

## ADAPTATION ISSUES IN URBAN SETTLEMENTS FOR CLIMATE CHANGE IMPACTS

NAGARAJU KAJA

**Abstract :** Most of the World's population lives in urban centres relatively in small areas surrounded by economical, cultural and individual activities. They are the drivers of the GHG emissions due to the presence of Industries, transportation and many other emitters of Green House Gases (GHG) and are also the ones effected by the impacts of Climate change and Global warming first. They are also the main source of response for the adaptation and Mitigation of this burning Global issue with. The impacts of Climate Change on urban centres may be in a way of increased rains, storms, heat waves and other extreme weather conditions. The changes in mean temperatures, precipitation levels and sea level changes also may occur with frightening impacts on the urban infrastructure and on socio economic conditions of the population living in there. Climate change impacts are not only related to exposure but mainly due to the lack of adaptive capacity to the problem. Globally many cities have witnessed vulnerabilities to Climate change impacts even after taking efforts to face the problem. Without even considering the future impacts of Global warming, the population and infrastructure of many urban settlements are facing adaptive deficits with in the current range of climate variability. It is often found from the past experiences that adaptation actions are very limited and these are seldom undertaken in response to climate considerations alone. Adaptation measures on contrary have multiple social and economic drives and has to be implemented as a part of broader development initiative rather than being purely based on climate change. This paper deals with the adaptive deficits now urban settlements are facing and discusses the remedial measures to deal with it.

**Keywords:** Climate change, adaptive measures, urban settlements, Global warming

**Introduction :** Climate Change has become one of the most challenging environmental issues for mankind today. Societal activities in urban settlements like industries, Infrastructure, transportation are the key sources of GHG with frightening impacts on the Global climate. The range of effects has included warming of sea water temperatures that has given us warning signs such as the collapse of ice shelves like Larsen A(1995) an Larsen B(2002) in Antarctica propelling a sea level rise that now threatens many urban settlements along the coasts. Not only this, polluted warm seas threatens the coral reef ecosystems around the world. Climate change is recognized both as a threat and as a challenge. The impact of human activities on climate and climate systems is unequivocal. Climate has a significant role in the economic development of the world as many sectors of the world's economy are climate sensitive. Climate change has origins in anthropogenic activities and is engaging the attention of planners, governments, and politicians worldwide. It is no longer a scientific question as to whether the climate is changing, but the question is the timing and magnitude of Climate Change. The governments of the countries across the world are busy in working out the impacts and associated Vulnerabilities of their economies to impending projected climate change.

The potential climate change impacts are as follows:

- Meteorological records indicate rise in the mean annual surface air temperature by 0.4°C with not

much variations in absolute rainfall.

- The tide gauge observations in the last four decades across the coast of India also indicate a rise in sea level at the rate of 1.06-1.25 mm/year.
- Some preliminary assessments point towards a warmer climate in the future over India, with temperatures projected to rise by 2-4°C by 2050s.
- Spatial pattern of the rainfall are likely to change, with rise in number and intensity of extreme rainfall events though there may not be any change in total quantity of rainfall expected.
- The sea level is also projected to rise with cyclonic activities set to increase significantly with warmer oceans.

There is no doubt that the populations, infrastructure and ecology of cities are at risk from the impacts of climate change. However, tools are becoming available for addressing some of the worst effects. For example, appropriate building design and climate sensitive planning, avoidance of high-risk areas through more stringent development control, incorporation of climate change allowances in engineering standards applied to flood defences and water supply systems, or allocating green space for urban cooling and flood attenuation. Though we cannot totally avoid or mitigate the calamities, preparedness and adaptation strategies will definitely reduce the adverse impacts. Under some circumstances both adaptation and mitigation must be addressed within a broader developmental context (Du-Plessis, 2003).

### Vulnerabilities of Urban Settlements (Impact of Climate Change on Urban settlements) in recent times

It is no longer a scientific question as to whether the climate is changing, but the question is the timing and magnitude of Climate Change impacts. The governments of the countries across the world are busy in working out the impacts and associated Vulnerabilities of their economies to impending projected climate change impacts. This is evident from the recent findings that Global average air and ocean temperatures are raising, increase in the melting of snow and ice, rising global sea levels and increase in the severity of the storms. If you look at the recent natural calamities across the World, the severity of the disasters has increased very much.

\*Over the years, nations have suffered huge losses due to extreme weather events. The Global monetary loss has reached 225 billion US dollars (Down to earth, Nov 16-30, 2011). The year 2005 was the worst hit, Hurricane Katrina hit New Orleans in the US. It was one of the most destructive natural disasters in US history with an estimated damage amounting to 96 billion dollars and effected area of 93,000 square miles and 1300 lives. This has awakened the US administration and shown that the preparedness or adaptation to disasters is insufficient. The storm

demonstrated the need for greater interaction and synchronization of preparedness not only from the federal government but also with the state and local government and non profit sectors as well. In the report submitted to the president, USA it was mentioned that the federal preparedness and coordination efforts were not sufficient to provide necessary framework to manage the challenges of 21<sup>st</sup> century catastrophic threats.

