

UNDERSTANDING THE DISASTER
RISKS AND CLIMATE RISKS AND
RESILIENCE OF SLUM COMMUNITY
OF AHMEDABAD, GUJARAT: A PILOT
STUDY

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Understanding the Disaster Risks and Climate Risks and Resilience of Slum Community of Ahmedabad, Gujarat: A Pilot Study

1. Strategic Context and Background:

Over many millennia, the Earth's climate has seen frequent peaks and troughs, with several ice ages being followed by warmer periods. As we know, greenhouse gases trap heat in the Earth's atmosphere and cause global warming. Most of the global warming so far has occurred in the past 40 years, with the last seven years being the warmest recorded in history. In its Sixth Assessment Report, published in 2022, the Intergovernmental Panel on Climate Change (IPCC) states that 'since systematic scientific assessments began in the 1970s, the influence of human activity on the warming of the climate system has evolved from theory to established fact'. Human-induced warming reached approximately 1°C above pre-industrial levels in 2017 and at the current rate of global warming, it would increase to 1.5°C around 2040. As the planet warms, the balance of climate systems is affected and the resulting change in weather patterns over long-term averages is known as climate change. An increase in GHG emissions and consequently in the mean temperature of the Earth is causing widespread climate disruptions with severe impacts across the globe. Floods, storms, heatwaves and droughts resulting from global warming are already threatening lives and livelihoods of billions¹.

The Indian coastline is expected to be amongst the regions most affected by climate change globally, negatively affecting the approximately 250 million people (14% of the country's population or 3.5% of the global population) who live within 50 km of India's coast. The Bay of Bengal and the Arabian Sea are both predicted to be subject to extreme climate variability under future climate scenarios. For example, changes in monsoon rainfall patterns and drought frequency as a result of climate change are expected to impact negatively on water resources, agricultural output, livelihoods, public health and the economy². In addition, temperatures are expected to rise by between 1.6–2.1°C compared to the 1970s³. Several climate change impacts are aggravating the degradation being caused by direct human influences such as urbanization, overfishing and poorly planned coastal development.

India is increasingly becoming urban. By 2050, more people in India will live in urban than rural areas, of which 138 of the 6000+ cities will have populations above 500,000 people (World Urbanisation Prospects). With people increasingly living in cities, urban densities are bound to increase, and with them other assets and sources of economic output. The 2011 Census estimated that there are 8,000 urban centres and over 660,000 villages. With this growing urban share, risk will begin to concentrate in urban areas owing to the

¹ Prayaas se Prabhaav Tak, Lifestyle for Environment, by Ministry of Environment, Forests and Climate Change, Government of India and UNDP, 2022

² MoEFCC. 2015. India: First Biennial Update Report to the United Nations Framework Convention on Climate Change.

³ Lee J-WW, Hong S-Y, Chang E-C, Suh M-S & Kang H-S. 2014. Assessment of future climate change over East Asia due to the RCP scenarios downscaled by GRIMsRMP. *Climate Dynamics* 42:733–747.

fewer numbers of such locations. It can be argued that bringing attention to these areas can reduce future risk, especially small and medium-sized towns which are yet to grow. Exiting institutional systems and planning instruments like zoning regulations and bye-laws could be put into practice to assist in mainstreaming risk reduction in urban areas.⁴ As centres of the economic activities, cities would, in the near future be affected by climate change impacts. Climate change impacts manifest directly through visible disasters like increases number and intensity of extreme weather events such as heavy rainstorms (flooding), cyclones and typhoons, and through invisible impacts on urban ecology, food supply and pricing resulting from shifting rainfall pattern. Invisible impacts of climate change manifest through urban drought and continuous stress on the water system. Significant health impacts in urban areas due to heat waves, vector borne diseases would ultimately lead to economic impacts, especially as cities are centres of economic growth⁵.

The state of Gujarat is situated on the western end of the Indian region, with vast coastline of approximately 1663 km, which is highly vivid and distinct from others in terms of geomorphology, natural resources and human activities. This makes Gujarat even more sensitive to impacts due to Climate Changes. Covering more than 15 districts extending from Lakhpat in the north to Valsad in the South, the State of Gujarat lies exposed to the likelihood of changes in climatic parameters including changes in temperatures, rainfall variability, sea surface temperatures, rainfall extremes, variation in sea levels, storm surge occurrences and cyclonic activity in the Arabian Sea⁶.

