



Technical Assistance Consultant's Report

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Asian Development Bank

ADB Urban Climate Change Resilience Trust Fund

City Resilience Profiles: Bangladesh, Pakistan, Philippines, & Viet Nam



URBAN CLIMATE
CHANGE RESILIENCE
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Introduction

Climate change poses a growing threat to the lives and livelihoods of people in cities worldwide. This is especially true in Asia, where climate-related hazards such as heavy rainfall, intensifying cyclones, and extreme heat exacerbate vulnerabilities related to rapid urbanization, population growth, and critical infrastructure. To safeguard lives and livelihoods, these interconnected challenges require significant investment to support physical, ecological, financial and economic, and social and institutional resilience.

To direct investment where it will make the most impact, Asian cities and their partners must have a holistic picture of the kinds of systemic risks the cities face. They must understand how climate hazards intersect with pre-existing social and infrastructural vulnerabilities. In 2018, the Asian Development Bank's (ADB) Urban Climate Change Resilience Trust Fund (UCCRTF) visited 17 cities in four countries (Bangladesh, Pakistan, Philippines, and Vietnam) to assess the cities' ability to cope with shocks and stresses from climate change.

The work provides a baseline assessment of each city's resilience based on a series of structured interviews with city officials. In twelve of the cities, household-level surveys were conducted, uncovering the perceived resilience of citizens in climate-vulnerable areas. In each of the cities, UCCRTF has implemented urban resilience projects. The baseline results provide a basis for a better understanding of the impact these interventions have had.

This document presents the results of the baseline studies for each city in a series of City Resilience Profiles (CRPs). Each CRP provides an insight into the current perceived level of resilience across four key dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The findings provide an indication of potential areas of future investment in infrastructure, governance or planning, that could help to further strengthen the city's resilience.

The four dimensions of resilience

The CRPs provide a systems view of urban resilience in each of the target cities, measuring resilience against four dimensions and twelve resilience goals:

- The **'Health and well-being'** dimension assessed the provision for the protection and safeguarding of human health and quality of life. Cities were scored against three resilience goals: 'Minimum Human Vulnerability',

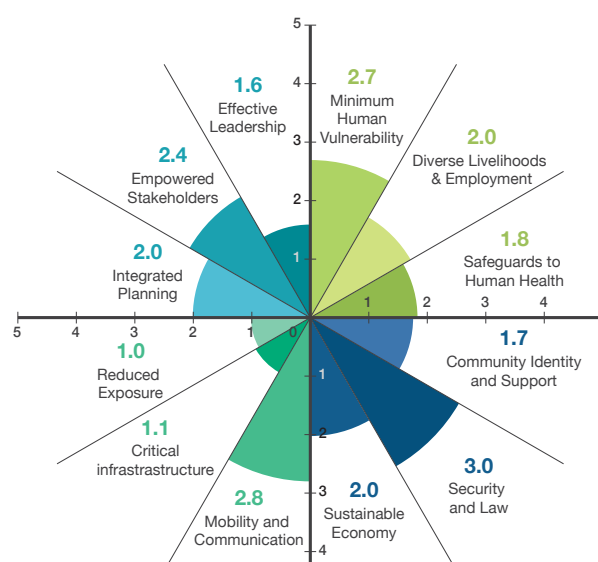
'Diverse Livelihoods & Employment', and 'Safeguards to Human Health'.

- The **'Economy and society'** dimension assessed how strong the urban economy was and the strength of community and social cohesion. The three resilience goals for this dimension were 'Sustainable Economy', 'Security and the rule of Law' and 'Community Identity and Support'.

- The **'Infrastructure and environment'** dimension measured the perceived quality of cities' infrastructure systems. The resilience goals under this dimension were: 'Reduced Exposure', 'Critical Infrastructure' and 'Mobility and Communication'.

- The **'Leadership and strategy'** dimension measured the perceived quality of the urban governance and leadership: The resilience goals tested under this dimension were: 'Integrated planning', 'Effective leadership', and 'Empowered stakeholders'.

Each CRP presents the results of the baseline in the unique context of the city in question. As these scores are based on perceptions of resilience, they are not cross-comparable between cities. All cities had significant resilience challenges, usually across multiple resilience dimensions.



City-wide resilience results for Faridpur, Bangladesh. The city requires significant investment to boost its resilience.

The most common climate threats cities faced were flooding from coastal inundation or intense rainfall, extreme heat, and storms. Generally, the CRPs found that the most significant challenge for cities in building resilience was a lack of municipal capacity for urban development planning, procurement and development, a lack of funds to improve poor-quality or non-existent critical infrastructure systems, and fast-growing populations that were leading to unplanned expansion into climate-vulnerable areas.

The CRPs also highlighted how climate change is likely to hamper cities' economic growth and prosperity.

Extreme events causing damage to already poor-quality infrastructure systems, increased heat stress affecting outdoor workers, and pressures on municipal finances were all found to be significant breaks to economic development. Many cities were also found to have substantial dependence on climatically sensitive sectors such as agriculture, making them especially economically vulnerable.



