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Urbanisation, Climate Change and Policy: A Study of Delhi

Kanika Kakar, Ph.D.

Assistant Professor

Department of Sociology

Janki Devi Memorial College, University of Delhi

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Abstract

Flooding during monsoons, poor air quality, thick smog, extreme cold and heat waves are not uncommon for the residents of Delhi. These are harsh realities of climate change that beset many urban centers in India. This article explores the deep impact of urbanisation process on the climate of Delhi effecting the biophysical environment of the inhabitants of Delhi. The state of Delhi was the first to release its Climate Change Agenda, 2009-2012 in line with the National Action Plan on Climate Change, 2008. A growing interest of city administrators and policy makers to formulate plans on climate change and action is further evident since its incorporation as one of the SDGs by the UN in 2015. The article reviews the plans, measures and action taken up by the Delhi government to combat climate change over the years. It is well known that climate change exacerbates the vulnerability of poor and marginalised groups. Following a social justice perspective, the article critically assesses the efficacy of climate change policy in Delhi in representing and addressing the interests of the vulnerable and marginalised groups in the city.

Key words: urbanisation, climate change, anthropogenic, natural ecosystem, policy, vulnerable

Introduction

Flooding during monsoons, poor air quality, thick smog, extreme cold and heat waves are not uncommon for the residents of Delhi. These are harsh realities of climate change that beset many urban centres in India. ‘Climate change has been one of the greatest ecological and social challenges of the 21st century’ (Dietz, Shwom and Whitley 2020: 135). Over the past two decades or so there is an increasing realisation globally that cities are the key drivers of

climate change and action, 'placing new importance on India's urban transitions' (Khosla and Bhardwaj 2019: 459). It is estimated by the United Nations Division of Economic and Social Affairs (UNDESA) that India's urban population will be doubling from 400 million mark in 2014 to 800 million in 2050 (ibid.). Delhi being the capital of the country and among one of the most populated cities of the world becomes an interesting case to explore to understand the relation between urbanisation and climate change, and policy intervention therein.

A salient impact of urbanisation is on the climate of the city. Rapid and unplanned urbanisation in Delhi has put a heavy pressure on its natural ecosystem, which is gradually transforming its climate and weather conditions. The article commences with taking an overview of the manner in which the urbanisation of Delhi has proceeded putting it to climate risk. At the outset the article focuses on understanding urbanisation as a cause for climate change. The correlation between the increasing urbanisation of Delhi and climate change is examined by highlighting the multiple risks and hazards that these have exposed the city to in recent times.

Further, a relationship between urbanisation and climate change related risks calls for reviewing the plans, measures and actions to overcome the same. The next section traces the evolution of international and national discourse and policy documents linking climate change action with urbanisation. A connection between international and national efforts to combat climate change risks is evident. These efforts have acted as blue-prints for states and cities to evolve their strategies and action plans to resolve climate change as is apparent from the case of Delhi.

The state of Delhi was the first to release its Climate Change Agenda, 2009-2012 in line with the National Action Plan on Climate Change (NAPCC), 2008. A growing interest of city administrators and policy makers to formulate plans on climate change action is further evident since its incorporation as one of the Sustainable Development Goals (SDGs) by the United Nations (UN) in 2015. This paper reviews policy plans of the Delhi government to understand

its approach to combat climate change. It is well known that climate change exacerbates the vulnerability of the poor and marginalised groups. Following a social justice perspective, the paper critically assesses the efficacy of the climate change policy in representing and addressing the interests of these groups in Delhi.

Urbanisation and Climate Risks in Delhi

Understanding Urbanisation as the Cause of Climate Change

'The natural ecosystem is the template upon which the urban habitat is imposed' (Turaga 2015: 85). The ecosystem with its biodiversity performs many functions that are critical in maintaining a clean and healthy environment and climate for the well-being and sustenance of human life. Any transformation and modification in this natural ecosystem is liable to disturb the environmental balance and alter weather systems with severe implications on human life.

A foremost cause of climate deterioration in Delhi has been rapid urban development, which has come to weigh heavily on its natural ecosystem and biodiversity. To understand the impact of climate change on Delhi it becomes imperative to reflect briefly on its geographical and historical evolution. The present set up of Delhi as it stands today has evolved on and around the Aravalli ridge forest and the river Yamuna that have contributed to making it suitable for habitation. Historically, Delhi is believed to contain seven cities which were developed as capitals by the various medieval dynasties, each adding to its built-up area and having an impact on its natural resources and environs (Singh 2019; Thomas 2011). There are accounts that point out that the first four of the medieval cities of Delhi were built on the ridge, 'partly for ecological reasons and partly because of the military vantage afforded by the hills' (Thomas 2011). In fact, the fifth and the sixth cities are also said to have been built around or in the vicinity of the ridge. However, by the time when the seventh city, Shahjahanabad was set up by the Mughals the ridge had lost much of its forest. This city, which constitutes the old Delhi

today was therefore built towards the banks of the Yamuna River. It is believed that the population of Delhi began to increase with the setting of this city (Singh 2019).

