

Integration of Multi-dimensional Rural and Urban Planning Efforts for Achieving SDG 13 – Indian Context

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1 ABSTRACT

Earth's climate is dynamic phenomenon subjected to change through natural cycle and anthropogenic influences. Rapid urbanization and industrialization have accelerated the process of climate change. During last few decades world has become more concerned about changes in climate, popularly known as Global Warming. Every sphere of life is affected through climate change. Prime anthropogenic reason for climate change is accumulation of Green House Gases due to burning of fossil and fuel. As per estimation of World Bank half of the world's population lives in cities, a share that is likely to reach 70 per cent in 2050 (World Bank 2010). Cities utilize as much as 80 per cent of worldwide energy production and account for a roughly equal share of global greenhouse gas emissions. Urban population is expected to be double by 2030 however; the global built-up area is expected to triple during the same period (Angel et al. 2005).

Sustainable Development Goal 13 (SDG13) talks about climate change action plan, it is one of the 17 Sustainable Development Goals established by United National during 2015. SDG13 invites Governments to “take urgent action to combat climate change and its impacts”. It emphasizes addressing and minimizing the risks arised due to climate change and is integral to the successful implementation of SDGs. Scope of SDG13 comprises multi-dimensional focus which inter alia includes adaptation and mitigation, mainstreaming climate concerns in development policies and discussing financial mechanisms to meet the targets.

Cities are hubs of opportunities for livelihood, therefore, it attract population for migration. Cities are drivers of global climate change and at the same time it is most affected party. Rapidly growing cities in developing countries and emerging economies with limited infrastructure very often become unsuccessful to provide adequate protection from extreme weather events and changing climatic conditions. The urban poor are particularly most vulnerable towards extreme weather events as they are more exposed to these events. In many cities, unplanned and haphazard urban growth leads to rapid urban sprawl, pollution, and environmental degradation. To meet the demand of urbanization issues related to climate change is largely under estimated. Peri urban areas are the most dynamic space in the process of urbanization, encounter land use change, haphazard development without prefeasibility study. These areas need special attention for mitigation and adaptation for climate change.

Rural ecosystem of India possesses unique physical, social and economic characteristics which make them uniquely vulnerable to the impacts of climate change. Impact of climate change in rural areas involves major questions of detection and attribution. Whilst having potential, there are complications with using traditional knowledge and farmer perceptions to detect climate trends (Rao et al., 2011; in IPCC 2014). Climate Change impact may be categorized into two segments, i.e. first sort involves extreme events, such as floods and storms, as they impact on rural infrastructure and cause direct loss of life and second sort will involve impacts on agriculture or on ecosystems on which rural people depend.

Sustainable development, climate change impacts and disaster risk management are core issues for both rural and urban areas of India. Vulnerability due to climate change is a dynamic concept, varies spatially as well as temporally with sensitivity, exposure and adaptive capacity. In case of urban areas climate change responsive city plan should not be confined within city administrative boundary it should encompass peri-urban areas. Similarly for climate change responsive rural planning efforts may integrate climate change issues with rural employment, infrastructure development, natural resource management, basic need development programme, etc.

Various initiatives like, Smart City Mission, National Urban Information System, Environmental Information System, National Spatial Data Infrastructure, Atal Mission for Rejuvenation and Urban Transmission, Rurban Mission, etc. are implemented by the Government of India toward sustainable rural and urban development. But in these rural and urban planning programmes issues related to climate change are not addressed. Details study of these programmes/ schemes reveals the scope of integration of climate change related issues with exiting planning initiatives. For achievement of SDG13 there is need to integrate

these initiatives along with climate change responsive plan for both rural and urban areas. . In this article an attempt has been made to develop a methodology for preparing cross sectoral and multi-dimensional planning model for climate change responsive planning for rural and urban areas.

Keywords: Rural Planning, Urban Planning, Peri Urban, Vulnerability, Adaptation, Mitigation

2 BACKGROUND

Climate Change is primarily the outcome of accumulation of Green House Gases (GHG) in atmosphere. The global increase in carbon dioxide concentration is basically due to burning of fossil fuel and landuse change, while those of methane and nitrous oxide are primarily due to agriculture activities. ‘Global Warming’ is a specific example of broader term ‘climate change’ and refers to observe increase in average temperature of air near earth’s surface and oceans in recent decades. It’s effect particularly on developing countries is adverse as their capacity and resources to deal with the challenges are limited’ (India, Ministry of Environment and Forest, Annual Report, 2012-13:349). Scientific studies have shown that the global atmospheric concentrations of carbon dioxide, methane and nitrous oxide which are the most important Green House Gases, have increased sharply as a result of human activities since 1750 and now far exceed pre-industrial values.

During 1988 Intergovernmental Panel on Climate Change (IPCC) was established for assessing “the scientific, technical and socio-economic information relevant for the understanding of the risk of human-induced climate change”. Based on the analysis of data and information for several decades IPCC in its Fourth Assessment Report has said that the incident of climate change is evident everywhere on the planet. Its impact is vivid from the depths of the ocean up to troposphere. In this report, Working Group Summary for Policymakers had synthesized current scientific understanding of global warming and also projects future climate change. It says that emissions of heat-trapping gases from human activities have caused “most of the observed increase in global average temperatures since the mid-20th century”. Evidences say that human activities are the prime cause of recent climate change and are even stronger than prior assessments.