Photo of downtown Peshawar, Pakistan.

City Resilience Profiles

Bangladesh



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Bagerhat

Bagerhat, also known as the Mosque City of Bagerhat, is a UNESCO World Heritage site home to several mosques from the 15th century located on the edge of the Sundarbans. Tourists are attracted to the city for its architecture, though today, Bagerhat's economy is driven primarily by agriculture, with rice, sugarcane, wheat, jute, and potatoes among its main crops.

Bagerhat is regularly exposed to climate-related shocks and stresses, such as flooding, tropical storms and cyclones, especially during the monsoon season. Events like these are likely to become more frequent and severe due to climate change. Therefore, improvements to Bagerhat's infrastructure, urban planning, and

community preparedness are essential to strengthen its resilience.

This study provides a baseline assessment of Bagerhat's resilience based on a series of structured interviews and on surveys that were conducted with 103 households in vulnerable districts of the city. The study found that Bagerhat requires investment to bolster its resilience across all resilience dimensions. In particular, the city requires investment in urban planning to ensure that its future growth and investment is well targeted. Improved governance systems and targeted investment in critical infrastructure systems, especially transport, water, sanitation and disaster prevention, are also needed.

KEY FINDINGS

- Bagerhat is sensitive to climate change shocks and stresses, including flooding and extreme storms, and experiences frequent severe weather events, including tropical storms and cyclones, during the monsoon season.¹
- Although the city displays limited resilience, there are opportunities to improve by investing in improved infrastructure and urban planning. Flooding and lack of drainage capacity are among the main challenges facing the municipality. Poor solid waste management further exacerbates the drainage issue.
- Bagerhat's resilience to climate-related extreme events is boosted by its early warning system.
- The city's resilience could be further enhanced by improving its integrated urban development planning and increasing community participation in decision-making.
- Bagerhat's economic and social resilience is supported by effective law enforcement, crime prevention, access to criminal justice systems, and a strong sense of community in the city. However, there is a limited diversity of livelihood opportunities, and the city has no specific budget allocation for disaster response or supporting businesses at times of crisis.
- Household-level surveys found that the most vulnerable households in Bagerhat reported that they had good access to food supplies. However, there was a relatively high dependency on government support services, suggesting that these households are less resilient when faced with a disaster or shock.

Bagerhat in the context of climate change

Bagerhat is an ancient, coastal city with a population of 1.5 million² lying on the western bank of the Bhairab River. The city is prominently flat and lies only two meters above sea level.³ This means that the city is exposed to a variety of climate shocks and stresses, particularly to flooding and storm surge brought on by tropical cyclones. A UNESCO World Heritage site home to several mosques from the 15th century, Bagerhat's economy is driven by agriculture, especially rice, sugarcane, wheat, jute, and potatoes farming.

Climate change projections indicate that Bangladesh could experience a 1.5 C increase in temperature and 4% increase in precipitation, by mid-century.⁴ Sea levels in the Bay of Bengal are also expected to rise by around 27 centimetres or more over the same time period.⁵ Warmer temperatures are likely to result in more frequent and intense cyclones and storm surges, which can cause damage to roads and bridges, drainage, water supply, and sanitation systems, as well as threatening public health and safety.⁶

Urban flooding and a lack of drainage capacity are among the main challenges facing the municipality. All nine of the city's wards experience intermittent flooding, to a depth of one meter and lasting up to five hours.⁷ Chronic waterlogging and the lack of drainage capacity, combined with poor solid waste management, further exacerbate the city's lack of drainage capacity.⁸ Furthermore, despite 93% of the population having access to an improved water source, only 78% is piped. As groundwater sources are too saline for human consumption, many citizens rely on surface water stored in open water ponds which carries health risks.⁹

In January 2019, Cyclone Fani triggered storm surges around 5 feet higher than normal tidal levels along the coasts of Bagerhat, displacing over 1.2 million people across Bangladesh.¹⁰ Following such disasters, the city experiences increased pressure on resources due to influx of displaced people from rural areas.¹¹

Housing supply is a major concern in the city with 16% of households living in “kutcha” houses, which are built using organic materials and are often located in areas of high-flood risk. The need for affordable housing is driving expansion of the municipality outwards, placing even greater pressure on already strained municipal systems, including its transportation system.¹²

Poor urban planning has led to undirected urbanization in flood-prone areas, which increases the climate risk exposure of the population. Of specific concern are Wards 5, 7, and 8 which continue to expand beyond the municipal boundaries. This expansion into flood-prone areas, when coupled with an inability to actively pursue and enforce disaster risk reduction (DRR) measures, further increases the risk to the municipal population.¹³

Climate hazards have significant impact on those who rely on seasonal work. While no single industry dominates the city's economic base, agriculture-based industries play a prominent role. Workers often migrate seasonally to find work or engage in marginal and irregular activities.¹⁴ As it can take several days for the water to drain, those who rely on ‘occasional’ work such as street vendors, rickshaw drivers, and day labourers are susceptible to losing their income.