Delhi's population further increased after 1911 as the British shifted their capital from Calcutta to Delhi, and thenceforth from 1931 it recorded a phenomenal growth, 'when New Delhi was inaugurated as the imperial capital' (ibid. 2019:234). The Delhi Town Planning Committee, 1912 headed by the British architect Edward Lutyens drew the master plan of New Delhi, the eighth city, to the south of Shahjahnabad on the Raisina hill, a range of Aravalli mountains which forms a part of the ridge (Sinha 2107; Singh 2019 ibid.). In keeping with the town planning principles of aesthetics and beauty the British urban planners and architects underwent an extensive reforestation drive in parts of the ridge close to the imperial city of Delhi. However, such drives were undertaken overlooking the indigenous ecology. The British planted many foreign species, of which only the Mexican invasive tree, the *Prosopis juliflora*, *vilayati kikar* survived. The *kikar* spread over the entire ridge gradually contributing to its degradation as a habitat and leading to the depletion of the ground water. The *kikar* menace reached a point and in recent called for an action from the government and other agencies like the Centre for Environmental Management of Degraded Ecosystems (CEMDE), whereby measures have been instituted for reducing its presence by planting indigenous varieties of trees like *pilkhan, gular, sira, palash, amaltas, chamrod and arjun* etc. (Gandhiok 2023).[i]

Post-independence the territorial boundaries of Delhi were carved again by the State's Reorganisation Commission in 1955 by merging together the old and new cities in a singular unit, the union territory of Delhi. Later, Delhi was declared as the National Capital Territory (NCT) in 1991 and subsequently made a state in 1992. The continuous drive for urbanisation and structuring of the urban habitat in Delhi after independence has further destroyed its forest ecosystem, and fragmented the ridge into smaller and isolated patches, turned storm water drains into dirty water drains, ponds and lakes into garbage dumps (Sikka 2015: 227). This is

making the city of Delhi experience climate related vagaries in the form of extreme temperatures, high precipitation, floods and pollution, which has been examined in detail in the next section.

The Asian Games Complex set up in 1982 replacing the Siri Fort Forest, the Akshardham temple complex and the Common Wealth Games (CWGs) village constructed in 2010 on Yamuna's land are a few examples of uncontrolled urbanisation in the post-independence years. The Sunehri *nala*[ii] is an example of natural rain water drain that was covered to construct parking space for the Jawaharlal Nehru Stadium during CWGs (ibid.). The Kushak drain is yet another city drain flowing in South Delhi localities like the South Extension and Defence Colony that has been covered. The Najafgarh *nala*, Barapullah drain,[iii] the *nala* from Malviya *nagar* to Greater Kailash I (GK I)[iv] and many more provide evidence of storm water drains being reduced to dirty water drains with the inflow of sewage and sediments from the surrounding populated areas owing to rampant urbanisation and development, contributing to the flooding of the city.

Further, the growth and development of Delhi in the years following independence is marked by suburbanisation[v], as a part of which number of villages on the peripheries of the city were engulfed expanding its spatial expanse. Over the years uncontrolled urbanisation has led to construction of various unauthorised colonies and settlements in these engulfed areas known as the *lal dora*[vi] or 'urban villages'. The first master plan of Delhi in post-independent India was formulated in 1962 and focused on large scale acquisition of agricultural land to meet the housing needs of the growing population. The Delhi government absorbed many of the *lal dora* villages such as the Khirki village, in Saket in the south-west district of Delhi into the expanding city following the early years of India's independence from the British. A further addition of the *lal dora* villages to Delhi happened in 2019 and 2020 when the lieutenant governor handed over these to the Delhi Development Authority (DDA) to meet the ever-

growing needs of the expanding city (Lopes 2020). These urban villages owing to their *abadi* status are exempted from following 'any development rules and building bye-laws, so as to preserve their distinct rural identity and communal land ownership (Lopes 2020 and Roy 2023). This has led to haphazard and unplanned physical growth both vertical and horizontal in these villages and made them prone to natural disasters and risks like earthquake, flooding and water-logging during rains as has been elaborated in the following section.

