Health Hazards of Climate Change: A Review

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Abstract
Climate change is a leading agendum today. Traditionally India has been highly vulnerable to climate related events like floods, droughts and cyclones. In developing countries like India, climate change is an additional burden because ecological and socio-economic systems are already facing pressures from rapid population, industrialisation and economic development. The present paper highlights impacts of climate change on varied aspects of economy such as agriculture, industry, forests, biodiversity and water resources and ultimately on health of human beings. The paper also focused on initiatives taken by the government to cope up with climate change. It is suggested that adverse impacts of climate change can be reduced by mitigation and adaptation strategies.
Keywords: Indian Economy, Vulnerability, Health Hazard

Introduction

Crucial sectors in India like agriculture, water resources, health, sanitation, and rural development are likely to be affected by climate change. India's large population primarily depends on climate-sensitive sectors like agriculture and forestry for livelihood. Small farmers are likely to be more affected by climate change because of their poor access to technologies, inputs, information and finance for mitigation and adaptation (Birthal*et.al,* 2014).
Several recent analysis have concluded that the higher temperature expected in coming years will disproportionately affect agriculture in the planet's lower latitudes where most of the world's poor live (Kumar & Gautam, 2014)

Impacts of Climate Change

Impact on Water Resources

- Changes in cropping and land-use patterns, over exploitation of groundwater and changes in irrigation and drainage have modified the hydrolytic cycle in many climate regions and river basins in India. Water quantity and quality are serious constraints in most part of India (Kumar & Gautam, 2014).
- The most significant changes are likely to occur in the glacier fed river systems, due to the melting of the Himalayan glaciers.
- Changes are likely in the long-term lean-season water flows of large snow- and glacier-fed river systems of the Brahmaputra, the Ganga, and the Indus.
- A decline in run-off by more than two-thirds is projected for the Sabarmati and Luni basins.

Impact on agriculture and livelihoods

- Under the scenario of changing climate, the livelihood security of the farmers especially small and marginal holders, is becoming increasing precarious. Any adverse impact of the climate on water, energy and markets has the potential to severely jeopardise their food and income security. (Sidhu*et.al, 2011)*
- Wheat production for the country as a whole may decline after 2020 and rice production may be adversely impacted in the eastern states. Boundary changes in the growth of crops are also expected.
- Small changes in temperature and rainfall have significant effects on the quality of fruits, vegetables, tea, coffee, aromatic and medicinal plants, and basmati rice.

- Pathogens and insect populations are strongly dependent upon temperature and humidity, and changes in these parameters may change their population dynamics.

Projected Impacts on forests and biodiversity

- Studies project an increase in the area under xeric shrub lands and xeric woodlands in central India, replacing dry savanna in these regions.
- A study carried out by Indian Institute of Science (Ravindranath et al., 2006) assessed the impact of projected climate change on forest ecosystems in India. The main conclusion is that in 2085, between 68% and 77% of the forested grids in India are likely to experience shift in forest types depending upon projected climate change scenarios.
- Biodiversity is likely to be impacted under the projected climate scenarios due to the changes or shifts in forest or vegetation types in 57% to 60% of forested grids, forest dieback during the transient phase, and different species responding differently to climate change without change in forest type.
- The net primary productivity (NPP) of biomass from tropical evergreen forests may, however, increase 1.5 times under the scenarios. Generally the rate of increase is higher for warmer vegetation types.

Impact of Climate Change on Industry

- Climate change does also affect the non-agricultural industries through its effects on the climate dependent primary economic activities.
- Food and brewery, textile, and other natural resource dependent (e.g. timber and pulp and fishery) industries are among such industries through which climate change can have repercussions on non- agriculture economic activities.
- Because the production process in these industries is also (more of unskilled) labour intensive, the impacts, are double—through both labour productivity and repercussions. (Kumar & Amsalu, 2012)

Health impacts of climate change

- Changes in climate may alter the distribution of important vector species (for example, malarial mosquitoes) and may increase the spread of such diseases to new areas.
- An increase of 3.8 °C in temperature and a 7% increase in relative humidity by 2050 over present levels are projected to lead to the transmission windows being open for all 12 months in 9 states in India. The transmission windows in the states of Jammu and Kashmir and Rajasthan may increase by 3–5 months.

Initiatives Taken By Government

For developing countries like India, adaptation requires assisting the vulnerable population during adverse climate events and empowering them to build their lives and to cope with climate risks in the long term.

Initiatives taken in Agriculture Sector

Some of the programmes promoted by the government that assist the communities in coping with climatic variability include

- Developing watersheds in rainfed areas
- implementing drought-proofing measures
- developing drought-resistant varieties
- promoting crop diversification

- promoting on-farm water-efficient technologies
- introducing a system of credits and loans to farmers
- promoting the National Agricultural Insurance Scheme
- Encouraging RCTs (resource conserving technologies) for crop production.