Resilience context

Climate impacts



Bagerhat is **exposed to cyclones and storm surges** leading to urban flooding.



Rainfall is expected to increase and could also fall in more intense bursts leading to flash flooding.



The **salinity of soils and groundwater** is expected to increase during the dry season.

Additional factors



Housing supply is a major concern in the city with **16% of households living in poorly built houses**.



Drainage infrastructure in the city is either non-existent or of poor quality.



Agriculture is the main source of income for the city. The sector is highly exposed to climate impacts.

City Resilience Profile



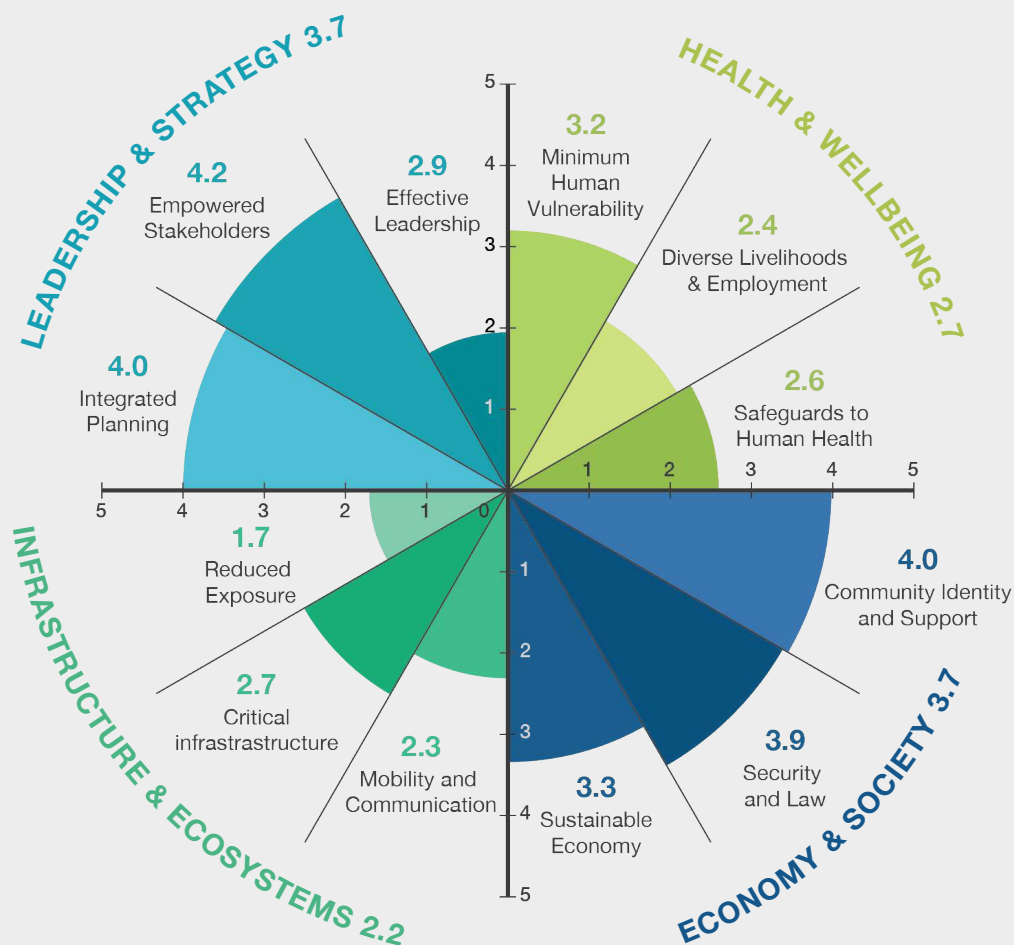
In 2018, ADB's Urban Climate Change Resilience Trust Fund (UCCRTF) visited Bagerhat to conduct a baseline assessment of the city's resilience. The study assessed Bagerhat's resilience in four key areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe.¹⁵ The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis shows that Bagerhat scores poorly in the dimensions of 'Health and Wellbeing', and 'Infrastructure and Ecosystems', suggesting it needs major improvements in these areas to reduce the vulnerability of its residents, especially when faced with an emergency. However, in terms of leadership and strategy, Bagerhat demonstrates qualities that lend it resilience. The results of this baseline assessment are discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

Bagerhat's resilience in this area is boosted by strong scores in relation to development planning (4.0) and the empowerment of citizens (4.2). The city has had a municipal Master Plan in place since 2010, however it is not yet legally enforced. Bagerhat's resilience could be increased further by implementing the municipal Master plan and increasing community participation in urban planning and decision making.¹⁶ Resilience in this area could be boosted further by improving the efficiency of governance in the city ("effective leadership and management": 2.9). Particular attention needs to be paid to strengthening technical and administrative capacity for operation and maintenance of all municipal processes, equipment, facilities and infrastructure in the city.¹⁷

HEALTH & WELLBEING

Continued reliance on climate-sensitive livelihoods, especially fishing, is one of the major causes of vulnerability for Bagerhat's population. Diverse livelihood and employment opportunities, notably in the tourism sector, are needed to boost its resilience ("Diverse Livelihood and Employment": 2.4). Bagerhat is well equipped with health facilities having 3 government hospitals and 17 private clinics. However, poor quality housing, issues with the quality of the water supply, and poor drainage and sanitation infrastructure pose health risks to the population especially during emergencies ("Minimum Human Vulnerability" 3.2). Bagerhat's resilience is boosted by its early warning system. However the city's resilience is undermined by ineffective coastal flooding infrastructure, and it does not have emergency plans and protocols in place ("Effective safeguards to Human Health & Life": 2.6).