Nature of Climate Change in Delhi

It is important to realise that while urbanisation is the foremost driving force behind climate change, it is the city and urban centres with its residents that are the victims of climate induced changes. The previous section has explored the manner in which the rampant and uncontrolled urbanisation of Delhi intervenes with its natural ecosystem making it prone to climate risks. This section proceeds taking a stock of the nature of climate change and risks in the city of Delhi owing to the extensive urbanisation and development.

The 2023 Delhi floods have been one of the most recent and visible manifestations of the interrelationship between climate change and urbanisation induced risk on cities. Prior to 2023, the recorded history indicates that 'Delhi has experienced floods in the years 1924, 1947, 1976, 1978, 1988, 1995, 1998, 2010 and 2013 when the Yamuna River crossed its danger level of 204.33 meters' (Gupta 2017:21). The 2023 floods were the severest of all the earlier instances of flooding in Delhi with the water in Yamuna crossing the danger mark of 208.6 meters. The politically articulated response for the Delhi floods was the excess water released from the Hathnikund barrage in Haryana. However, in the past flooding incidences the water released by the barrage has been far greater in volume, consequently, drawing attention to seek answer for 2023 floods in terms of the environment's response to anthropogenic intervention.

The city has been a victim of floods and related hazards because of changes in rainfall patterns and urbanisation. In the foregoing section it was seen that the natural ecosystem of the city has

changed with uncontrolled urbanisation and construction. The spatial reduction of the ridge and the green cover in the city has increased the amount of Greenhouse Gases (GHGs) in its atmosphere and raised the temperature, making it prone to increased precipitation. Over the years it has been noted that there has been a significant increase in the intensity of precipitation leading to inundation in the large parts of the city.

Additionally, the growing anthropogenic intervention with the river ecosystem due to unplanned urbanisation have contributed to compound the problem of flooding of Yamuna and making it more frequent feature of the city of Delhi. The flood plains and the wetland area of the river Yamuna, which acts as a buffer zone absorbing water has shrunk drastically. These have been encroached by the settlements of rural migrants, real-estate developments, industry, landfills, parks and other infrastructure. There have been multiple bridges and fly-overs that have come up in the flood plains causing obstructions in the flow of the river. Also, the absence of adequate drainage system only intensifies the flooding problem of the city. The city has multiple natural storm water drains connected to three primary drainage basins- Najafgarh, Trans-Yamuna and Barapullah; which in idle scenario were to drain it dry following the monsoon showers. However, in early years of independence owing to influx of refugees following the partition of India, post-independence Delhi began to grow haphazardly (Suri 2013). To check the unplanned growth of the city, the government formulated the Delhi Development Act 1957 so as to bring it on the way of planned and systematic spatial development (ibid.). However, Delhi's development proceeded giving precedence to constructing the above-ground infrastructure, dwellings and market places without giving any thought regarding protecting the storm-water drains (ibid.). Over the years the unplanned and wanton development has either led to these getting covered with concrete structures on the top or getting converted into dumps for sewage and waste water, which have no capacity to take in water during rains leading to water-logging and flooding. Moreover, as these drains, drain

dirty water into the river, they have led to its siltation causing the riverbed to gradually rise and compromise its capacity to absorb water during rains unless cleaned and desilted. In addition, the landslides in the Himalayan region have increased the sedimentation load on the upstream, being yet another reason for rise in the riverbed.

Thick haze and smog in Delhi air during the winter months is another visible example of urbanisation induced climate disaster in Delhi. The problem of air pollution in Delhi is not recent, though it received wide attention after the smog of 2016. There are a series of studies that reflect on the issue of poor quality of air in the city, its causes, effects and solutions (Rizwan, Nongkynrich and Gupta 2013; Raman and Mukherjee 2019). A study conducted by the World Bank Development Research Group indicated that for the period 1991-94, the average total suspended particulate level in the city was around five-times more than the standards set by the World Health Organisation (WHO) (Rizwan, Nongkynrich and Gupta 2013: 4). In 1997 in a report by the Ministry of Environment and Forests, India (MoEF) pointed out air pollution as a matter of grave concern, identifying vehicular emissions followed by coal-based thermal power plants as the major contributors in polluting Delhi air (ibid.). Again, according to the Central Pollution Control Board (CPCB) there was a growing trend in vehicular pollution from 1989 to 1997 attributable to the increase in the numbers of vehicles in the city (ibid.).

In November 2023 a Swiss air monitoring company, IQAir has listed Delhi as the most polluted cities of the world with the concentration of toxic PM2.5 particles in the city air, far exceeding the safe limits during the winter months making its residents prone to respiratory and other health ailments (Mehta and Kumar 2023). The industrial and vehicular emissions, construction and demolition related activities along with the combustion from the crop stubble burning activity in the neighbouring states of Punjab and Haryana during the winter months release a range of pollutants and harmful substances that travel and settle over the air in Delhi, propelled

by wind patterns deteriorating its quality. Alongside this, the widespread cutting of trees for the construction of the Delhi Metro and Rapid Transit System has disturbed the climate of the city by reducing the green cover, which is largely responsible for absorbing the carbon emissions and particulate substance and purifying the air by releasing oxygen.