According to IPCC assessments the degree of climate change in coming decades is directly related to emission scenario. It means, if emissions from various sources like transportation, power plants, landuse, etc., are reduced then some degrees of warming will still continue because past emissions will persist in the atmosphere for decades or more. Another scenario is that, if no action is taken to reduce emission, there will be twice as much warming over the next two decades than efforts taken to stabilize heat-trapping gases and other climate relevant pollutants in the atmosphere at their year 2000 levels.

Sustainable Development Goal 13 (SDG13) is one of the 17 Sustainable Development Goals established by United Nation during 2015. SDG13 invites Governments to “take urgent action to combat climate change and its impacts”. It emphasizes addressing and minimizing the risks arise due to climate change and is integral to the successful implementation of SDGs. Scope of SDG13 comprises multi-dimensional focus which inter alia includes adaptation and mitigation, mainstreaming climate concerns in development policies and discussing financial mechanisms to meet the targets. Targets of Goal 13 comprises Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries (13.1), Integrate climate change measures into national policies, strategies and planning (13.2), Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning (13.3), Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible (13.3a), Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities(13.3b). SDG 13 targets emphasize on capacity building , awareness generation along integration of climate measures into national policies, strategies and planning. The successful implementation of the targets demands mainstreaming of climate concerns not only in national policy making process but also at rural and city planning.

3 OBSERVATIONS ON CLIMATE CHANGE EVENTS IN INDIA :

According to India's Initial National Communication, 2004 (NATCOM) to UN Framework Convention on Climate Change (UNFCCC) observations are as follows:

Surface temperature: Over the past century the average surface air temperature has increased by 0.4°C across the country. The subcontinent is withstanding two different trends in change of surface air temperature. A warming trend has been recorded along the west coast, in the central part of the country, peninsular India and in the north-eastern region of country. While cooling trend in the surface air temperature is prevalent in north-west and parts of southern India.

Prakasa Rao et al. (2004) examined the effect of urbanization on the meteorological parameters at fifteen Indian cities and found that radiation values, bright sunshine hours, wind speeds and total cloud amounts have a decreasing tendency during the last 40–50 years, whereas relative humidity and rainfall amounts show increasing tendency in some cities. The impact of climate change may differ from one region to the other, specially for a geographically complex country like India.

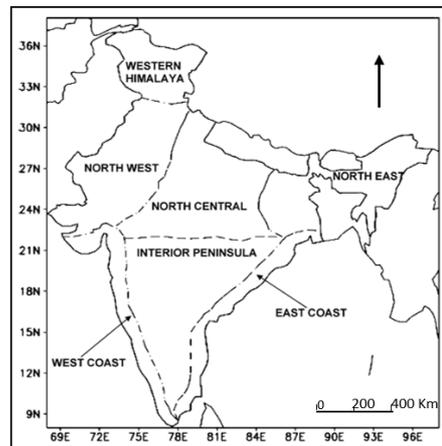


Fig. 1 : Seven homogenous regions of India used for examining temperature trends. Source: IITM.

India has been divided into seven zones as shown in Fig.1.0 to examine the changes in maximum and minimum temperatures over these regions. Seven identified zones are north-west, western Himalaya, north central, north-east, interior peninsula, east coast and west coast. West coast shows maximum increase in its maximum temperature by about 1.2°C followed by 1°C in the north east, 0.9°C in the western Himalaya, 0.8°C in the north central, 0.6°C in the north west, 0.6°C in the east coast and the least amount of 0.5°C in the interior peninsula.

- **Rainfall:** At the national level monsoon rainfall does not show any significant trend while at the regional level rainfall anomalies have been observed. The areas along the west coast, northern Andhra Pradesh and north-western India have increasing trend of monsoon rainfall (+10 per cent to +12 per cent of the normal over the last 100 years) while eastern part of Madhya Pradesh, north eastern India and some parts of Gujarat and Kerala are receiving less monsoon.
- **Extreme weather events:** The weather reports of the previous century do not indicate any significant long term trend in the frequencies of large-scale drought and floods. During the last two decades, however, the incident of more frequent droughts followed by less severe droughts become common phenomena. The coastal areas of the country experience increase trend in severe storm at the rate of 0.011 events per year (MoEF&CC). West Bengal and Gujarat have reported increasing trends severe storm while Orissa is experiencing decline trend. The analysis of daily rainfall data set have shown (i) a rising trend in the frequency of heavy rain events, and (ii) a significant decrease in the frequency of moderate events over central India from 1951 to 2000 (Goswami et al 2006).
- **Rise in sea level:** Based on the records of coastal tide gauges in the North Indian Ocean for more than 40 years Unnikrishnan and Shankar have estimated sea level rise was between 1.06 -1.75 mm per year. These rates are consistent with 1-2 mm per year global sea level rise estimates of IPCC.
- **Impacts of Himalayan Glaciers:** The Himalayas possess one of the largest resources of snow and ice and its glaciers form a source of water for the perennial rivers namely Indus, Ganga, Brahmaputra,

etc. Glacial melt may impact their long –term lean –season flows, with adverse impacts on the economy in terms water availability and hydropower generation. The monitoring data on the spatial extension of glacier in the Himalayan regions shown recession of some glacier in recent year, the trend is not consistent across the entire mountain chain.