INFRASTRUCTURE & ECOSYSTEMS

Bagerhat's infrastructure and ecosystems are generally underdeveloped, undermining the resilience of its citizens. Transport infrastructure within the city requires significant investment with 70% of the city's roads in poor condition resulting from inadequate drainage, footpaths and lighting ("Mobility and communications": 2.3).¹⁸ Water supply is another significant concern with the city only providing 40 minutes of water connection per day. Drainage congestion, and inadequate waste management and sanitation also undermine resilience and degraded water quality ("Provision of critical infrastructure": 2.7).¹⁹ Bagerhat lacks infrastructure to reduce flood risk and informal settlements encroach on its water bodies. Furthermore, tidal and flood water levels regularly breach the height of the present embankments ("Reduced exposure": 1.7).

ECONOMY & SOCIETY

Bagerhat's resilience in this area is undermined by the fact that it is economically over-exposed to shrimp farming and agriculture which are climate sensitive industries ("Sustainable Economy": 3.3). There is no specific budget allocation for disaster response or supporting businesses at times of crisis. However, the baseline study suggests that Bagerhat's resilience is boosted by a strong sense of community in the city ("Collective Identity & Community Support": 4.0). The citizens have adequate access to police and the justice systems; however, more could be done to improve the safety of the public realm, especially with regards to street lighting and street quality ("Security & Rule of Law": 3.9).

Household perceptions of resilience

Alongside the city-level baseline study, UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain sections of the city's population. The data collection was limited to 103 respondents from wards where ADB infrastructure investments are planned or underway. The results provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community in Bagerhat, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the highest, against four characteristics: i) Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As shown in Figure 1, respondents scored Bagerhat highest for community organisation (2.50), but relatively poorly for economic opportunities (2.01), connectedness (2.27) and infrastructure and services (2.35). Overall, Bagerhat scored 2.28; suggesting weak community resilience. However, these results may be influenced by the socio-economic position of many of the households that were interviewed for the survey.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Asset Ownership; iii)

Adaptive Capacity; iv) Income and Food Access; and v) Social Safety Net. Scores against each of these dimensions were calculated as an averaged index from survey responses and secondary data.

As shown in Figure 2, perceived household resilience was highest for "income and food access" with 90% feeling that they had sufficient access to food. Levels of asset ownership and access to basic services were also relatively high, with 74% reporting that they owned assets and 75% of households saying they are aware of the availability of basic services in their area. Despite the aforementioned perception of relative financial security in Bagerhat, over half (53%) of households feel that they are still dependent on some form of government-supported social program, suggesting that these households are less resilient when faced with a disaster or shock.

To understand major shocks and stresses and their likely impacts, the residents of Bagerhat were asked about disasters and unexpected shocks and stresses that they had faced in the past five years. Overall, almost half of respondents to the household survey felt that their level of resilience was "medium" (47%) compared with 18% who felt they had relatively high levels of resilience and 35% who saw their resilience as "low". As shown in Figure 3, over half of respondents also reported that their ability to recover from shocks was the same as before (50%), a further 14% felt that their ability to recover was better than before, and 15% felt that it was worse than before.