The relationship between rapid urbanisation to meet the needs of growing population and the increasing carbon footprint of Delhi, in particular, must be read in juxtaposition with the lack of consensus and dialogue among the states on the issue of adequate management of stubble waste that has further increased, its climate change vulnerabilities. In recent times the stubble burning in the neighbouring states has been among the foremost contributors to air pollution in Delhi. It has emerged as a serious policy concern calling forth a reflection on the historical context, which was marked by a shift from manual to mechanised agriculture practices under the aegis of Green Revolution in India since mid-eighties. Mechanised harvesting fails to clear the field properly and leaves massive crop residue, which does not decompose easily and has to be cleared by setting it on fire so that the farmers can sow in the forthcoming harvest season.

The burning of stubble is a crime under Section 188 of IPC and banned by the National Green Tribunal (NGT) and the Delhi High Court. The Delhi government has sought to find solutions to the problem by entering into discussions with the governments of Punjab and Haryana in finding eco-friendly solutions to the disposal of the crop residue[vii]. The Union government has also released funds under various schemes for its effective management. While the state of Haryana has shown some progress in reducing the burning of stubble, Punjab has failed drastically on this front. The Haryana government in the past year has come down heavily on those engaging in farm fires to destroy crop residue by imposing fines and penalties on them. Further, its recent proactive approach on familiarising the farming community on the advantages of the eco-friendly methods for stubble management, provisioning of subsidises on

their purchase and setting up of efficient Custom Hiring Centres for procuring these on loans is noteworthy in bringing down the incidences of farm fires in the state. Contrarily, the stubble problem has remained unresolved in Punjab, amidst the battle between the Centre and the state governments, with the former refusing to agree to a joint proposal made by the Delhi and Punjab governments to provide cash incentives to farmers to curb stubble burning (Kumar 2022). Further, it took a peculiar turn as the Supreme Court reprimanded the Punjab government for 'soft pedalling on enforcing of ban' on the burning of the crop-residue, and directed, it to impose fines on farmers as environment compensation (Rambani 2017). Subsequently, the Punjab government initiated the process of registering FIRs against the farmers for the burning of stubble and imposing hefty penalties on them. However, amid strong lobbies and unions, the farmers of Punjab have refused to commit to refraining from burning the stubble, in case, of the non-fulfilment of cash incentive from the government, but have also turned violently on the field officials who are bearing the brunt of collection of penalties from them.

Moreover, extreme heat and cold waves that the city of Delhi has been experiencing since past few decades or so is an indicator of the alarming relationship between urbanisation and climate change. Deterioration in the natural ecosystem as a response to growing urbanisation is causing an increase in the emissions of the GHGs that trap outgoing infra-red radiation, thus raising temperature and leading to global-warming. So, in the summer months when sun rays strike the surface of earth directly and when there is excessive rainfall in the following rainy season, causing greater evaporation from water-bodies, there is an exacerbated warming effect. Post monsoons, in the winter months there is a reverse cold wave effect due to greater moisture in the atmosphere.

While it will be difficult to explicitly link Delhi's vulnerability to earthquake related hazard with the climate change in the city, though at a nascent stage, there is research that correlates

weather changes and earthquake risks (Mashi 2018; Blackett 2023; Matto 2023). This suggests that change in precipitation patterns and glacial melting due to climate shifts can disturb earth's subsurface and increase occurrence of earthquakes. The correlation between rainfall and seismic activity has been well established by the geologists (Blackett 2023). There are studies that indicate that the rainfall pattern influences the frequency of earthquake in the Himalayas (Blackett 2023; Matoo 2023). The seismicity of the region is higher in the winter months as compared to the summer-monsoon season as the weight of water owing to rainfall tends to suppress it (ibid.). Consequently, the glacial melting, erratic rainfall and warming of the region on the account of growing urbanisation and cutting of the Himalayan forests can have a serious impact on the micro-seismicity and increase the frequency of small earthquakes in the region, which could lead to more severe ones and thenceforth, add to Delhi's vulnerability owing to its proximity to the Himalayas and location in the seismic zone IV.