Based on the increase trend in concentration of atmospheric GHG, various studies are undertaken by scientists to project future change in climatic characteristics. Some of the observations are listed below:

- As per IPCC’s projection annual mean surface temperature increase will range from 30C to 50C under A2 scenario and 2.50C to 40C under B2 scenario while Indian Institution of Tropical Meteorology (IITM), Pune forecast more pronounced worm in the northern parts of India.
- IITM, Pune indicated that summer monsoon intensity may increase beginning from 2014 and by 2100 under A2 scenario of IPCC.
- Changes in frequency and / or magnitude of extreme temperature and precipitation events. Some results show that fine scale snow albedo influence the response of both hot and cold events and that peak increase in extreme hot events are amplified by surface moisture feedbacks.

3.1 Possible Impact of Projected Climate Change

Impact on water resources: Changes in climatic factors like, temperature, precipitation, humidity will have long term impact on quality and availability of water. The decrease in snow cover in the Himalayan region will affect the availability of water in the rivers systems like Brahmaputra, Ganga, during the lean season. NATCOM has projected a decline in total run-off for all river basins, except Narmada and Tapti. The decline in run-off is also estimated by more than two-thirds for the Sabarmati and Luni basins. Intrusion of sea water due to sea level rise will affect the costal fresh water sources.

Impacts on agriculture and food production: The agricultural yields are subjected to the variation in monsoon rainfall and seasonal temperature change. Studies by Indian Agriculture Research Institute (IARI) and others forecast greater expected loss in Rabi crop. It says 1oC rise in temperature reduces wheat production by 4-5 Million Tonnes. Small changes in temperature and rainfall have significant impact on quality of fruits, vegetables, tea, coffee, aromatic and medicine plants and basmati rice. Other impacts on agriculture and related sectors include lower yield from dairy cattle and decline in fish breeding, migration and harvests. Global reports show a loss of 10-40 per cent in crop production by 2100.

Impact on health: Change in climatic pattern may have also impact on distribution of important vector species and may increase the spread of such diseases to new areas. It is estimated that an increase of 3.8oC in temperature and 7 per cent increase in relative humidity the transmission windows i.e., months during which mosquitoes are active will be open for all 12 months in 9 states in India. The transmission windows in Jammu and Kashmir and in Rajasthan may increase by 3-5 months. However, Orissa and some southern states, a further increase in temperature is likely to shorten the transmission window by 2-3 months.

Impacts on forests: Based on the future climate projections, it is estimated that on an average 70 per cent of the forest areas in the country are likely to experience shift in forest types, followed by changes in forests produce, livelihood etc. outcome of NATCOM projects shows an increase in the areas under xeric scrublands and xeric woodlands in central India at the cost of dry savannah in these regions.

Vulnerability to extreme events: Densely populated regions of coastal areas are exposed to climatic events, such as cyclones, floods and drought and huge declines in cultivable areas in arid and semi-arid regions arise during extreme climatic conditions. Vast areas in Rajasthan, Andhra Pradesh, Maharashtra and Gujarat and relatively small areas in Karnataka, Orissa, Madhya Pradesh, Tamil Nadu, Bihar, West Bengal and Uttar Pradesh are frequently affected by the incidents of drought. It is estimated that about 40 million hectares of land is flood prone, including most of the river basins in the north and north eastern belt, affecting about 30 million people on an average each year.

Impacts on coastal areas: By the mid 21st century the mean Sea level Rise (SLR) projected along the India’s coast will be 15 – 38 cm and of 46-59 cm by 2100. India’s NATCOM assessed the vulnerability of coastal district based on physical exposure to SLR, social exposures to SLR, social exposure based on population affected and economic impacts. In addition, a projected increase in the intensity of tropical cyclones poses a threat to the heavily populated coastal zones in the country (NATCOM 2008).

3.2 India's Action Plan for Climate Change

India's emissions are estimated as 1331.6 million tonnes of the carbon dioxide equivalent Green House Gas (GHG) emissions in 2007. The emissions indicate an annual growth of 4.2 per cent from the levels in 1994. Whereas India's CO₂ emissions are only about 4 per cent of total global CO₂ emissions and much less if the historical concentrations are taken into account (India, Ministry of Environment and Forest, Annual Report, 2012-13: 349).

In pursuance of the obligations cast on parties to the United Nations Framework Convention on Climate Change (UNFCCC), India has undertaken to communicate information about the implementation of the Convention, taking into account the common but differentiated responsibilities and respective capabilities and their specific regional and national development priorities, objectives and circumstances. The elements of information provided in the communication include a national inventory of anthropogenic emissions by sources and removals by sinks of all Green House Gases, a general description of steps taken to implement the Convention including an assessment of impacts and vulnerability and any other relevant information. India has submitted the Second National Communication (NATCOM) to the UNFCCC in 2012. The first National Communication was submitted in 2004. As per the Second National Communication submitted by India to the UNFCCC, it is projected that the annual mean surface air temperature rises by the end of the century ranges from 3.5 c to 4.3 c whereas the sea level along the Indian coast has been rising at the rate of about 1.3 mm/year on an average. These climate change projections are likely to impact human health, agriculture, water resources, natural ecosystems, and biodiversity (Economic Survey, 2012-13:257).