Gujarat's 1,600 km of coastline and settlements, both urban and rural, could be impacted by sea level rise in terms of inundation of low-lying coastal areas, sea water ingress into the coastal groundwater aquifers and loss of ecologically fragile and important mangroves and wet lands. The incidences of storm surges and cyclones could bring heavy economic and structural losses to communities besides making the entire area vulnerable to water resources particularly for drinking and agricultural purposes. The cities of Gujarat are at much greater risk to extreme weather, like heat waves, that can aggravate air pollution and limit the functioning of critical infrastructure, such as transportation, water, sanitation, energy systems, hospitals, roads, bridges and water treatment systems.

As per the Sixth Assessment Report of IPCC, in Ahmedabad, 11 million people would be at a high risk of living in an [urban heat island](#), with much higher temperatures than nearby areas. The IPCC report acknowledges that while individual livelihoods have been affected, impact on human health, destruction of homes and loss of income, and other such impacts have exacerbated inequity across gender, caste, class and other socio-economic groups.

For city governments, increased climate variability imposes additional challenges to effective urban management and the delivery of key services, while for residents it increasingly affects their lives and livelihoods due to more frequent floods, landslides, heat waves, droughts, and fires. There is an urgent need for cities to consider disaster and climate change by streamlining assessments of related risks in their planning and management as well as delivery of services. Climate change is now being more closely linked

⁴ Urban Risks and Resilience in India by Garima Jain and Amir Bazaz

⁵ Training Module on Urban Risk Reduction and Resilience by Gujarat Institute of Disaster Management, 2019

⁶ State Action Plan on Climate Change, Climate Change Department, Government of Gujarat

with urban challenges due to its expected ability to exacerbate the risks of India's urban settings, which now have inadequate infrastructure and resources. The socio-economic costs of climate change are already evident in the widespread destruction of property and infrastructure during catastrophes, the occurrence of vector and water-borne diseases, the poor quality of life, the loss of livelihoods, the decline in food security, etc.

Thus, the urban risk must be understood in the context of all socio-economic, political, and environmental processes, not just natural disasters, that exhibit dangers in urban settings. Indian policy and programme efforts are currently only centred on hazard-prone areas, not on regions where vulnerabilities or exposure are higher or where coping mechanisms are less developed. For Indian cities, a resilient and inclusive city approach is necessary so that the urban systems and infrastructure can endure shocks and harsh weather, minimizing the vulnerability of men, women, and children.

As a result, AKAHI has conducted a pilot study targeting two vulnerable urban slums in Ahmedabad city showcasing how urban risk must be understood in the context of all socio-economic, political, climate change and environmental processes, not just natural disasters. The study highlights the need of resilient and inclusive city approach so that the urban systems, communities, and infrastructure can endure shocks and harsh weather, minimizing the vulnerability of men, women, and children.

1.2 Study Geography:

The pilot study has been conducted in the urban areas in Gujarat which is highly prone to frequent storm flash flooding, heatwaves, air pollution, industrial hazards and other extreme weather events. The weather pattern in the Ahmedabad means that communities experience higher rainfall that leads to flash floods. Climate change is expected to further increase variability of rainfall patterns along the Gujarat coastal plain, with more intense rainfall events causing more frequent flooding and reduced groundwater infiltration, and longer dry spells affecting drinking water availability.

1.3 Study alignment with the India's vision and policy response to climate change:

The pilot study has alignment with the key initiatives of Government of India and State Government's policy response to disaster risk reduction and climate change. The pilot study is aligned with National Disaster Management Plan, 2016 as well as National Action Plan on Climate Change, 2008 of Government of India.

The National Disaster Management Plan 2016 outlines a new Risk Governance Framework as noted below, and lists the potential lead central agencies as well as state agencies for each (NDMA, 2016):

1. Mainstream and integrate Disaster Risk Reduction and institutional strengthening
2. Develop capacity
3. Promote participatory approaches
4. Work with elected representatives
5. Grievance redress mechanism
6. Promote quality standards, certifications, and awards for disaster risk management

The National Action Plan for Climate Change (NAPCC) and its eight National Missions along with the recently announced National Disaster Management Plan 2016 (which is aligned with the Sendai Framework), already provide a framework of action for risk reduction. The latter is an ambitious plan and provides a short-, medium- and long-term action plan for various actors to work to achieve comprehensive risk reduction and thereby sustainable development.

Other than these, mainstream development programmes such as the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Smart Cities Mission, Pradhan Mantri Awas Yojna (PMAY) and Swachh Bharat Mission Urban (SBM-U) could play a leading role in building resilience in the urban areas. The proposed project proposes to mainstream these four development programmes.

Apart from above each of the target states have also identified priorities in their State Action Plans on Climate Change to address climate-related threats to urban development.