Figure 1

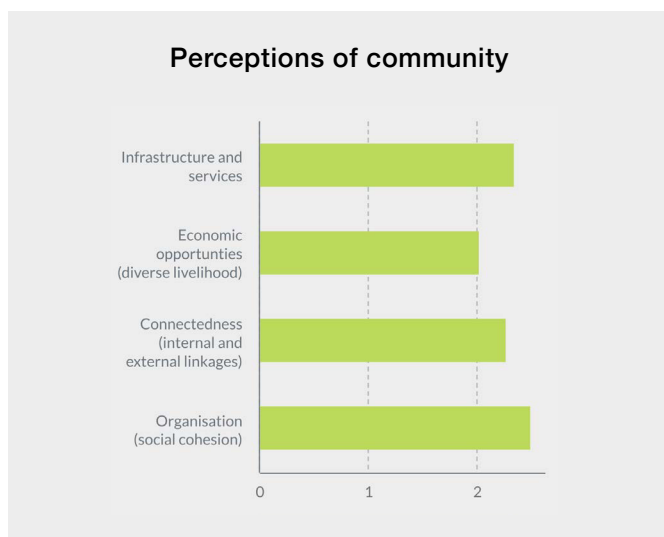
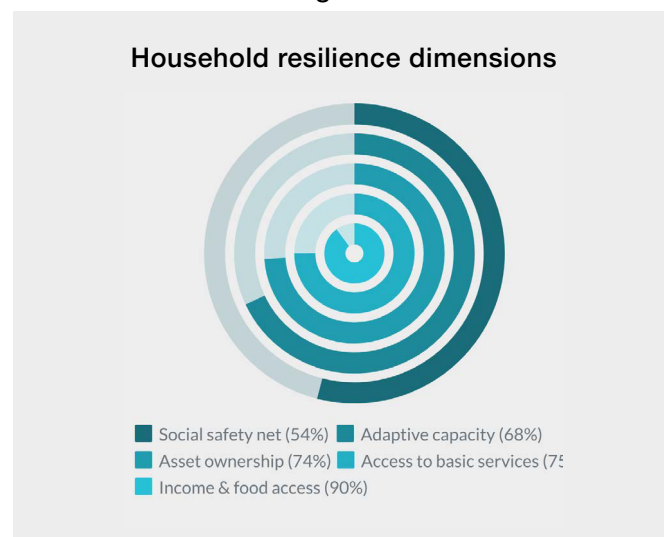


Figure 2



Disaster Response in Bagerhat

The majority of respondents in Bagerhat reported that they had received an early warning before the last disaster (87%). These warnings were communicated effectively via multiple channels, the most popular of which were: radio (41%), television (71%), and from neighbours or relatives (43%). Only 61% of respondents indicated that they were aware of where to seek shelter or help when faced with a disaster, suggesting weak city-level mechanisms to create awareness.

Despite the effective early warning system in Bagerhat, most people did not move to another place to take shelter either before or after the last disaster (84%). This is likely due to several factors. Firstly, the most popular communications channels for receiving the early warnings were largely passive. Far fewer respondents reported receiving warnings via direct instruction from people who have received training such as community volunteers or disaster management committees (20% combined).

Secondly, responses indicate that early warning information was not entirely accessible. Only 39% of respondents indicated that they were aware of where to seek shelter or help when faced with a disaster, suggesting weak city-level awareness raising mechanisms. Additionally, 86% of respondents were not aware of any members of the community who are trained to help during a disaster and very few people reported having received disaster preparedness training



Baseline work in progress in Bagerhat.

(12%). In fact, 38% of respondents did not evacuate during the last disaster due to lack of awareness of surrounding evacuation shelters.

Figure 3

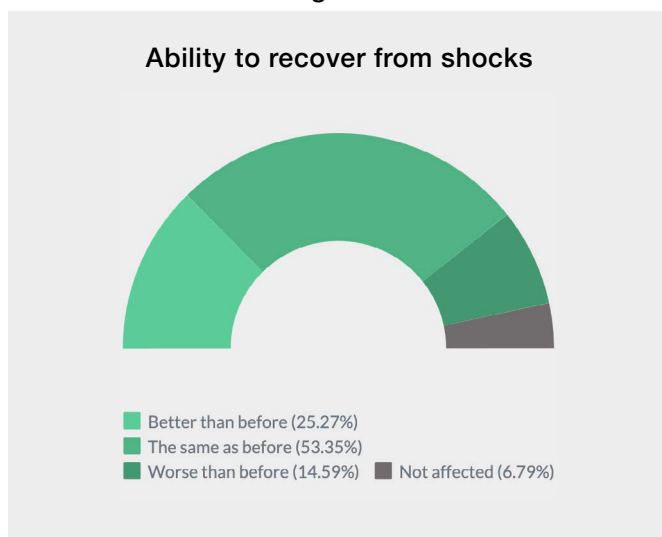


Figure 4



Resilience interventions in Bagerhat

ADB and UCCRTF projects in Bagerhat

CURRENT ADB PROJECT

CTEIP (Loan 3133 and Loan 8284)

\$82 million loan covering 8 coastal towns in Bangladesh



Improved climate resilient municipal infrastructure, including climate and disaster risk-reducing infrastructure and local economic infrastructure



Strengthened institutional capacity, governance and awareness



Project management and administration supported

UCCRTF Technical Assistance to Support Climate Resilient Integrated Urban Plans (CRIUPS) \$1.6 million (TA 8913)

Supporting:

- assessments of socio-economic vulnerability, climate risk, and urban systems
- an understanding of urban climate change resilience issues and their relevance in the urban context
- action plans that respond to climate risks on critical urban systems
- identification of feasible soft and hard infrastructure projects to build urban climate change resilience

UCCRTF Investment Grant CTEIP - Additional Financing \$6 million

Supporting:

- construction of one (1) cyclone shelter road
- drainage improvements
- 6.5kms of emergency access road improvements
- preparation of integrated drainage, solid waste and fecal sludge management plans

UCCRTF Spatial Data Analysis Explorer (SPADE) (TA 8913)

Supporting:

- improved city-level climate and geospatial data
- project preparation, consultation and map production

Resilience in Bagerhat

According to the baseline assessment, the qualities that contribute to Bagerhat's resilience include effective leadership within the government and community, and a strong sense of security and law. However, given the high-level of exposure to climate change and its impacts, there are several areas where the city can invest to strengthen the resilience across all four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy.