In addition, there is research that indicates that in Delhi the process of 'rapid urbanization has led to aggressive metamorphosis of earth's surface, the atmosphere, hydrological cycle, ecosystem processes and climate systems; disturbing the subsurface stability of earth' and this has compounded its vulnerability to earthquake tremors (Tiwari et.al. 2023: 1). Urban expansion has led to change in land coverage pattern evident in diminishing content of crop and forest land and rise in high-rise constructions for residential and commercial purposes. Added to this is the setting of fly-overs and metro services, the increasing expanse of urban sprawl in the form of 'urban villages' as pointed out earlier. This increased weight of urbanisation on earth is leading to ground subsidence exposing the city to greater risk from earthquakes. Further, there has been an overexploitation of ground water aquifers to meet the requirements of the ever-growing city, which act as trigger for the seismic activity by unclamping subsurface faults (Jayaraman 2021).

The growing susceptibility of the city to the climate induced risks and disasters has drawn Delhi government to plan a policy framework to evolve schemes, measures and strategies for mitigation and adaptation. The climate action of the Delhi government shows an influence of both international and national policy framework on climate change action and urbanisation. Before examining the case of Delhi, therefore it becomes significant to take an overview of growing international and national policy framework.

Bringing the 'City/Urban' into Climate Focus: A Policy Framework

Urbanisation and the resultant climate change are world-wide scenarios, which have drawn attention of both the state and non-state actors since a little over a decade and a half both internationally and nationally. Today, the cities account for over 70 percent of global GHGs emissions and are increasingly facing the impacts of climate change (Mukim and Roberts 2023). This has led to a growing focus on the 'city/urban centre' as a key driver and victim to the climate dynamics and transformations.

It is however, interesting to note that the interrelationship between the city and climate change escaped the attention of Inter-governmental Panel on Climate Change (IPCC)[viii] in its initial years of formation (Hebbert and Jankovic 2013). Even the Kyoto Protocol[ix] (1997) had bypassed any discussion on the cities (ibid.). Such omissions however, have gradually eroded. There has been a growth in the international discourse that reads urbanisation and climate change as twin processes. The fourth Assessment Report of IPCC (2007) marked a shift in its earlier approach to climate change by mentioning urbanisation for the first time. The fifth IPCC Assessment Report (2014) included a full-fledged chapter on cities and their impact on climate, reflecting on risks and their mitigation (ibid.). Again, the Paris Climate Convention 2015 pointed a need to bring a shift in focus to human activities in urban transitions as actual causes of climate change problem rather than merely focusing symptomatically on it by reducing carbon emissions. It brought 196 countries across the globe in an agreement in 2016 to make

their Nationally Determined Contributions (NDC) in this direction. Of these developments in the international discourse, the UN SDGs 2015 have been the most pivotal bringing to forefront the issues related to urbanisation and climate change. Goal 11 on 'Sustainable Cities and Communities', clearly reflects on the increasing energy consumption, rising pollution levels and vulnerability of some cities to climate change and natural disasters due to high concentration of people. Goal 13 points out to the urgent need to focus on the problem of climate change and strategies and solutions to mitigate it. In the recent report *Synergy Solutions for a World in Crisis: Tackling Climate Action SDG Action Together, (2023)* by the UNDESA reflects on the need to treat cities, as sites of major population growth and expansion of economic activities; hence calling forth for a synergistic action between SDGs and climate change action agenda (p.13-14)[x].

The 2023 Group of Twenty (G20) Summit under India's presidency marks a further advancement in the discourse on urban planning and climate.[xi] The Green Development Pact, which the G20 leaders entered into during the recent summit needs a special mention. Amidst its multiple goals the summit called for prioritising on addressing the challenges of climate change, building resilience and sustainability in urban development and mitigating disaster risks. While some of the earlier G20 Summits had made city-specific goals none of them had a clear-cut climate focus. Hence, these summits either only implicitly reflected the city in relation to climate change or were completely silent on such linkages. The earlier G20 Summit under Italy's presidency in 2021 had reflected on the importance of cities as being the enablers of sustainable development (Nath: 2023). Its declaration included a section on 'cities and circular economy'[xii] (ibid.). The G20 Summit under Japan's presidency had emphasised on building smart cities (ibid).

A definite Indian policy framework on climate change began to emerge since 2007-8 and runs parallel to the various international developments. The NAPCC [xiii] was introduced in India in

2008 by the Prime Minister's Council on Climate change (PMCCC).[xiv] Of its eight missions, the one on 'Sustainable Habitation', focuses on making cities and urban centres as climate resilient. Further, the Development of Solar Cities Programme is consistent with the Solar mission of NAPCC, emphasising on the potential of urban centres for climate action by lowering the emission of GHGs by using cleaner sources of energy like the sun, wind or even biomass.