The Gujarat State Action Plan on Climate Change identifies the following climate and non-climate related threats to the urban areas: i) increases in the frequency and intensity of health diseases; ii) loss of lives, livelihoods and infrastructure following flash flooding, heatwaves and other climatic events; iii) industrial and chemical disasters; and iv) air pollution. The plan identifies several adaptation priorities for the state including: i) reducing global warming due to urbanisation; ii) adopting clean fuels to decrease the impacts of heatwaves and air pollution; iii) protecting vulnerable populations against climate-induced disasters through community participation; and iv) promoting environmental sustainability, including mitigation measures.

2. Aims & Objectives:

The overarching goal of the study has been to understand the resilience of the lives and livelihoods of the most vulnerable populations, particularly women, in the coastal areas of India to climate change and extreme events, using an eco-system centred and community-based approach.

In addition, the study lays out the holistic understanding that effect the disaster risks and climate centric mitigation in Ahmedabad, Gujarat. This pilot study intends to present based on the parameters assessed the following factors:

- Assess the vulnerabilities and whether residents are directly or indirectly exposed to the climate change and weather effects.
- Understanding the city's geographical location and how it increases certain vulnerabilities and impact on poorer segments.
- Identify and recommend the plan of action for resilience building which is based on systemic and area-based solution.

2.1 Project Area:

The study was conducted for the coastal communities at two selected slums of Ahmedabad city in Gujarat. Ahmedabad is located on the banks of the river Sabarmati in the northern part of Gujarat and the western part of India. It is located at 23.03°N 72.58°E spanning an area of 205 km². The average elevation is 53 metres. Ahmedabad is known as the commercial capital of Gujarat. As per the census in 2011, the total population of Ahmedabad city is close to 55 lakh people, which the fifth largest in the state. It has a total literacy rate of 86.6% which makes it the second most literate city in the state. Spread over an area of 464 Sq. Km. it has a sex ratio of 853 girls per 1000 boys, which is pretty less as compared to the national average.

3. Socio-Economic Dimensions of Ahmadabad

Ahmedabad serves as the seat of Gujarat High Court and is the seventh largest metropolitan area in India. Ahmedabad is an important economic and industrial hub and is reported to be one of the fastest growing cities of the decade⁷. Textile, pharmaceuticals and automobile are the most prominent industries based in and around Ahmedabad. In addition, there has been significant advancement of the IT sector as well, as the many prestigious higher-education institutes in the city continue to attract a large pool of highly skilled young professionals⁸. There are currently four SEZ's in the city region, with another three new industrial estates in the planning, by the Gujarat Industrial Development Corporation (GIDC). In terms of transport infrastructure, Ahmedabad has a successful BRT system in operation, and a proposed metro-rail set to open in 2018.

3.1 Demographic Profile⁹

Indicator	City (Municipal Corporation)	State (Urban)	India (Urban)
Total Population	5577940	25745083	377,106,125
Total Population of UA (if)	6357693		
Share of ULB population in District Urban population (%)	92.00		
Population Growth Rate (AEGR) 2001-11	4.60	3.07	2.76
Area (sq. km)*	468.92		
Share of ULB area in district (%)* #	5.78		
Density of population (person per sq. km)*	11895		
Literacy Rate (%)	88.29	86.31	84.11
Schedule Caste (%)	10.66	6.96	12.60

⁷ https://financedepartment.gujarat.gov.in/Documents/Bud-Eng_1096_2022-3-3_683.pdf

⁸ Annez, Patricia Clarke, et al. "Policy Research Working Paper 6267." (2012).

⁹ Census 2011

Schedule Tribes (%)	1.20	3.48	2.77
Youth, 15 - 24 years (%)	19.26	19.85	19.68
Slum Population (%)	4.49	14.92	17.36
Working Age Group, 15-59 years (%)	66.78	66.31	65.27

3.2 Economic Profile (Based on Centre for Statistics Office, Census Reports)

Indicator	City
Per Capita Income (Rs.) at 2018-19*	1,97,447 INR¹⁰
Urban Poverty Ratio (% of urban population) **	6.64
Unemployment Rate, 2011-12***	0.86
Work Participation Rate, 2011-12***	37.06
Work Status, 2011-12 (%) ***	
Self-employed:	50.56
Regular/wage salaried employees:	45.65
Casual labor:	3.80
Sectoral Distribution of Workers, 2011-12 (%) ***	
Prim	1.94
Sec	47.76
Tert	50.30
Workers Classified by Major Occupation, 2011-12(%) ***	
Legislators, senior officials and managers	15.93
Professionals	4.72
Technicians and associate professionals	6.39
Clerks	5.98

¹⁰ <https://timesofindia.indiatimes.com/city/ahmedabad/state-gsdp-grows-9-2-in-2018-19/articleshow/74326325.cms>