India's development is closely knitted with its unique natural resources, the huge demand for economic and social development and poverty eradication and its adherence to its civilization legacy that places a high value on the environment and maintenance of ecological balance. Climate change may alter the distribution, quality and quantity natural resources and it will adversely affect the livelihood of its people. Maintaining a high economic growth rate is essential for increasing living standards of the vast majority of our people and reducing their vulnerability to the impacts of climate change. In order to achieve the sustainable development path along with the economic and environment development objectives, the National Action Plan for Climate Change (NAPCC) is guided by the following principles (MoEF&CC, 2014):

- Protecting the poor and vulnerable section of the society through an inclusive and sustainable development strategy, sensitive to climate change.
- Achieving national growth objectives through a qualitative change in direction that enhances ecological; sustainability, leading to further mitigation of greenhouse gas emission.
- Devising efficient and cost effective strategies for endues Demand Side Management.
- Deploying appropriate technologies for both adaptation and mitigation of greenhouse gases emissions extensively as well as at an accelerated pace.
- Engineering new and innovative forms of market regulatory and voluntary mechanism to promote sustainable development.
- Effecting implementation of programmes through unique linkage, including with civil society and local government institution and through public –private –participation.
- Welcoming international cooperation for research, development, sharing and transfer of technologies enable by additional funding and global IPR regime that facilitates technology transfer to developing countries under the UNFCC.

The National Action Plan focuses on the development and use of new technologies. Eight National Missions namely; National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for sustaining the Himalayan Ecosystem, National Mission for Green India, National Mission for Sustainable Agriculture, National Mission on strategic knowledge for Climate Change are identified. Further Indian Network for Climate Change Assessment (INCCA) has also taken steps at the institutional level for conducting research in climate change related sciences and making necessary assessments. The MoEF&CC has already set up a network, namely the Indian Network for Climate Change Assessment (INCCA) comprising of 127 research institutions tasked with undertaking research on the science of climate change and its impacts on different sectors of economy

across various regions of India. INCCCA has helped the Ministry to put together its Green House Gas (GHG) Emissions Inventories and in carrying out other scientific assessments at more frequent intervals.

3.0 Impact of Climate Change

3.3 Scenario in Rural India

The word “rural” generally refers to areas of open country, small settlement with primary/ agro – based economic activities. During year 1951 share of urban population in India to total population was 17 percent and it becomes 31.6 per cent during 2011 census. In contrast to this during last 50 years the share of rural population of the country has decreased from 82.0 to 68.9 per cent. The disparity in rate of development, opportunity for livelihood, etc are major reasons for decrease in rural share of population. According to National Sample Survey 64th Round approximately a third of Indians (i.e. some 325 million people, out of a population of 1.14 billion in 2008) are migrants. Employment seems to be the prime force for migration; in rural areas, 55 per cent of the households have migrated for employment related reasons.

Rural ecosystem of India possesses unique physical, social and economic characteristics which make them uniquely vulnerable to the impacts of climate change. Impact of climate change in rural areas involves major questions of detection and attribution. While having potential, there are complications with using traditional knowledge and farmer perceptions to detect climate trends (Rao et al., 2011; in IPCC 2014). Climate Change impact may be categorized into two segments, i.e. first sort involves extreme events, such as floods and storms, as they impact on rural infrastructure and cause direct loss of life and second sort will involve impacts on agriculture or on ecosystems on which rural people depend.

Impacts of climate change on agriculture and related activities are due to rising temperature and changes in rainfall characteristics and seasonality along with extreme events. Changes in temperature and rainfall pattern bring changes in agricultural season. Rural economy is primarily agro based and governed by occurrences of monsoon. According to Central Statistical Organization (CSO) growth in GDP in agriculture and allied sectors in 2014-15 over 2011-12 is -0.1%, share of agriculture and allied sectors in total GDP has reduced by -0.4% .

The reasons for migration in India are usually summarized as push and pull factors. While push factors are mostly convincing reasons which help the migrants to make up their mind for migration. The pull factors offer opportunity and attract migrants towards the place of destination. The push factors include the population pressure, declining yields, institution of marriage, disintegration of joint family system, lack of livelihood opportunities, etc; the pull factors also include better educational, health care facilities, modern means of transport and communications, more employment opportunities and a growing craze for urban life. In addition to these factors, the incidents of climate change is affecting the rural ecosystem in various ways. It is causing flood, drought, sea level rise, etc. These events trigger rural to urban migration. Climate refugees are push migrants , they may be permanent or temporary in nature.

Rural to urban migration is the major reason for urbanization. Rapid growth in urban population is a big challenge to the city administrator to serve housing, infrastructure, environmental quality, etc. to the city dwellers. Rural to urban migration has both positive and negative impacts on urban areas. Due migration of people from rural to urban areas the mushrooming of slums in are around the urban areas/ urban centre takes place. According to the study carried out by economic and social commission for Asia and the Pacific (ESCAP, 1991) “migration from rural to urban areas continues at a rapid pace in many countries of the region, and it was often beyond the capacity of towns, cities and metropolitan areas to cope with the increasing numbers”. Increasing inflow of distressed population from rural to urban area results into overcrowding of cities and development of slums. Economically weaker migrants from rural areas come to the urban areas and settle in the slums. It is observed that unskilled marginal farmers or landless labours migrates to the urban areas become unskilled labourers and settle in the slums. The great slums of India are mainly formed because of migration of large numbers of individuals or families to the urban centers in search of their dreams, usually in hunt of better economic prospects/ livelihood (Bandyopadhyay , 2018) .