Consequently, in the years following its inception the NAPCC was to serve as a blue-print for the states and cities to evolve policies and strategies to mitigate and adapt to climate change. In keeping with the wider objectives of NAPCC the PMCCC in 2009 had instructed the various states of the country to formulate their own State Action Plan on Climate Change (SAPCC). A framework on the formulation of SAPCC was provided by the MoEF in 2010 (Dubash and Jogesh 2014:86).

Further, in conformity with the SDGs and the Paris Agreement in 2016 as a part of fulfilling its Intended Nationally Determined Contribution (INDC) India committed itself towards 'policies and programmes to promote clean and renewable energy, development of less carbon intensive and resilient urban centres' (WWF n.d.: 16). The Green Urban Mobility Scheme introduced in 2017 by the Ministry of Housing and Urban Affairs (MoHUA), Government of India (GOI) is in keeping with the above commitment. The scheme focused on making urban transportation more sustainable by promoting electric vehicles and non-motorised transportation infrastructure and a bicycle sharing system (Verma, Harsha and Subramanian 2021: 7). The Smart Cities Mission launched in 2015 by the MoHUA aligned with the climate change action agenda through the Climate Smart Cities Assessment Framework (CSAF) in 2019. The Assessment Framework calls for 'anchoring climate actions within activities catering to urban development' reflecting on five broad themes viz., Energy and Green Buildings; Urban Planning, Green Cover and Biodiversity; Mobility and Air quality, Water

Management and Waste Management (MoHUA 2020: 9). Also, the National Clean Air Programme, 2019 of the Ministry of Environment, Forest and Climate Change (MoEFCC)[xv] draws attention towards the growing realisation of relationship between city and climate change. The programme document delineates strategies and measures for reducing air pollution as a part of 'India's commitments and obligations to the environmental sustainability under SDGs' (MoEFCC 2019:2).

It is amidst the expanding international and national discourse, particularly since its incorporation as one of the SDGs as discussed above, an increasing emphasis of the Delhi government on urbanisation with a climate focus has started to get evident in its plans, measures and actions. The following section takes a historical reading of some of the policy documents of the Delhi government to understand its efforts in making the city resilient to climate change. In doing so, it will also familiarise us with some of the ongoing and existing measures, schemes and action of the Delhi government. The emphasis will be to assess whether the climate policy framework of Delhi is inclusive of the needs of the vulnerable and marginalised groups of society.

Climate Change Policy Interventions and Social Justice in Delhi: How Much? How Little?

A master plan is a foremost document providing guidelines for policies, measures and actions for a planned and structured development of the city. Delhi has had three master plans; 1962, 2001 and 2021. The Delhi Master Plan, 2041 which awaits to be notified will be the fourth in the history of its urban planning. The urban planning in Delhi runs parallel to the global and national policy framework. This is well evident from its master plans. The first three master plans neglected including any clear guidelines and actions for Delhi in view of climate change. The Master Plan 1962 was formulated to streamline the haphazard growth of Delhi following the post partition period and abysmally falls short for not even giving any concept

on the city environment. The second and the third master plans though, envisioned to focus on Delhi's ecological balance and sustainable environment, again failed to mention an interlinkage between urbanisation and climate change. It is the draft of the Delhi Master Plan, 2041 which explicitly spells out making the city as environmentally sustainable and adaptable to address the impact of climate change as one of its fundamental visions, parallel to growing international and national concern on climate change.

While the third master plan failed to build linkages between urbanisation and climate change an explicit focus of the state of Delhi in developing climate change resilience had begun to emerge in line with the NAPCC, 2008 when it became the first in the country to release a Climate Change Agenda, 2009-2012.[xvi] Further, translating the NAPCC into the local context, the SAPCC for Delhi was formulated to cover the time period 2011-2020. However, the plan got delayed and was finally notified for implementation in 2019. It expired soon as it was meant to cover a decade and made projections for the same. Moreover, in 2018 the various state governments were suggested by the central government to revise their climate action plans. The draft for the new climate action plan for Delhi is awaiting approval and release before made public (Express News Service 2022). Till the release of the new plan, the Delhi SAPCC covering the period 2011-2020 remains a significant document to assess Delhi government's approach to climate change action. The plan provides a comprehensive sectoral account of the problems that has made Delhi vulnerable to climate change and the existing initiatives taken by the various ministries and departments of the government of Delhi. The existing initiatives are on the given themes of NAPCC mission, which have been pointed out earlier. These include schemes and measures that focus on use of solar energy, reducing vehicular pollution by odd/even formula, promoting the use of CNG buses in DTC fleet, e-transportation, restoration of river Yamuna, waste-management, rain water harvesting, concept of green building, replenishment policy of replacing old trees with native species, maintaining city parks, gardens

and forests etc. Here it is imperative to focus on the fact, that while both the Climate Change Agenda and Delhi SAPCC draw attention to the growing GHGs emission in relation to the vehicular pollution and have suggested some possible remedies to it, they have completely bypassed the problem of stubble burning in the adjacent states and the resultant climate crisis in Delhi.