Service workers and shop and market sales workers	17.25
Skilled agricultural and fishery workers	0.73
Craft and related trades workers	22.32
Plant and machine operators and assemblers	19.33
Elementary occupations	7.36
Workers not classified by occupation	0.00
Primary Commodity Manufactured#	Cotton Cloth Chemicals Medicines
Major Industries##	Automobile, Bicycle and its parts Machinery, Machine tools and its parts Textile Pharmaceuticals & bulk Drugs
No. of sanctioned SEZ	7

4. Climate of Ahmedabad

It has a dry, semi-arid climate with hot summers and mild winters. The summer season lasts from March to June and is characterized by high temperatures and low rainfall. The average temperature during this time is around 32-35 degrees Celsius. The monsoon season lasts from July to September and brings moderate to heavy rainfall to the region. The winter season, which lasts from November to February, is mild and pleasant with temperatures ranging from 10-20 degrees Celsius. It receives an average annual rainfall of around 600 mm, mostly during the monsoon season from June to September. The city is also prone to drought and occasional cyclones during the monsoon season.

Recent studies have shown that Ahmedabad is experiencing the effects of climate change, with an increase in temperature and changes in precipitation patterns. A study by the Indian Institute of Management Ahmedabad found that the city has experienced a 0.5°C increase in average temperature over the last 30

years. Also, it has been found that the number of very hot days (above 40°C) has increased, leading to heat stress and increased risk of heat stroke¹¹.

In addition, studies have indicated that the monsoon season in Ahmedabad has become more unpredictable, with increased variability in rainfall. Today, there is a water scarcity and drought in some areas, as well as increased flooding in others.

The increasing temperatures and changes in precipitation patterns have also had an impact on the city's vegetation and wildlife. A study by the Gujarat Ecological Education and Research (GEER) Foundation found that the city has experienced a decrease in tree cover, leading to loss of habitat for animals and birds.

Ahmedabad is experiencing the effects of climate change, with increased temperatures and changes in precipitation patterns. These changes have had negative impacts on the city's vegetation and wildlife, as well as increased risks for human health and wellbeing.

5. Rationale for the Study:

Climate change has had a significant impact on slums and informal settlements, particularly in low- and middle-income countries. These communities are often located in vulnerable areas, such as floodplains and coastal areas, and are particularly susceptible to the effects of climate change, including increased temperatures, extreme weather events, and sea level rise.

Studies have shown that slums are more likely to experience heatwaves, floods, and other natural disasters, leading to loss of life and livelihoods. For example, a study of slums in Ahmedabad, India found that extreme weather events have led to loss of homes, displacement, and reduced access to basic services such as clean water and sanitation.

In addition to the direct impacts of climate change, slums are often located in areas that are vulnerable to environmental degradation, such as air and water pollution. This can have negative impacts on the health and wellbeing of residents, particularly for those with pre-existing health conditions.

Furthermore, slums often lack the infrastructure and resources to adapt to the impacts of climate change, such as early warning systems, evacuation plans, and disaster relief. This can leave residents vulnerable to the effects of extreme weather events, and can exacerbate the impacts of climate change.

Overall, climate change has had a significant impact on slums and informal settlements, leading to loss of life and livelihoods, and exacerbating existing vulnerabilities. There is a need for increased support and resources to help these communities adapt to the impacts of climate change.

Ahmedabad experienced one of its worst heatwaves in 2010 with 1,344 deaths, while 24,223 people lost their lives between 1992 and 2015 across India. In 2019, the country faced its longest heatwave in three

¹¹ <https://public.wmo.int/en/media/news/climate-change-made-heatwaves-india-and-pakistan-30-times-more-likely>

decades, and the year concluded a decade of exceptional global heat and high-impact weather due to climate change.

As the population in urban centers becomes denser, climate change pressures such as heatwaves, water scarcity, and floods could make the standard of living in cities fall drastically, especially for the poor¹².

6. Methodology:

For understanding the conducting of survey method along with participatory tools such as FGDs with practitioners were undertaken. The primary and secondary research approach was adopted to gather data of the five slums mapped the slums on various parameters which look at physical and climatic hazards faced.

