisha Economic Survey, 2009-10, 2012-13)

Adaptation strategies of farmers

- Changing planting dates
- Multiple cropping
- Changing crop varieties
- Increasing irrigation facilities
- Shifting the land use pattern
- Double seeding (for some crops)

Empirical studies reveal that the major barriers for the farmers to adapt to climate change are their poor economic conditions and the poor infrastructure facilities in the areas in terms of unavailability of irrigation water, and lack of extension services (Mishra and Sahu, 2014b). In this context crop insurance in rural agricultural sector may be address the economic loss.

Climate Change and Industry

The economic growth of Odisha since 2005-06 has been mainly induced by the growth of the industrial sector. Odisha's substantial mineral resource endowments have led to the growth of metallurgical and non-metallic mineral based and other energy intensive manufacturing industries in the state (Ghosh et al., 2014). Given the resource base of the state, **twelve industrially active zones** have been developed across the state,

- About 65% of all industrial units in Odisha fall under the critical polluting red category identified by the Ministry of Environment and Forest. In terms of CO2 emissions, during 1980-2000, Odisha ranked 9th among all the states in the country with an average annual emission of 8539.78 kilo ton of CO2 with a CAGR of 6.74% per annum (Ghoshal and Bhattacharya, 2008)

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- Rapid industrialization and wide spread mining activities have made the groundwater contamination by fluoride and other chemical occurrence of several health problems in the vicinity. Nanda etal. (2011)
- The fly ash generated during these power plant operations and ash ponds in the coalfield area also create environmental hazard particularly in water by increasing the suspended, dissolved and heavy metals concentration.
- The industrial and mining area has also been substantially adding to the rise in temperature and flow of heat-waves.
- The main environmental concern associated with the sponge iron industry is air pollution that has adversely affected the health and livelihood patterns of the people.
- Lower annual rainfall and regular drought in the state has reduced the electricity generating capacity of hydroelectric power plants.

Climate Change and Forestry

Forest area affected by climate change depends on various factors like species and age of trees, possibilities for forests to migrate, and quality of forest management (Sharma and Kavikumar, 1998).

- Climate change impacts over forestry turn to have profound implications for traditional livelihood, industry, biodiversity, soil and water resources, and these lead to changes in agricultural productivity.
- Odisha is endowed with vast forests extending over 37.34% of its geographical area.
- Overall, 40% of state's population depends on forests for their livelihood.
- Studies have revealed that forest resources contribute about 25% to 52% to the household income of people living in and around forests.
- Forest resources contribute about 7% to Gross State Domestic Product.

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- About 50% of the forest area of the state has been estimated to be in various stages of degradation.
- The deforestation in the state has been mainly due to expansion of mining sector, urbanization, industrialization, infrastructure building, and increased household demand for fire-woods.
- This deforestation has been estimated to contribute to about 20% of total CO2 emissions leading to adverse climate impacts in the state.
- Tribal people in Odisha are dependent on a wide variety of native plants for food and medicine. But due to deforestation and desertification, local tribes are failing to collect food for survival and medicinal plants for healthcare.

Thus, large scale plantation for creating forests can only save our future generations from the devastations that we can only imagine now. The deforestation not only affect the livelihood of the population but also seriously affect the life of wild life in the state. It is wetness that elephants are frequently move to the habitation and its increase the conflict among the human and animal.

Climate Change and Mining

Mining is a major economic activity in the state and it contributes significantly to the state growth. Odisha possesses 24% of India's coal reserves, 17% of iron ore, 98% of chromites, 51% bauxite and 35% of manganese. This sector provides employment to about 45000 manpower every year. In spite of such a contribution, mining in Odisha has serious local environmental and social impacts.

- These include air pollution (particulates),
- Water pollution (mine water discharges),
- Social impacts (displacement and rehabilitation) and
- Forest impacts (most of the mining area is in forest areas or in their vicinity).
- Mining being energy intensive is also a big contributor to global GHG emissions.

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- The percentage of degraded forest to total forest cover increased to 47.98 in 2007 from 44.24 in 1997 in mining districts and to 44.6 in 2007 from 42.76 in 1997 in non-mining districts.
- This has resulted in increase in temperature of mining districts, and experiencing increased heat-waves and erratic precipitation patterns.
- Mining districts in the north-western part of the state are experiencing droughts in recent years. Along with coastal districts, the interior mining districts are experiencing severe floods in recent years. Water scarcity is also a problem in mining districts.
- The occurrence of forest fires is more a concern for non-mining districts. All these have resulted in loss of human well-being of people in the state.