The Delhi SAPCC lists out and proposes actions for future and moves beyond the Climate Change Agenda in spelling out explicitly budgetary estimates and time-frame for these. However, it remains unclear on the implementation of the proposed actions with no specific strategies and guidelines for the local administration. Consequently, it appears as more of Delhi government's "statement of intent" regarding tackling climate change, providing a wish-list of actions for each department' (Gogoi 2017: 05).

The plan appears as an improvement over the Climate Change Agenda as it entails a chapter on vulnerability assessment, identifying six sectors that are sensitive to climate change (Hughes 2013). It also presents a city map representing areas vulnerable to impact of climate change. The vulnerability and the adaptive capacity of area being identified in terms of various factors, viz., social, physical or infrastructural, human, and financial capitals. Still, the vulnerability assessment and map presented in the plan is superficial, broad and fails to give an accurate account of climate change risks as it is based on secondary literature and data. The plan provides a narrow identification of vulnerable groups by giving a surface understanding of the concept of social capital defining it as a function of social discrimination manifest only in terms of scheduled caste status or defining them primarily in terms of economic parameters as those living in slums, informal settlements, unauthorised and resettled colonies. It thus overlooks various other identities such as other backward castes, indigenous communities and gender which may exacerbate vulnerability in the case of climate change. Alongside, there are other criteria such as age and disability that may add to disadvantage in scenarios of climate disaster

and risks. The toll of climate crises weighs most heavily on low-income families particularly from the historically marginalised castes, indigenous communities, women, children and elderly making them susceptible to multiple risks like loss of home and livelihood, increased health burden, discrimination and violence.

The climate justice debates and narratives of the history of the marginalised groups clearly indicate that the incessant drive towards accumulation and development have led the dominant communities exploit the environment severely putting the marginalised groups to climate related hazards and risks owing to their unequal socio-economic position. These bring capitalism to centre stage as a fundamental problem. A clear connection of the ecological and socio-economic exploitation with the capitalist nature of the state is evident, for example, when the socially marginalised groups are shifted from the floodplains for the sake of being a risk to the natural ecosystem while the real estate developers are given a clean chit for making a housing complex in the vicinity of Akshardham temple (Baviskar 2011). This brings to fore the urgent need to rethink climate change policy keeping social justice at its core (Harlan *et al*. 2015).

A social justice perspective calls for participatory planning and action from the vulnerable groups and communities. This is imperative as many a times policy on climate change such as 'the Clean Development Mechanism (CDM) and Reducing Emissions from Deforestation and Land Degradation in Developing Countries (REDD+) may bring in "false solutions" as they are seen empowering state and investors while disempowering the local communities' (ibid.: 148). Consequently, there is a need to integrate community-based methods and practices that build on the traditional knowledge of the locals on environment and ecology into policy planning and action on climate change. It is unclear whether the Delhi SAPCC has met this criterion effectively. Its formulation process, clearly called for the involvement of various stakeholders, which should have included those most vulnerable to climate change. The plan

document provides an annexure with detailed lists of participants of the stakeholders' meetings that preceded its formulation and finalisation. These include members from various state agencies, universities, academia and research institutes, bilateral and multilateral organisations. While at the outset, the plan mentions engagement of civil society in its formulation process, however, it does not indicate any definite involvement of any organisation that is specifically and directly aligned with vulnerable groups and communities. The international NGO, ICLEI South Asia, which provides technical consulting to local and regional governments for promoting sustainable development is the only civil society organisation which appears in the lists of participants at the end of the plan. Further, while the plan at the start refers to the engagement of the NGOs like Teri and Centre for Science and Environment (CSE) as stakeholders, the annexure fails to cite any representation from these.

Some Observations and Conclusions

The article has elaborated on the impact of urbanisation on climate studying the case of Delhi. It clearly examines urbanisation as a key driver to the alteration in climate, posing a challenge to the city of Delhi and its residents. The Delhi government in order to respond to threats of climate change is gradually moving towards integrating sustainable and ecologically friendly strategies in its urban development policy. This is in keeping with the growing discourse on climate change induced risks and strategies to tackle the same both at the international and national level. The Climate Change Agenda and the SAPCC are the foremost policy documents of the Delhi government to bring an exclusive focus on climate change and its implications on the city. A comparison of the two documents reflects a slowly expanding interest of the Delhi government to introduce measures to mitigate and adapt to the adversities of climate change by improving its policy framework on it.