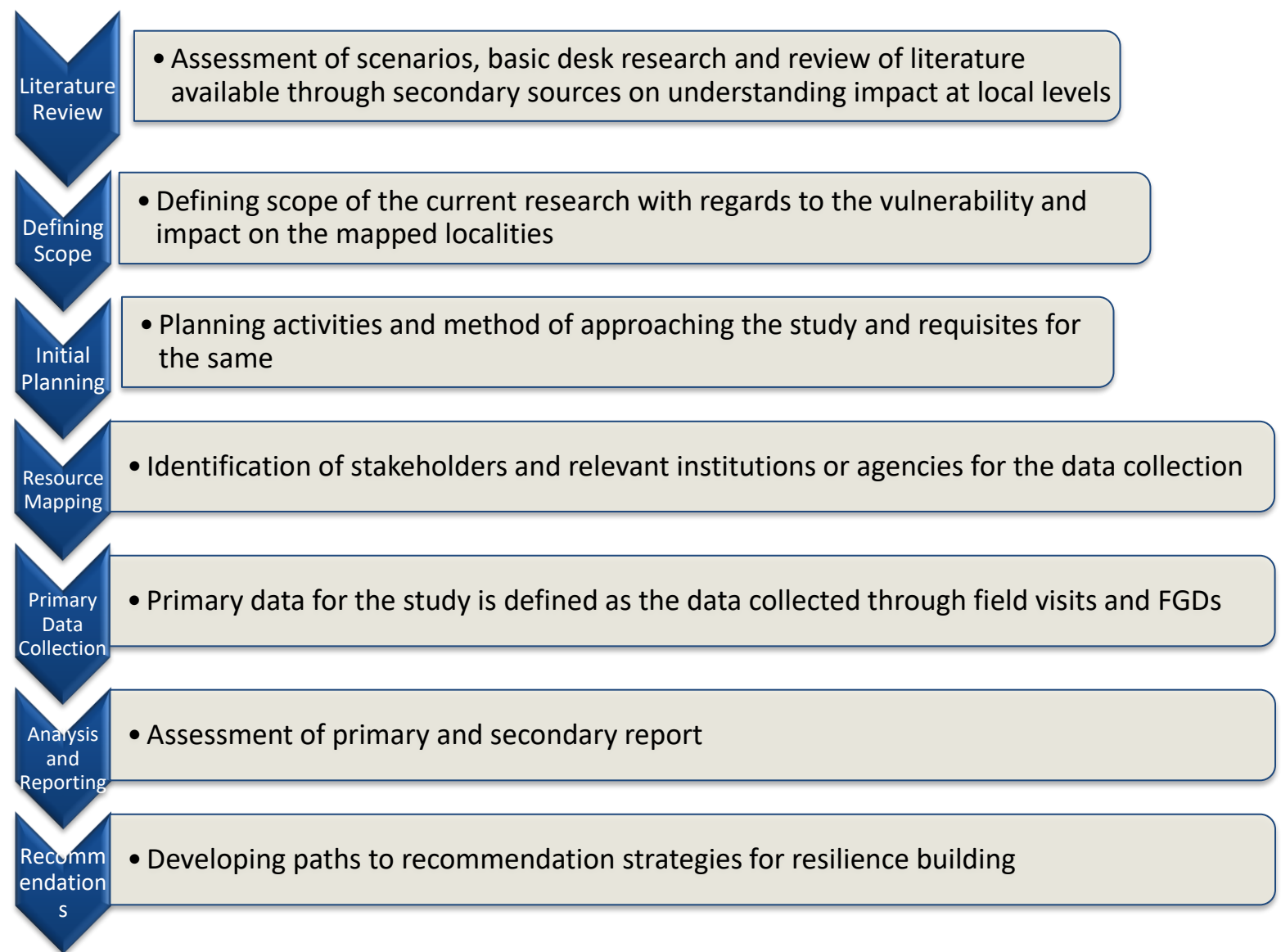
1. A desk review for the study by mapping NGOs, Academicians and Government Agencies work in the area and compiling the relevant information.
2. Gathering information from stakeholders through survey, FGDs, about their understanding and preferences.
3. Corroborating, compiling and analysing data collected from various sources.
5. Conducting validation and triangulation workshop on findings

Method for Data Gathering:

Focus Group Discussions with – males, females and youth (158 males, 146 females and 82 youths)

- One to one discussion with prominent slum leaders, ward persons, faith-based leaders, ASHA leaders, Anganwadi workers, UHC officials, School administrators and other stakeholders
- KIIs with department officials from health, fire etc. In addition, voices of CSOs and other practitioners

¹² <https://www.oneearth.org/in-ahmedabad-women-act-to-make-slums-climate-resilient-one-house-at-a-time/>



6.1 Approach for the Study

Socioeconomic Evaluation	Understanding the current socio-economic condition of the local slum dwellers, major sources of livelihood
Climate Change Perception	Assess the perception of local communities on climate change and build a better understanding on how they perceive climate change and changes in weather parameters
Mapping thematic areas of concern for the slum dwellers	Identify sanitation, housing, education, health facilities, physical infrastructure, demographic profile.
Finding Linkages	Establish linkages between the changes in climatic parameters and the resulting impact on the vulnerability of the local communities