3.4 Scenario in Urban area

In the recent days a new challenge has been added to urban issues, that is climate change. Its outbreak is in the form of increase in temperature/ occurrence of super storm/flood/drought/ submergence of coastal areas,

etc. Coping with climate change remains a daunting challenge. The degree of quandary that cities are facing due to climate change has made the urban sustainability a big question.

The majority of the world's population already lives in urban areas and it will become 66 per cent by 2050. Cities consume up to 80 per cent of total global energy production and account for 71 to 76 per cent of global CO₂ emissions (Gerics 2015). They are the drivers of global climate change and at the same time it is most affected party. Rapidly growing cities in developing countries and emerging economies with inadequate infrastructure fails to provide adequate protection from extreme weather events and changing climatic conditions. The urban poor are particularly most vulnerable towards extreme weather events as they are more exposed to these events. In many cities, unplanned and haphazard urban growth leads to rapid urban sprawl, pollution, and environmental degradation. In addition, cities are points of convergence of many risks, which makes them particularly vulnerable to chain reactions and amplify the interconnection between global risks (World Economic forum 2015) such as natural hazards and climate change impacts. The concentration of people, assets, critical infrastructure and economic activities in cities exacerbates the potential of natural hazards (Gerics 2015). Asia, Africa and Latin America have experienced high rates of increase in the incidence of natural disasters over the last three decades, with many urban areas having sustained heavy losses of human lives due to disasters. Total population exposure to cyclones and earthquakes, is projected to rise (Lall & Deichmann, 2009). Many of the world's cities are situated along the coast, they are exposed to flood from storm surges and sea level rise. The risk of coastal flooding has further increased in cities affected by subsidence. Coastal cities of South America have to face more frequent heavy rainfall and higher temperature which could put thousands of homes in the low-income settlements at risk (United Nation 2011).

The International Council of Local Environmental Initiatives (ICLEI), South Asia, associated with 54 local governments in the South Asian region (including 41 cities from India) to collect city energy consumption and related carbon emissions inventory data of the participating cities (Figure 2.0).

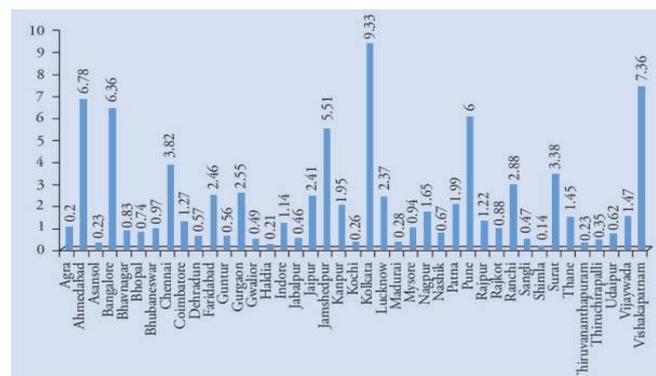


Fig. 2: City-wise energy consumption and related carbon emissions inventory data.

It shows the highest emissions are in Kolkata, followed by Vishakapatnam and Agra. It is found that the average per capita carbon emissions are higher in the metropolitan cities of India (being 1.19 tonnes per capita as compared to only 0.90 tonnes per capita in the non-metropolitan cities) and the national average is 0.93 tonnes per capita (Sridhar, Kala Seetharam, 2011). This is because larger cities have more industries and other polluting activities such as emissions from public and private transport. However, the corporation level emissions as a percentage of city-level emissions are much higher in the non-metropolitan areas than in the metropolitan areas. This is because smaller city corporations lack the adequate technology to minimize their carbon emissions in the provision of various public services such as water supply, sewerage, street lighting, and transportation. Not only cities and urbanization impact climate change, but also, the question of whether climate change has impact on cities India's cities which are characterized by high density of population, housing stock, and poor infrastructure, all these make them more vulnerable to climate change. Given that the most valued infrastructure is usually located in cities, the economic and social costs of climate change will be much higher in cities. For example, cities house valuable communications infrastructure as they do physical infrastructure such as buildings, roads, bridges, and fly-overs. Hence, any climate change impacts in the form of damage will be quite expensive. Revi (2009) highlight the multiple ways in which climate change can impact Indian urban residents through loss of livelihood opportunities (including housing and assets) and income, loss in terms of health or ability to work, loss of community and informal social nets due to forced migration, reduced resilience to future shocks, reduced affordability and access to public

services, and greater vulnerability to unsustainable debt exposure, that could be necessitated in times of crisis. There is nothing uniquely urban about these phenomena and these channels can work equally in rural areas. Second-order impacts of climate change on Indian cities as occurring via migration, since climate change can accelerate the pace of rural–urban migration, driven by increases in extreme events, greater monsoon variability, drought, flooding, and resource conflict, as well as loss of both livelihood opportunities and informal social nets, especially due to sea-level rise and enhanced flooding in cities by the coasts, leading to changes in the spatial distribution and density of both formal and informal settlements. Degradation of building and infrastructure materials is also projected to occur. As warmer temperatures extend into higher latitudes, diseases that have long been considered eradicated may re-emerge; and new diseases may also be experienced. The health ramifications could be serious. The gap between water supply and demand is also projected to increase as drought-affected areas expand and the episodes of flood intensify.