The formulation of SAPCC as a policy document may be viewed as the opening of the complex process of mainstreaming concerns of environment sustainability with social justice issues into

Delhi's development planning. It offers an improvement over the earlier Climate Change Agenda, including a full-fledged chapter on vulnerability assessment. Although it shows limitations in adequately representing vulnerability it does provide an inception of a platform, which can be made more inclusive and representative of the environmental needs of the city by also including perspectives of various vulnerable groups and communities. The drawing on full range of stakeholders may lead to formulation of a policy framework that is more wholesome and complete, which is extremely important to consider as we stand at the threshold of reworking and finalising the new SAPCC for Delhi.

Further, the success of any policy framework depends on whether it is able to provide mechanisms and guidelines for its effective implementation. Unlike the earlier SAPCC, the forthcoming one can live up to this expectation by prioritising the ways in which suggested actions and strategies on climate change can be implemented. This would require it to explicitly layout tasks, responsibilities and procedures for action involving various actors in the practice of climate change policy rather than simply making their sectoral and departmental allocation. In addition, the plan should recommend for building interlinkages and cooperation between the governments of different states in developing climate change action policy measures rather than taking a fragmentary approach to it. For the smog problem in Delhi in the winter months is to a great extent linked to the stubble burning/farm fires in the adjacent states. An emphasis on fostering awareness among the farming community on issues related to crop waste disposal need to be incorporated to mainstream climate concerns in agricultural practices. Finally, the long-time invested in notifying the SAPCC call for a revision in Delhi government's approach as thence, the document produced is a mere reflection of much energy and effort wasted with little time left for its implementation.

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End Notes:

[i] The Delhi government introduced a modification in the ecological restoration project of the ridge during its implementation in April 2022 (Gandhiok 2023). It decided to only prune the foliage of *kikar* and plant native species, rather than eliminating it completely, since it forms a predominant part of the overall green cover of the city, and contributes in carbon sequestration (ibid.).

[ii] The Sunheri *nala* is a storm water drain situated on Lodhi road near Dayal Singh College in South Delhi.

[iii] The Najafgarh *nala* and Barapullah drain were tributaries of river Yamuna, which over the years have been reduced to dirty water drains.

[iv] Malviya Nagar and GK I are residential colonies of the South Delhi district.

[v] Suburbanisation is the process of growth of city suburbs, resulting in urban sprawls.

[vi] The *lal dora* village was a term designated by the British to demarcate abadi (habitation) settlements from agriculture land on the village map to aid them in revenue collection (Lopes 2020).

[vii] The technology like the Happy Seeder and bio-decomposer provide eco-friendly solutions to get rid of farm stubble. The Happy Seeder is a machine that has to be mounted on a tractor, and removes straw while sowing wheat. This method is however, costlier compared to the traditional practice of burning the stubble. Again, the bio-decomposer is microbial solution that converts paddy residue into manure in 25-30 days the time period, which most farmers do not have before the sowing begins for the next, crop season. However, a strong support from the government in the form of subsidises and cash incentives on the use of these methods and awareness programmes regarding their plausible benefits can play an instrumental role in popularising them.

[viii] IPCC was formed in 1988 by the World Meteorological Organisation (WMO) and United Nations Environment Programme (UNEP) to provide scientific information to the member governments of the UN so that they can develop policies on climate.

[ix] The Kyoto Protocol was implemented on 16 February 2005 to operationalize United Nations Framework Convention on Climate Change (UNFCCC).
[x] The 2030 Agenda For Sustainable Development provides an action plan to make world move on a sustainable and climate resilient path. It proposes an integrated action on climate change for achieving many of the SDGs and their targets.
[xi] The G20 is an intergovernmental forum of cooperation constituted by a group of 20 nations. This forum initially concentrated on larger economic concerns, however later it came to focus on trade, health, environment and climate change etc.
[xii] The circular economy is a model of production and consumption, that proposes to recycle and reuse the existing materail.
[xiii] The NAPCC consisted of eight national missions- Solar, Enhanced Energy, Sustainable Habitat, Green India, Water, Sustaining Himalayan Eco-system, Sustainable Agriculture and Strategic knowledge for Climate.
[xiv] The PMCCC was constituted in 2007 by the union government headed by then Prime Minister, Manmohan Singh.
[xv] The MoEF formed as a ministry of the Indian government in 1985 was renamed as MoEFCC in 2014 with the increasing emphasis on climate change action.
[xvi] The Climate Change Agenda for Delhi, 2009-2012 included 6 missions of NAPCC baring Himalayan Ecosystem and Sustainable Agriculture.