Fundamental to these improvements is the need to establish a development control framework to prevent further unplanned expansion into high-risk areas. Similarly, integrated urban planning processes need to be updated, ratified and enforced to ensure the city can reduce its climate vulnerability and increase economic opportunities for its citizens. Addressing the very considerable infrastructure gaps will be crucial to its future development, especially with regards to flood protection, water supply, energy supply and transport.

Overall, the results of the household survey appear to support the scores at the city level, with high levels of income and food access lending the populations resilience to shocks and stresses. However, the household survey also pointed to areas for improvement, especially regarding a high dependence on government-supported social programmes that leave households highly susceptible to climate change impacts.

Besides requesting local government assistance, strategies used to recover from these unexpected shocks include reducing expenditures on health and education; reducing the number of meals and the quantity of food per day; and seeking assistance from local Non-Governmental Organisations or family and friends. This use of severe strategies not only serve as a temporary fix in limiting loss and damages, they also negatively impact the economy through reduced expenditure on health, education and food.

To begin to address these issues, ADB is supporting Bagerhat's Coastal Town Environmental Infrastructure Project (CTEIP).²⁰ This programme is facilitated by an \$82 million loan and focusses on strengthening the climate resilience and disaster preparedness in eight vulnerable coastal pourashavas (municipalities).

Taking a holistic, integrated approach to urban development, the project will provide climate-resilient municipal infrastructure, strengthen institutional capacity of local government, and raise public awareness about improved urban planning and service delivery that can respond to climate change and disaster risks. Infrastructure investments include drainage and water supply, sanitation facilities, drainage systems, cyclone shelters, and emergency access roads and bridges. CTEIP aims to improve the wellbeing in coastal towns, increasing the climate and disaster resiliency particularly of the poor and women.

Resilience building and the Urban Climate Change Resilience Trust Fund

To complement the ADB loan project, UCCRTF is also supporting several interventions:

- i) formulation of a participatory Climate Resilient Integrated Urban Plan
- ii) providing support to the development of climate-resilient infrastructure and urban planning;
- iii) piloting a geo-spatial data tool, the 'Spatial Data Analysis Explorer (SPADE)', to increase data access

UCCRTF supported resilience planning in Bagerhat via a \$1.6 million technical assistance under TA 8913 which also covers the Bangladeshi cities of Faridpur, Cox's Bazaar, Gopalganj, Kushtia, Mymensingh, and Patuakhali. The project identifies priority interventions in key areas by undertaking ward-level climate resilience vulnerability assessments, known as Rapid Urban Climate Change Assessments (RUCCAs). These RUCCAs inform the development of Climate Resilience Integrated Urban Plans (CRIUPs), which identify priority interventions, and provide actionable priorities over a five-year investment timetable. The project also includes consultations with local stakeholders, particularly the poor and vulnerable, and articulating the vision of a climate resilient city.

To improve infrastructure, UCCRTF has allocated a \$6 million grant as additional financing to the CTEIP loan for the cities of Bagerhat and Patuakhali. The project takes a holistic and integrated approach to urban resilience by simultaneously providing climate-resilient municipal

infrastructure and strengthening institutional capacity, local governance, and public awareness for improved urban planning and considering climate change and disaster risks.

UCCRTF has also piloted SPADE; a web-based platform supported by UCCRTF that contains various geospatial data that can be used for consultation, project preparation, production of maps, and analysis of climate change impacts. Hosted on a centralized cloud-based server, the platform uses open-source technology to provide support to Regional Departments on their planning and spatial analysis needs. Bagerhat was one of five pilot cities covered by SPADE. The maps and socio-economic surveys carried out in the city have been digitized and are available on the platform.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Bagerhat, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment.

- 1. Increased investment in the quality of the Bagerhat's water supply, and effective drainage and sanitation infrastructure.** Poor infrastructure in this area poses health risks to the population, especially during emergencies.
- 2. Improved transport infrastructure and internal**

transport links. This is to reduce congestion and improve air quality, to handle increased numbers of tourists and a growing population.

- 3. Increased investment in water supply, transport, waste management and flood protection infrastructure.** These directly influences Bagerhat's ability to improve socio-economic conditions and increase equitable access to economic opportunities.
- 4. Economic diversification to build the city's tourism infrastructure.** It will also help to boost employment opportunities and reduce poverty.
- 5. Strengthened efforts to foster community engagement and support in resilience planning and urban development.**

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Faridpur

A city of two million people, Faridpur is located in the fertile plains of the Padma River catchment. The city is low-lying and subject to frequent flooding that poses a danger to life, livelihoods and property. It is an important center of the jute and fish trades. Its industry supports numerous jute mills, and sugar mills powered by a 50-MW thermal power plant in Central Bangladesh on the west bank of the Mara Padma stream. The city also faces other extreme events, including earthquakes and tornadoes. Faridpur's resilience to such hazards could be improved by investing in critical infrastructure, especially water, sanitation, and housing. The baseline assessment of Faridpur suggests that Faridpur requires

significant investment to build its resilience across each of the four resilience dimensions.