Climate Change and Wetland in Odisha

The loss of wetlands is also a key concern. The expansion of agricultural and urban areas in recent decades have reduced wetland in state and sinks the drainage. These changes include

- An increase in river discharges
- A reduction in groundwater levels
- Base flow discharges
- loss of ecological and cultural functions
- Affect water table in ecosystem
- Affect fisheries sector and livelihoods of the fisher folks

Climate Change and Water Resources

In recent years, the demand for water has increased tremendously due to an increasing population, expanding agriculture and rapid industrialization that are responsible for considerable imbalances in the quantity and quality of water resources. The effect of climate change on water resources is observed in terms of

- Increase in water pollution due to warm air, higher water temperature and changes in rainfall patterns;
- Changes in the availability of drinking water supplies due to changing rain pattern,
- Increased evaporation and salt water intrusion; water body boundary movements and displacements due to rising sea levels;
- Quantity and quality of groundwater resources
- Surface water flow
- Groundwater recharge and discharge

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- Odisha which traditionally receives 120 days of rainfall now receives rainfall only for 90 days, and that too is erratic.
- The average annual normal rainfall shows a declining trend. This has decreased from 1502 mm during 1961-2000 to 1482 mm after 2000. Thus, river flow is gradually decreasing.
- The water quality in the rivers and lakes is degrading due to the increased flow of sediment and pollutants with higher run off, decreased flushing, and higher salinity levels with reduced stream flows.
- Adversely affecting the fish stock due to higher water temperatures and low oxygen content
- This has reduced fish production in the state

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- The fishing's share to Gross State Domestic Product has decreased from 1.55% in 2000-01 to 1.11% in 2009-10.

Increase in sea level has resulted

- In submergence of low-lying areas,
- Erosion of sea beaches and increase in the area of coastal wetlands,
- Coastal flooding and increase in salinity

As a consequence of these adverse effects, the net sown area has declined and crop yield pattern has been disturbed in the state. The irrigation intensity has also reduced to about 30.9%. Odisha has recently about 54,69,336 hectares of degraded land which constitutes 5.18% of total geographical area of India. It has been estimated that about 29 lakh hectares of cultivable land, nearly 45% of total cultivable land in Odisha, are facing high degree of soil erosion.

Another major feature relating to climate change impact in Odisha is waterlogging. This creates flood situations basically in urban slum and costal areas, surface and groundwater pollution, contamination of drinking water, and outbreak of water-borne diseases.

Climate Change and Human Health

The consequences of climate change on human health are categorized as

- Asthma, respiratory allergies and airway diseases;
- Cancer;
- Cardiovascular disease and stroke;
- Food-borne diseases and nutrition;
- Heat-related morbidity and mortality;
- Human developmental effects;
- Mental health and stress-related disorders;
- Euro logical diseases and disorders;
- Vector-borne and zoonotic diseases such as malaria, dengue, chikungunya, filariasis, encephalitis etc.
- water-borne diseases

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- Changes in sea temperature, reduced access to clean drinking water have increased the risk of diarrhoeal disease;
- Increased salinity in soil and drinking water have caused moving blood pressure;
- The intensity and frequency of extreme weather events like heat-waves, cyclones, droughts and floods have increased health related issues such as heat strokes, skin diseases, eye diseases, injuries, psychological distress and human mortality;
- Air pollution from industrial pollutants and automobile emissions has increased the diseases like allergies, asthma, bronchitis, heart attacks and other cardio-vascular diseases;
- Altered food productivity and associated pest and diseases especially in agriculture have resulted in malnutrition, hunger, impaired child growth and development.

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- Odisha reported 1520 cases of dengue in 2012, 3490 cases in 2013, 1547 cases in 2014 and 1002 cases in 2015 (Mishra et al., 2016)
- Chikungunya virus has been rapidly spreading in Odisha since 2006
- Acute diarrhoeal diseases in Odisha was 7.43 lakh, i.e., 6.35% of total cases in India which slightly decreased to about 6.0 lakh, i.e., 5.51% of total cases in India in 2012.
- In 1998, the heat-wave in Odisha was recorded as one of the worst, claiming more than 2000 lives.
- JE is increasing after 2017 in south and western Odisha

Policies and Actions taken by Government

Considering the concern, the state has formulated Climate Change Action Plan 2010-15 in a holistic manner to address the issues of mitigation and adaptation. It focused on 11 critical sectors, which are

- Agriculture
- Coastal Zones and Disasters
- Energy
- Fisheries and Animal Resources
- Forests
- Health
- Industry
- Mining
- Transport
- Urban Planning
- Water

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- The budget for climate change response actions was estimated as Rs. 17,000 crore for a 5-year period between 2010-11 and 2015-16.

Under this plan the demonstration projects were

- Installation of solar PV panel in the boats plying in Chilika Lake,
- Battery operated auto-rickshaws in Bhubaneswar,
- low cost sewage treatment system and maximum use of fly ash.
- Strengthen capabilities of State Pollution Control Board, Climate Change Cell, and green energy consumption, etc.
- Massive plantation and increase canopy density of degraded forests to mitigate a large load of carbon on environment.
- The state has already taken up solar project initiatives and the use of energy saving devices, for example, OREDA and OMFED have been working to promote improved Chullah and bio-gas plants for energy saving. The state is in the process of providing incentives to private households for having roof top solar projects and rain water harvesting system.

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- Emphasis has also been given to promote regulated irrigation measures in the areas under major and medium irrigation projects.

The climate change adaptive measures taken up in the state include

- Disaster preparedness,
- Construction of flood and cyclone shelters,
- Improvement in agricultural productivity including cultivation of climate resilient crop varieties,
- Increasing perennial fruit plantation and adoption of integrated farming systems.

Similarly, mitigation measures undertaken include

- Adoption of super critical technology in power generation,
- Higher solar power generation,
- Efficient energy use in reduction initiative,
- Efficient energy use in urban water supply, energy efficient building, development of inland waterways, and transportation of bulk material through rail network.

Thank You