4 OVERVIEW OF PLANNING INITIATIVES IN INDIA IN CONTEXT OF CLIMATE CHANGE

4.1 Rural Development Initiatives in India

With the objective to improve rural economy, Govt of India has implemented numerous initiatives like; Community Development Programme, Twenty Point Programme, Drought Prone Areas programme, Desert Development programme, National Fund for Rural Development, Council for Advancement of People's Action and Rural Technology, Har Khet ko Pani, Mahatma Gandhi National Rural Employment Guarantee Scheme, etc.

During 2016 Government of India has launched National Rurban Mission to develop cluster of villages that preserves and nurtures the essence of the rural community life with prime focus on equity and inclusiveness without compromising with the facilities perceived to be basically urban in nature thus creating a cluster of 'Rurban Villages'.

An Integrated Cluster Action Plan (ICAP) for each Rurban cluster would be prepared to guide the development of the village cluster. ICAP is a key document comprising baseline studies of the cluster and the key interventions needed to address these needs and to leverage its potential. The ICAP prepared for the cluster includes: (1) A strategy for the cluster integrating the vision for each Gram Sabha (village level administrative body elected by villagers) identified in the cluster. (2) The desired outcomes for the cluster under the Rurban Mission (3) The resources to be converged under various Central Sector, Centrally Sponsored and State Sector schemes. (4) The Critical Gap Funding (CGF) required for the cluster. (5) Most importantly, the ICAP would delineate the cluster areas to form well planned layouts following the planning norms (as laid down in the State Town and Country Planning Acts/similar Central or State statutes as may be applicable), which would be duly notified by the State/UTs. These plans would be finally integrated with the District Plans/Master Plans as the case may be. ICAP for each cluster will contain two components ; Socio-economic components and infrastructure component and Spatial Planning Components.

4.2 Rural Planning Initiatives in the light of SDG13

Government of India has undertaken numerous initiatives towards infrastructure development, economic up-gradation, increase in agricultural production, spatial area development, socio-economic development, community development, etc. These efforts are disjointed and target based, lack of considering all aspects of rural development .

National Rurban Mission has scope for development of village cluster, it focuses on development of village cluster socially as well as economically. In National Rurban Mission villages clusters are considered as unit of planning. 300 villages clusters are identified for development . The Mission not only focuses on reducing regional disparity but also it focuses on social development . It has scope for development of spatial data , resource map, cluster profile for demography, socio-economy, culture, administrative profiles of the clusters, etc. The Mission has also embedded components like; training for economic activities, developing skills and local entrepreneurship and infrastructure amenities. For each cluster the comprehensive assessment are made on economic profile of the cluster to understand drivers of economic growth of the cluster, assess the basic strengths and weakness of the cluster and identify the opportunities for economic growth of the cluster. This exercise will not be restricted at the cluster level and will include economic assessments at the block and

district levels. The cluster level strength and deficiency analysis and identification of needs are integrated with the ongoing schemes of the Government of India. Resources for cluster development would be converged under various ongoing central and state level schemes. For implementation of the mission, bottom to top integration approach is adopted.

Though objective of National Rurban Mission is not directly focusing on climate change related issues but it has scope to accommodate the tasks and targets for achieving SDG 13 Goals.

4.3 City Planning Initiatives in India

Since independence various initiatives are taken by Government of India for city/ urban planning which, inter alia, include National Commission on Urbanization, 74th Constitutional Amendment Act, Urban Development Plan Formulation and Implementation Guidelines, Jawaharlal Nehru National Urban Renewal Mission, National Urban Information System, Rajiv Awas Yojana, National GIS, Smart City, Swachh Bharat, Atal Mission for Rejuvenation and Urban Transformation, etc

Government of India had appointed National Commission on Urbanisation during 1980s under the Chairmanship of Charles Correa to analyze the state of urbanization with reference to the demographic, economic, infrastructural, environmental, physical, shelter, energy, communication, land, poverty, aesthetic and cultural aspects and to identify priority action areas and it had also made projections of future needs and estimated the available resources. On the basis of analysis carried out by the Commission it had prepared basic guidelines for the specific action plan in priority areas along with policy frames and suggestion of basic approaches for the encouragement of manageable urbanization and also the methods of creating networks of interactions as an ongoing process among government, academic and research institutions and citizen groups. The recommendations of the Commission had not been finalized and yet to be implemented as policy.

The Constitution (Seventy Forth Amendment) Act, 1992 has introduced a new part namely, Part IXA in the Constitution, which deals with the issues relating to municipalities. The main provisions introduced by Act are constitution of municipalities, composition of municipalities, composition of ward committee, duration of municipalities, etc. This amendment has provided a constitutional form to the structure and mandate of local bodies. It has made urban local bodies to perform as democratic and self governing institution at grassroot level.