Suggestions & Recommendations Solutions that suggest climate resilient to adapt

7. Findings from the Study:

Clustered Informal Settlement in the Slums suggest the following challenges on different areas:

Slum Profile

Name of the Slum	Area of Slum	Total Population	No. of dwelling units
Gulab Nagar	40-50 meters sq	600	-
Jantanagar Talvadi	40-50 meters sq	291	52
Gafur Basti	-	448	-
Dantaniwas	40-50 meters sq	560	-
Khanwadi	-	1033	-

Findings from Community Perspectives:

Human Induced Risks:

(Chemical and industrial wastes, contaminated water in pools, stampedes)

- In recent years, as per National Disaster Management Authority (NDMA) and World Bank report the main ways that human activities contribute to climate change is through the burning of fossil fuels, such as coal, oil, and natural gas. When these fuels are burned, they release large amounts of greenhouse gases into the atmosphere, including carbon dioxide, methane, and nitrous oxide. These gases trap heat in the atmosphere and contribute to the warming of the planet¹³

¹³ <https://www.worldbank.org/en/news/factsheet/2021/10/29/10-things-you-didn-t-know-climate>

Community Perspective and Voices

As per the findings from the communities the major risks of which they are exposed to are- Floods & Flash Floods, Heatwave, Air Pollution, Fire, Stampedes, Industrial & Chemical disaster, Water Scarcity due to drought/heatwave, Water logging & contaminated water, and Dry & Wet Waste and minor shocks of earthquake.

In addition to the above risks, as per the findings from both community members and practitioners the integrated risks due to above risks of which the citizens are exposed to are- Human Health Risks are at a rise especially risks such as Dehydration, Heat Stroke, Respiratory Disorders, Cardiovascular Diseases, Chronic Diseases and Food Poisoning), Cardio Respiratory Issues such as eye burning, skin related problems, asthma. In addition, the deteriorating quality of water and water-borne diseases has been a challenge. The practitioners also revealed that lack of awareness, lack of behavioral practices, disposal of waste, release of polluted water from the industries, overflow of water in sewage, industrial waste, open drainage, infrastructural structures, defective roads, low-lying areas and haphazard roads are the main reasons for the vulnerabilities

Air-Pollution

- Disaster risk management has not been addressed and needs to be integrated here in the local levels
- The excess levels of heat which have been witnessed by rising temperatures.
- The sustainability of infrastructure development initiatives such as health care facilities in the nearby vicinities Gulab Nagar, Jantanagar Talavadi, Gafur Basti, Dantaniwas, Khanwadi has been indicated based on the primary survey and data collection.
- The provision of industries to be regulated, especially often due to industrial waste accumulating.
- The vulnerabilities of the slum dwellers also extend to the limited access to proper shelter and housing facilities with lack of land tenure, to construct permanent residences.
- In addition, the air pollution levels indicate a serious concern as respondents during primary data collection have indicated higher risks of heat strokes, respiratory problems, such as asthma and bronchitis, which are also linked to an increased risk of heart attacks and stroke. In addition, long-term exposure to air pollution can damage the lungs and increase the risk of lung cancer (WHO).¹⁴
- Many of the local practitioners in Ahmedabad have also highlighted that the environmental consequences include harm to the crops and natural habitats. It can also contribute to climate change by releasing greenhouse gases into the atmosphere¹⁵.
- The practitioners also point to the higher levels of vehicular emissions which have been witnessed across the city in the recent times¹⁶.
- The need for increasing the use of public transportation, implementing stricter emission controls for vehicles and industries, and promoting the use of clean energy sources. In addition, education campaigns can help raise awareness of the issue and encourage individuals to take action to reduce air pollution in their own lives.

Community level Mitigation Measures, examples

1. Those who are vendors have also started home based additional livelihood work during their free time between 2:00 pm to 5:30 pm as they are at home between this time due to heatwaves
2. Many of them have not removed big trees from their house as they feel it is their air conditioner during summer season to carry out their livelihood work at home
3. For sanitation, some members are using the bathrooms and toilets on sharing basis as 4-5 families, as they have constructed the toilets with their own contribution

¹⁴ <https://www.who.int/news/item/15-11-2019-what-are-health-consequences-of-air-pollution-on-populations#:~:text=Exposure%20to%20high%20levels%20of,heart%20disease%20and%20lung%20cancer.>

¹⁵ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7305892/>

¹⁶ <https://timesofindia.indiatimes.com/city/ahmedabad/65-prefer-private-vehicles-to-commute/articleshow/66308193.cms>