In 2005, Mumbai city witnessed a heavy floods due to unprecedented rain fall because of which the city came to a standstill. The maximum city received half of season's rain fall with

in a day. The financial cost of floods was enormous and these floods caused a stoppage of entire commercial, trading, and industrial activity for days. Preliminary indications indicate that the floods caused a direct loss of about Rs.450 crores or US\$100 million. This clearly illustrate that the Urban settlements who are relatively more resilient to cope with the impacts of climate change are also vulnerable with the increase in the intensity of storms. These dangers are compounded when the Urban centres fail to adapt themselves for the calamities The top 10 disasters caused the maximum financial loss in the 2009 is as follows

isaster Events	Country	Damages (in 2009 US \$ bn)
Winter storm 'Klaus', January	France, Spain, Italy*	5.1
Earthquake, April	Italy	2.5
Tornado, February	United States	2.5
Earthquake, September	Indonesia	2.2
Flood, September-October	India	2.2
Tornado, June	United States	2.0
Tornado, April	United States	1.7
Typhoon 'Morakot' (Kiko), August	China P Rep, Taiwan, Philippines**	1.7
Thunderstorm, July	Switzerland, Austria, Germany, Poland, Czech Rep***	1.6
Hurricane 'Ida', November	El Salvador, United States, Mexico, Nicaragua****	1.5
<b>Total</b>		<b>23.0</b>

(Source: The Disaster Centre, EM-DAT: The OFDA/CRED, International Disaster database, Annual disaster statistical Review, 2009)

**Adaptation** : Meaning of Adaptation is the adjustments of ecological, social, or economic systems in response to actual or expected climatic stimuli and their impacts. It refers to changes in processes, practices, and structures to moderate or reduce potential damages associated with climate change. Adaptations changes according to the system in which they occur, who undertakes them, the climatic stimuli that prompt them, their timing,

functions, forms, and effects. In unmanaged natural systems, adaptation is autonomous and reactive; it is the process by which species and ecosystems respond to changed conditions. In systems concerned to human beings, adaptation is undertaken by private decision makers and by public agencies or governments.

Adaptation depends greatly on the adaptive capacity or adaptability of an affected system, region, or

community to cope with the impacts and risks of climate change. The adaptive capacity of communities is determined by their socioeconomic characteristics. Enhancement of adaptive capacity represents a practical means of coping with changes and uncertainties in climate, including variability and extremes. In this way, enhancement of adaptive capacity reduces vulnerabilities and promotes sustainable development.

Estimates of likely future adaptations are an essential ingredient in impact and vulnerability assessments. The extent to which ecosystems, food supplies, and sustainable development are vulnerable or "in danger" depends both on exposure to changes in climate and on the ability of the impacted system to adapt. In addition, adaptation is an important policy response option, along with mitigation. There is a need for the development and assessment of planned adaptation initiatives to help manage the risks of climate change.

Enhancement of adaptive capacity represents a practical means of coping with changes and uncertainties in climate, including variability and magnitude of the impacts. In this way, Adaptation to climate change has the potential to substantially reduce many of the adverse impacts of climate change and enhance beneficial impacts. Having better adaptation Potential will promote sustainable development. Most sectors are reasonably adjustable /adaptable to the impacts with the less intensity. But the same sectors become less adaptable in case of extreme climatic impacts (Impacts of higher magnitude).

**Adaptation deficits :** It is observed over the years that much of the damage in extreme weather conditions in urban centres is not because of the disaster event but from the inadequate provision of protection. For example if the drainage system is inadequate, even a small rain storm can cause severe flooding.

The main impact will be in the form of

- Loss of infrastructure like houses, roads etc.
- Health and living conditions
- Livelihood

In most of the urban centres, the main deficits to cope up the extreme situation is infrastructure like weather proof roads, piped water supply, fool proof drainage facility. In any well-governed city, there is already a great range of measures in place to ensure that buildings and infrastructure can withstand extreme weather events.

#### **Adaptation Potential of Urban settlements**

The Fourth Assessment of the Inter governmental Panel on Climate Change (IPCC) refers that the urban centres and the infrastructure they concentrate are

often capable of considerable adaptation to reduce risks from the direct and indirect impacts of climate change. All major urban centres have to make their own adaptations to its environmental conditions and possible disasters to be able to withstand the same. Successful Urban centres are the ones having adaptation capacity to face the challenges of the climate change led disasters.

A report from Tear fund, in the UK, and the Institute of Development Studies, UK, considers how the climate change adaptation and disaster risk reduction (DRR) communities can work together to respond to these challenges. Climate change adaptation is an adjustment in natural or human systems in response to actual or expected climatic changes or their effects. These adjustments can be to reduce the harm or to exploit opportunities. DRR works to improve the development and application of policies and practices which minimize the risks of disasters and reduce people's vulnerabilities. When policies are done for sustainable development, emphasis should be given to climate change impacts.

Planned adaptation process has to be undertaken to reduce the risks of climate change related impacts on the infrastructure and on the inhabitants. There are time tested tools and techniques like the changing the land regulations, building bye laws, infrastructure standards, land use regulations, awareness to insurance etc. Policies to be implemented in the long run have to be envisaged. The main problem is not the actual disaster but the secondary problems like water contamination, spread of gas or chemicals when disaster happens. The later will create more havoc than the former. Integration of adaptation with disaster preparedness will get us better results in case of eventuality. Well planned water-supply systems can cope with variations in freshwater supplies. Good environmental and public health services should also be able to cope with any increase in other climate-change-related health risks. In the event of not having the capacity to with stand the climatic impacts we will witness a great disaster like the one we have witnessed in Mumbai, India in 2005.

**Conclusions :** There is wide range of measures to ensure that the settlements can with stand the extreme weather conditions like good water supply, drainage systems, good public health services to face the spread of communal diseases. Changing climatic conditions can also create new hazards. Above all, there is an urgent need to translate awareness of climate change impacts into tangible adaptation measures at all levels of governance. The Primer for Municipal Water Providers (Miller and Yates, 2005) and the Checklist for Development (GLA,2005) provide good examples of how the latest scientific understanding of sectoral impacts and adaptation

responses can be shared with practitioners. The next challenge is to integrate measures across sectors so

that such responses are implemented in a coordinated and cost-effective way.

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Department of Architecture  
School of Planning & Architecture Vijayawada  
Nidamanuru, Krishna Dt A.P (INDIA)