This baseline assessment of the city's resilience is based on a series of structured interviews with city officials and on surveys that were conducted with 102 households in vulnerable districts of the city. ADB is actively working with Faridpur to strengthen the city's urban planning and critical infrastructure. The ADB interventions in the city are complemented by UCCRTF activities to build climate resilience in Faridpur by supporting community-led resilience projects. UCCRTF intends to undertake another assessment to compare changes in resilience.

KEY FINDINGS

- Faridpur is highly exposed to climate-related hazards, especially flood, tornadoes and cyclones.
- The baseline results suggest that Faridpur requires significant investment in its critical infrastructure systems to provide basic services to the city's residents and protect them from disasters. The city's lowest scores were for the quality of its infrastructure and ecosystems.
- Faridpur's water, sanitation and transport infrastructure are in need of considerable investment to improve the quality of life in the city.
- There is a high level of economic dependency on climate-sensitive activities, including fishing and agriculture. The lack of diversity of livelihood opportunities undermines the economic resilience of Faridpur's citizens.
- More than half of the households perceived their own resilience levels to be low.
- The disaster early warning systems in the city can be improved, with nearly two-thirds of residents (63%) not receiving a warning with enough time to prepare.
- ADB and UCCRTF are actively investing in Faridpur to improve urban planning, governance systems and critical infrastructure to build resilience.

Faridpur in the context of climate change

Originally marshland, Faridpur district benefits from the highly fertile soils of Padma river floodplain. Home to two million people, the city's economy is mostly agricultural as a centre for the district's jute, rice and sugar industries. Faridpur is famous for its jute farming and processing in particular, cultivating over 80,000 hectares of jute in 2019, and processing it in its 13 operational jute mills.¹ Faridpur is also an important centre for the region's fish trade, but remains one of the poorer districts of Bangladesh. Due to extreme weather events such as flooding, the city faces considerable challenges when developing its critical infrastructure systems,² the impacts of which have so far exacerbated the vulnerabilities of the city's population.

Faridpur experiences severe flooding six times a year, on an average. Increased rainfall associated with climate change will put further stress on the city's drainage and flood protection infrastructure which is already unable to deal with intense rainfall events during the monsoon season. The city experiences an average of 1,583 mm of rainfall per year, however 90% of this occurs in four consecutive months from June to September. Faridpur lies on the Padma River floodplain which is prone to deep seasonal inundation, exposing several wards (in particular wards 1, 2, 3, 4, and 7) to regular flooding.³ Coastal flooding is also expected to increase in Faridpur as direct cyclone landfalls and their associated storm and tidal surges already regularly affect the city. Flooding of up to 1.5 m from high tides occurs regularly across Wards 1, 8 and 9. This repeated inundation leads to the salinisation of the soil and groundwater.⁴

During the dry season from December to March, the salinity of soils and groundwater increases steadily, negatively affecting water supply, fisheries and agricultural crop production. Salinisation, along with over extraction of groundwater sources, has eliminated the freshwater layer above 400 m in the wider Faridpur District.⁵ This supply of natural resources is also being polluted by poor waste management, further decreasing the

resources available. Increased demand from a growing population is also expected to increase the pressure on natural resource supply.

With climate change, temperatures are also expected to rise, increasing both the demand for clean water and the health risks posed by inadequate waste management. Extreme weather events including flooding and extreme heat have negative economic consequences for some of the poorest and most vulnerable people in the city, especially those who rely on "occasional" work such as rickshaw drivers, street vendors and laborers.

By the end of the century, climate change will cause temperatures to rise by up to 2-4°C in the country,⁶ putting further stress on existing freshwater resources. This is a concern for the city as 57% of its land is used for agriculture, and majority of residents derive their livelihoods from agriculture and fishing. Livestock and agricultural land availability are highly vulnerable to climate change in the geographical region.⁷ Climate change will also cause an increase in the intensity of rainfall events, which in turn will increase the intensity of flooding and other disaster events.

Resilience context

Climate impacts



Faridpur today experiences severe flooding 6 times per year.



Cyclones may become more severe leading to wind damage and coastal flooding.



The salinity of soils and groundwater is expected to increase during the dry season.

Additional factors



The majority of Faridpur's population relies on agriculture and fishing to sustain their livelihoods.



Over extraction of groundwater has eliminated the freshwater layer above 400 m in Faridpur District.