WaSH

- All five slum respondents face the challenge of waste accumulation and lack of smooth drainage systems due to the clustered size of the slums. The need for better planning and coordination among different stakeholders, as well as improved waste segregation and recycling efforts is the need of the hour¹⁷.
- As per a study on "Solid Waste Management in Slums of Ahmedabad: A Case Study" (2011) by A.V. Patel and others. It was examined that the solid waste management practices in slum areas of Ahmedabad, require improvement in effective waste collection, waste segregation, recycling and disposal systems, as well as greater community participation and awareness-raising efforts.
- At the identified locations, there is a higher risk of waterborne diseases from inadequate sanitation in the slums. The contamination of surface water and well water in the low-income settlements in Ahmedabad could expose high risk of waterborne diseases due to inadequate sanitation practices. "Assessment of water quality in slum areas of Ahmedabad city," by D. P. Patel and B. K. Patel. It provided the evidences that assesses of water quality in slum areas of Ahmedabad and contamination levels in the water sources are higher than the permissible limits. This is due to the inadequate sanitation practices and the lack of proper drainage systems in these areas.
- Even though there are public toilets, the provisions of cleanliness are a challenge and study "A study of sanitation in slums of Ahmedabad," by K. P. Raval and B. K. Patel. Looks at the sanitation conditions in slums of Ahmedabad and finds that most slum households do not have proper toilet facilities and rely on open defecation. This leads to contamination of drainage systems and water bodies, resulting in health hazards.

Excess Heat Wave

- The early provision of Heat Action Plan mentions about the need for awareness creation and early warning systems to be in place a suggestion which was also shared in the COP27.
- In the city, recently early indications of the rising temperatures reaching above 45 degrees Celsius has caused health systems also advocate for preventive measures and heat related illnesses to be curbed. Especially consumption of fluids and safety and precaution of the most vulnerable.
- Some of the main causes for urban heat are human-induced, which include Climate Change and unsustainable patterns of growth. Especially the higher concretization of infrastructure without green and eco-friendly infrastructure is also causing more heatwaves. Also, reduced the open spaces, green covers and forests decrease.
- As per the Gujarat Forest department, the green cover of Ahmedabad has reduced by 20% between 2005-2016¹⁸.

¹⁷ A Study of Solid Waste Management in Ahmedabad: With Special Reference to Slum Areas" (2008) by P.R. Patel and M.M. Patel.

¹⁸ <https://timesofindia.indiatimes.com/city/ahmedabad/ahmedabads-green-cover-flourishes-by-117-in-a-decade/articleshow/83267513.cms>

8. Recommendations

1. Mainstream resilience into city initiatives for the most vulnerable by integration into urban resilience in the City Vision or Development Plan to ensure that all infrastructure and assets, both old and new, are planned, developed and maintained in a resilient manner. Developing or updating building bylaws, urban and infrastructure planning guidelines to make them sensitive to shocks and stresses and equally important is their effective enforcement.

2. Risk assessment and establishing a Plan of Action is vital specially to assess and understand the shocks and stresses experienced by the most cramped and congested parts such as slums. This requires mapping of risks and identification of vulnerable hotspots and communities. Adopting a participatory approach and using local level data will ensure a realistic assessment of social, economic and physical vulnerabilities and the capacities to cope with shocks and stresses. The ULBs, civil society organisations, SDMAs, DDMAs can then formulate a long-term vision along with short and medium-term implementation strategies that reduce stresses and support in managing shocks.

3. Adopt a holistic approach to resilience building and enabling more collaborative measures to be taken. For instance, to become flood resilient, ULBs should follow a comprehensive plan that includes regularly maintaining storm water drains and checking for encroachments, resurfacing roads without raising its elevation, increasing permeable surfaces, promoting rainwater harvesting, restricting construction in low-lying areas, and developing multi-utility water retention spaces to absorb excess water. Such an approach will not only build resilience but will also provide sustainable co-benefits.

4. Mainstream resilience in urban development and governance processes and promote risk resilient urban investments in the slums.

Community Voices

- Ongoing awareness programmes in the campaign mode and trainings to foster behavior change in the communities which are need based and community driven;
- Heat Action Plan could be rolled out and finding funding streams from Corporate Social Responsibility and Public Private Partnership (PPP) model to demonstrate the mitigation measures;
- Recommendations to local planners and stakeholders to effectively integrate needs of communities such as safety assessments of public spaces and engage RWAs in the process and land-use planning along with city authorities;
- Planning programmes that have a sustainability aspect to them and have constant advocacy and liaisoning with the city authorities;
- Facilitate the City Authority to design the action oriented Urban Resilience and Climate Risks Reduction Road Map;
- Continuous advocacy with key departments such as **Health, WASH, Housing, Water Supply, Drainage and Sanitation, Fire, Solid Waste, Urban Community Development, Land use planning and Heritage** on risk reduction based on the evidences collected from the communities;
- Engage youth and women cooperatives in each and every intervention and collect evidences on climate risks and the potential opportunities for navigating through such risks;
- At the micro level, creating livelihood opportunities which are linked to government schemes, and improving housing through initiatives such as rain-water harvesting, cool roofing solutions, kitchen gardens which are affordable.