Since 1996, due to rapid growth of population and reasons like globalization and liberalization, the towns and cities have become more dynamic in nature. Urban areas are subjected to challenges in terms of requirements of infrastructure and other basic services and amenities. The Urban Development Plan Formulation and Implementation (UDPFI) Guidelines have been framed to incorporate the provisions of the various legal and policy/ guidelines of the respective Ministries and departments, best practices of the States as examples and the planning system in vogue. An interrelationship between them is proposed for a sustainable urban and regional development.

Jawaharlal Nehru National Urban Renewal Mission (JnNURM) was launched in 2005 to encourage cities to commence steps for bringing phased improvements in their civic service levels. The mission of JnNURM was to development in the context of urban conglomerates focusing to the Indian cities. JnNURM aims at creating 'economically productive, efficient, equitable and responsive Cities' by a strategy of upgrading the social and economic infrastructure in cities, provision of Basic Services to Urban Poor and wide-ranging urban sector reforms to strengthen municipal governance in accordance with the 74th Constitutional Amendment Act, 1992.

National Urban Information System (NUIS) initiated by Ministry of Urban Development (MoUD) in 2006 for creation of multi-scale (1:10,000, 1:2000, 1:1000) hierarchical urban geospatial database on thematic content using satellite, aerial and GPR techniques. It generated GIS based maps for preparation of Master Plan for selected cities.

Rajiv Awas Yojana (RAY) was launched in 2009 as a continuation of JnNURM. It envisages a "Slum Free India" with inclusive and equitable cities where every citizen has access to basic civic infrastructure and social amenities and decent shelter.

Ministry of Urban Development during 2015 has launched the Smart city mission transformation with the objective to support cities to enable them to offer core infrastructure and provide a decent quality of life to its citizens along with a clean and sustainable environment and application of 'Smart' Solutions. The aim is to

achieve sustainable and inclusive development. The mission aims to develop a replicable model which will act like a light house to other aspiring cities.

During 2015 the Ministry of Urban Development has launched Atal Mission for Rejuvenation and Urban Transformation (AMRUT) with the aim to formulate GIS-based Master Plan for selected AMRUT cities. The geospatial technologies is used for formulate a master plan for decision-making, effective land use management and utilization, spatial growth management, enable project planning and urban management.

4.4 City planning initiatives in the light of SDG 13.

Addressing climate change related issues for urban areas emphasize to integrate city planning programmes and climate change indicators as important input for decision support systems for city planning. Thorough review of city planning initiatives reveals that approach of city/master planning exercise is compartmentalized by nature and having prime focus on landuse, infrastructure, industrial, transportation development, etc. To meet day to day demand for urban life the vulnerability of the city arise due to climate change has become underestimated.

Non-consideration of climate change issues in city planning is mainly due to limited knowledge of climate change adaptation mechanisms. The measures identified by the researchers/ stakeholders deal mostly with mitigation (afforestation, sustainable transport, etc.) and not with adaptation initiatives. Knowledge about possible adaptation mechanisms specific to the local context is missing. Another reason is lack of information and mechanism for information exchange. One of the emerging gaps is lack of reliable, accessible data sets. While some data are available with Government and also with a couple of NGOs. The main issue is non-availability of reliable data in public domain. Most of the information available with the Government of India can be accessed through the Right to Information Act. But it remains a project in itself to access and collate the data available in different places, especially, when spatial data is required for planning at a city level. By using spatial data sets available in public domain some of the constraints can be overcome. Lastly, it is attributed to limited planning capacities, restrictive planning processes and institutions. Most of the cities have limited internal capacity to plan beyond the immediate project at hand. Moreover, the planning process itself is protracted and still driven primarily by landuse planning that often fails to incorporate the current risks and resource constraints. The institutions dealing with planning are fragmented, like the municipal corporations, the development authorities and the town planning institutions all have a role to play.

Though protocols of ongoing city planning initiatives like; NUIS, AMRUT, Smart City etc. are not directly addressing climate change related issues of urban areas but within their protocol there is scope to incorporate aspects of climate change responsive planning without hampering the basic structure of the scheme.

5 INTEGRATED MULTIDIMENSIONAL MODEL FOR RURAL AND CITY PLANNING

In previous segments it is understood that impacts of climate change are vivid in both urban and rural lives of India . Climate change is acting as one of the push factors for rural migrants, generating addition burden to urban infrastructure, peri urban growth, haphazard development, poor quality of life, degradation of natural resources , environmental degradation etc. ICAP for rural areas and NUIS, AMRUT, Smart City, etc for urban areas have scope to incorporate targets of SDG 13 in their exiting planning mechanism. There is requirement of integrated multidimensional planning model for rural and urban planning which will knit climate change related issues with exiting planning mechanisms.

The model will be a rational approach to understand and assess the risks of climate change, policy to reduce the impact of climate change and lessen the causes behind climate change at city and rural levels. The components of the integrated multidimensional model will be assessment of risk, policy to reduce the risk, approaches to reduce the impact of the hazard and last not the least to diminish the functions accelerating the process of climate change. Performance of these tasks entails data and information from various aspects of both rural and city life, its environment and factors influencing GHG emission.