Table 1: Climate Change: Temperature, Precipitation & Weather

Mediating Process	Health Outcomes
Direct	
Exposure to thermal extremes (especially heat waves)	Altered rates of heat- and cold-related illness and death (especially cardiovascular and respiratory diseases)
Altered frequency and / or intensity of other extreme weather events (floods, storms etc.)	Deaths, injuries and psychological disorders; damage to public health infrastructure
Indirect	
Effects on range and activity of vectors and ineffective parasites	Change in geographic ranges and incidence of vector borne diseases
Altered local ecology of water-borne and flood-borne ineffective agents	Changed incidence of diarrheal and certain other infectious diseases
Altered food (especially crop) productivity due to changes in climate, weather events, and associated pests and diseases	Regional malnutrition and hunger, and consequent impairment of child growth and development.
Sea level rise with population, displacement and damage to infrastructure.(e.g., sanitation)	Injuries, increased risks of various infectious diseases (due to migration, crowding and contamination of drinking water), psychological disorders
Levels and biological impacts of air pollution, including pollens and spores	Asthma and allergic disorders: other acute and chronic respiratory disorders and deaths
Social, economic, and demographic dislocations due to adverse climate change impacts on economy infrastructure, and resource supply	Wide range of public health consequences (e.g. mental health, nutritional impairment, infectious diseases, civil strife)
Source: http://coe.mse.ac.in/overview/11.pdf	

Initiatives in the water sector

- The National Water Policy (2002) stresses that non-conventional methods for utilization of water, including inter-basin transfers, artificial recharge of groundwater, and desalination of brackish or sea water, as well as traditional water conservation practices like rainwater harvesting, including roof-top rainwater harvesting, should be practised to increase the utilizable water resources.
- To be able to cope effectively with floods, the government has outlined several initiatives that promote the implementation of flood-proofing measures including repairs and protection of embankments and prevention of settlements in the flood zones.

Initiatives in coastal regions

- In coastal regions, coastal regulation zones have been formulated that indicate the sensitivities of coastal ecosystems and prevent their exploitation for development as well as for their natural resources, including groundwater.
- Restrictions have been imposed in the area between 200 m and 500 m of the HTL (high tide line) while the area up to 200 m has been declared as a 'no development zone'.
- The coastal zone regulations are under major review, which will also take into account the vulnerability to sea-level rise.

Initiatives in the forestry and biodiversity sector

- One of the major initiatives has been the introduction of the Participatory Forest Management Programme of the Government of India, which has shown remarkable success. Involvement of local stakeholders in the management and protection of local forest resources not only ensures their sustainable management but also prepares communities dependent on them to strengthen their coping practices in the context of uncertainties.

The Biological Diversity Act was adopted in 2002 to conserve biodiversity as a whole, apart from specific laws on forests, wildlife, water, and pollution. The National Biodiversity Authority (NBA) has been established that regulates access to genetic resources and associated traditional knowledge and promotes conservation.

Adaptation & Mitigation Strategies

The main challenge for India is to integrate adaptation and mitigation efforts with sustainable development and poverty reduction.

- There is a need to set up and develop concerted action plans for watershed management, rainwater harvesting and groundwater recharge.
- Flood control measures required to strengthen adaptive capacity. Flood protection works – i.e. embankments and reservoirs – can provide only a partial solution to the problem. They must be supplemented by non-structural measures, including efficient management of flood plains, flood proofing, and disaster management.
- There is a need to explore collaboration in research control programmes relating vector borne and diarrhoeal diseases. A number of legislative, technical, educational and behavioural options can be exploited in the current programs, thus serving as indirect adaptation options.

- Revitalization of extension services would enhance the capacity to adapt to future climate change by providing farmers with reliable information regarding new initiatives that may be required to address climate change, such as new agricultural practices, new drought-resistant or pest- resistant seeds, options for crop diversification, etc.
- Coal is likely to remain the predominant resource for power generation in India. There is a need to implement cost-effective improvements in the efficiency of coal-based power plants and to introduce economically viable cleaner technologies in order to reduce the environmental impact.
- Usage of new and renewable energy (solar, wind power, bio-mass, etc.) have promising long-term prospects and could contribute to energy security by lowering India's dependence on fuel imports.

Conclusions

Climate change is unequivocal and threatens to pose a major risk to human health and safety, especially among poorer communities with high population densities in areas like river basins and low-lying coastal plains, which are vulnerable to natural hazards such as storms, floods, and droughts. There is an urgent need for coordinated efforts to strengthen the research to assess the impact of climate change on agriculture, forests, animal husbandry, aquatic life and other living beings.

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