5. Maximize the use of resilient urban solutions in the city through enforcement of policy and regulations which can foster innovation and risk-resilient investments in urban development process.

6. Strengthen institutional capacities strengthening institutional capacities of governmental organizations; private sector; academia, and civil society organizations is key for building resilience in vulnerable areas. It is important to identify specific roles and responsibilities, and platforms to share the knowledge and skills of various stakeholders. In addition, coordination with nodal person to convene stakeholders and coordinate resilience initiatives is key for institutionalizing resilience within the ULB organizational structure.

7. Engage with stakeholders and communities for ensuring participation and ownership of initiatives. Identifying and strengthening social connect, and community-based resilience building which can demonstrate effective action across the city.

8. Facilitating top-down and bottom-up communication that strengthens the knowledge and awareness of the public is important. Private sector and civil society can also play a key role in ensuring participatory action.

9. Strengthen financial capacities financial management is key for ensuring resilient public infrastructure and efficient service delivery. Besides channelling city budgets to embed resilience in slum areas, SDMAs can illustrate demand for resilience solutions from the market and contribute to resilience discourse. Innovative options like municipal bonds and green bonds for building resilient infrastructure can be explored.

Recommendations at Micro-level

- **Conduct training needs assessment and plan training programmes and awareness campaigns** based on the same, i.e. fire, solid waste management, air pollution, heat waves, WASH, Health, Road Accidents, knowledge around impacts and causes of climate change etc. for women cooperatives and youths by creating network of Climate Mitras
- Collect evidences of climate risks such as vector borne diseases and water quality due to water logging or solid waste- with participation of slum communities. Livelihood opportunities
 1. Linking with the government schemes (Livelihood Mission, Schemes by UCD Department)
 2. Vocational trainings for alternative livelihoods
- Demonstrate climate resilient sustainable solutions such as **rain water harvesting, kitchen gardens, roof top gardens, and cool roofing solutions**- which are affordable to the communities.
- Facilitate the city authority to prepare action oriented – three yearly Disaster Risk Reduction and Climate **Resilience Road Map of the city in consultation with key departments- Health, WASH, Housing, Water Supply, Drainage and Sanitation, Fire, Solid Waste, Urban Community Development, Land use planning and Heritage** based on the evidences collected from the slums/common citizens;
- **Conduct special training** of the above departments to discuss the rolling out plan of proposed actions for the city authorities of State Action Plan on Climate Change
- Organise **awareness campaigns and trainings** in consultation with CSOs and academic institutions;
- **Rolling out of actions** proposed in the Heat Action Plan of Ahmedabad and demonstrate the solution-based initiatives with mobilization of CSR funding/PPP model;
- **Coordination and advocacy** on periodic basis through Inter Agency Group.

Annexure

Findings: Practitioners' Perspectives

- Do our awareness programmes and trainings bring the behaviour change? Do we run our trainings and awareness programmes as an ongoing intervention for long periods?
- Are our training programmes context based, need based and demand based? Do we have the training pedagogy designed following context, needs and demands?
- Can we make a rolling out plan of our trainings in cascade mode is an important question to reaching out to the maximum citizens?
- Do we have enough approached the communities to understand what are the risks, what are the vulnerabilities, what are the bottlenecks and what are the mitigation measures practiced by the communities?
- We have heat action plan of Ahmedabad city. But do we have a rolling out plan of the same? Have we demonstrated the mitigation actions which are proposed in the heat action plan? Can we mobilise the CSR funding or PPP model to roll out the heat action plan?
- Do we have industrial and chemical Disaster Management plans? Have we rolled them out? Have we updated them based on our learning from rolling out?
- Have we integrated mapping of natural drainage channel in our land use planning?
- Have we conducted the safety assessments of public places and critical infrastructure such as schools and hospitals?
- Can we form citizen's forums and engage the committees of residential societies?
- How do we address the issue of water logging and waste management in the slum areas?
- Have we widened our internal roads in the slum areas for easy access of emergency services?
- Can we demonstrate examples of youths as agents of change?
- How do we engage community/women cooperatives for risk reduction and climate resilience interventions?
- How do we make community aware about the government schemes/programmes to avail the benefit?
- Have we prepared community representatives who can directly engage with the city authorities and represent his/her slum/area?