The major theoretical challenge involves in implementation of integrated multidimensional planning model is development of multidisciplinary approach that integrates diverse rural and urban themes such as social, economic, cultural, environmental, spatial and physical infrastructure into a unified conceptual framework capable of understanding present state of resiliency of any geographical area and how they should move

towards a more resilient state. The integrated multidimensional planning model aims to investigate the phenomenon of present resilience and developing a new multidisciplinary conceptual framework towards more resilient state. It will integrate the climate change responsive plan with mainstream planning.

While developing the indicators for integrated multidimensional planning model the followings aspects are considered:

- to assess a system's resilience for both rural and urban ecosystems.
- to understand dynamics of social–ecological systems in the light of resilience

5.1 Conceptualization of Integrated multidimensional planning model

While working on concept of integrated multidimensional model following aspects are taken into consideration:

- Mapping of multidisciplinary data sources;
- Reviewing the literature and categorizing the selected data;
- Identifying and naming the concepts;
- Integrating the concepts;
- Validating the conceptual framework.

The entire concept of integrated multidimensional model consists of basic four components:

(A) Vulnerability Assessment Index (VAI): It is a dynamic concept, significant to assess degree of present resilience of an area and to forecast future risks and vulnerabilities. The index analyzes and identifies characteristics of climate change hazards, its intensity, scope and impact on demography, infrastructure and other aspects of urban ecology. This concept deals with the affects of hazards, risks and uncertainties influencing various rural and urban population. VAI matrix is composed of three components, namely, demographic vulnerability, urban space informality and spatial dimension vulnerability. Urban space informality is applicable to urban areas only.

(B) Planning Initiatives: Any rural or urban area becomes more resilient when its governance is capable to promptly restore basic services and recommence social, institutional and economic activity after any hazard events. A common believe is that a more resilient State undertakes decision making processes in the realm of planning, open dialog, accountability, and collaboration. In this process rural and urban dwellers, local stakeholders, various social groups, communities, civil society, grassroots organizations, etc. participate. While weak governance lacks the capacity and capability to include participatory planning and decision making and generally fails to meet the challenges of resilience as well as increase the vulnerability of the urban population.

The role of governance in resiliency is very crucial, related to measures of quality of life, environmental well being, economic vitality and implementation of policies. Local authorities have important role in mitigation and adaption of climate change. According to this concept in order to cope with uncertainties, risks and hazards that cities and their communities may face, and make them more resilient, there needs a shift in governance. This shift will make governance more integrative, deliberative, and socially and economically sound. This concept is comprises the components like implementation, monitoring and management.

(C) Plan for Prevention: In order to move towards greater resiliency and less vulnerability, rural and urban areas are required to prevent environmental hazards and climate change impacts. There are three main components that aim to prevent future catastrophes. These components assess mitigation policies to reduce hazards, include the spatial restructuring as a preventive measure for future environmental disaster, and search for alternative clean energy.

(D) Plan to Address Uncertainty: According to this concept the planning exercise should be uncertainty oriented rather than adapting the conventional planning approaches. There is a need to rethink and revise current planning methods which leads to address uncertainties, challenge the concepts, procedures, and scope of traditional planning approaches. Planning efforts should be towards controlling uncertainty either by taking action now to secure the future or by arranging actions to be taken in case an event occurs any time in

future. In this concept there are three interrelated components, adaptation, spatial planning and sustainable urban design (for city planning only).

6 CONCLUSION

Climate change is no longer a distant possibility but a current reality (World Bank -2009). There is no scope to disagree with the fact that the global climate change is an outcome of human-induced GHG emissions. Increased levels of heat trapped in the atmosphere have accelerated the process of modifying weather patterns, which in turn alter temperatures, sea levels, storm frequencies, etc. These will impact both urban and rural areas especially those in geographically sensitive areas.

Sustainable development, climate change impacts and disaster risk management issues are core concerns for each and every nation. The action plan to reduce the impact of climate change starts with reducing emission of GHG. But reducing GHG emissions is not the sole solution to combat climate change. Management of urban areas, their growth and spatial planning requires the consideration of disaster risk management and the climate change agenda as essential components of urban development plan. Expectations from rural planning encompass plan for extreme events, such as storms, flood and plan to secure agricultural productivity.

Scope of SDG13 includes multi-dimensional focus for adaptation and mitigation, mainstreaming climate concerns in development policies and discussing financial mechanisms to meet the targets. The proposed integrated multidimensional model for climate change responsive planning is multidimensional in nature, it comprises components like vulnerability assessment, plan for prevention, plan for uncertainty and planning initiatives for successful implementation of model. The Model has ample scope to achieve targets SDG13.

While comparing outcome of each component of integrated multidimensional model with targets of SDG 13 it appears that targets of SDG 13.1, 13.3, 13.3b are directly addressed by components like; Vulnerability assessment index, Plan for prevention and Plan to address uncertainty, while SDG 13.2 and 13.3a targets can be achieved through meaningful planning initiatives.

Vulnerability of any geographical location is not static rather it is a function of exposure, sensitivity and adaptive capacity. The proposed model is a dynamic concept varies with geographical location, nature of impact of climate change, level of exposure, sensitivity and adaptive capacity. Plan for combating climate change may not be considered as stand-alone effort it should be embedded with existing city and rural planning programmes, schemes. The proposed integrated multidimensional planning model for climate change responsive planning can be easily merged with the existing rural and city planning schemes of India for achieving targets of SDG 13.

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