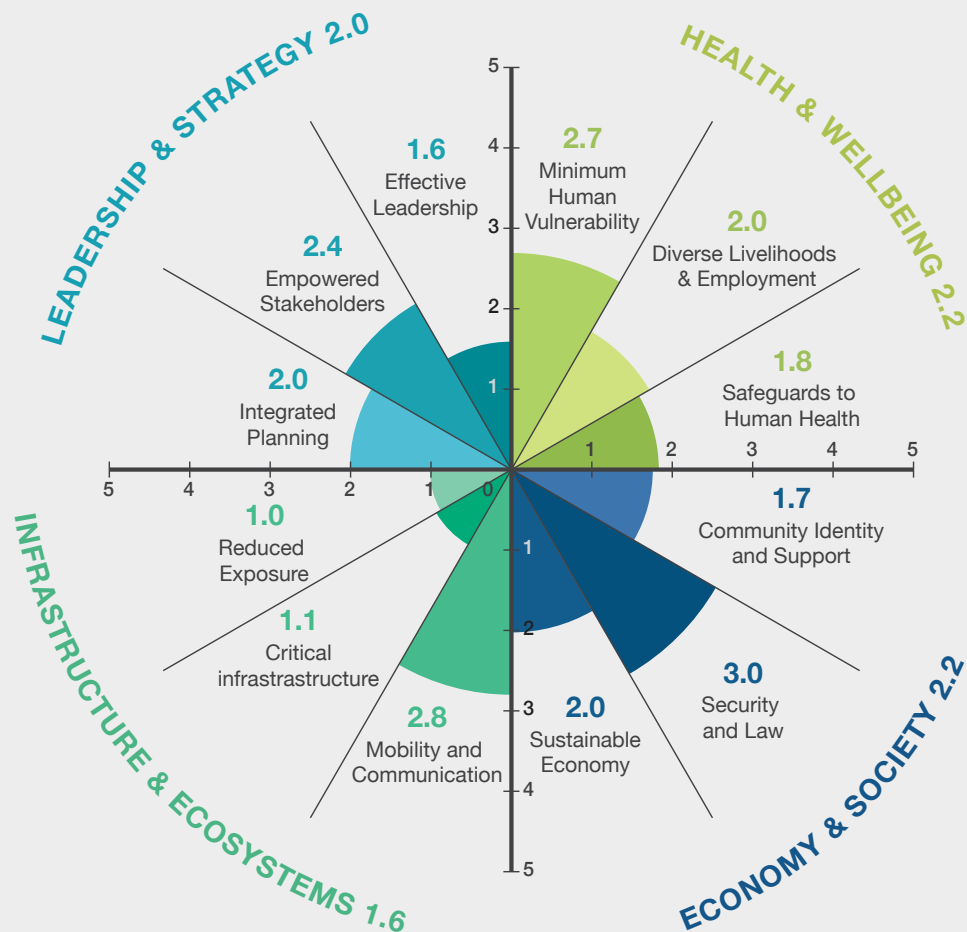


Poor waste management is leading to blocked drains, flooding and pollution.

LEADERSHIP & STRATEGY

HEALTH & WELLBEING

18



INFRASTRUCTURE & ECOSYSTEMS

Faridpur city suffers from drainage congestion, inadequate waste management and insufficient water supply, leading to flooding and poor water quality (“Provision of critical infrastructure”: 1.1). Just 49% of households have electricity, and over 20% do not have access to solid waste disposal. There is a lack of safe and affordable housing, and unplanned development is expanding, largely along new transport routes.¹⁴ Only 20% of the population can be served by the city’s emergency shelters (“Reduced exposure”: 1.0).¹⁵ With the opening of the Padma Bridge, freight traffic is expected to increase, leading to congestion and reducing the viability of the commercial centre due to reduced walkability and safety. Increased congestion is also expected to limit access to affordable transportation options (“Mobility and communications”: 2.8).¹⁶

ECONOMY & SOCIETY

Faridpur maintains reasonable levels of law and order in the city, and there is a high level of voter participation in municipal elections (70% at the last election),¹⁷ which provides the foundation for economic and social resilience (“Security and the rule of law”: 3.0). However, Faridpur has a low level of literacy in the city (49%)¹⁸ which constrains economic prosperity, and there is little diversity in terms of employment opportunities in the city. Overreliance on climate-sensitive livelihoods leads to repeated financial shock when such disasters hit. This reduces the financial capacity of the district and individual households to plan for and recover from such events. Increased resource and environmental degradation, especially water and air pollution, exacerbates the impacts of climate events, placing livelihood activities at risk and reducing the population’s ability to cope with climate shocks and stresses (“Sustainable economy”: 2.0).¹⁹

Household perceptions of resilience

Alongside the city-level baseline assessment, UCCRTF also conducted a household level survey to understand the community's perception of resilience in Faridpur. The survey was carried out in selected wards that were identified as vulnerable to climate impacts. Households within these wards were identified based on their exposure to climate impacts and socio-economic vulnerability, by the UCCRTF team and ADB staff along with city officials. In Faridpur, data was collected from 102 households. The results provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community, residents were asked to rate their community on a scale of 1 to 5, with 1 being the lowest rating and 5 being the highest against four characteristics: i) Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As shown in figure 1, Faridpur scored low (1.81) on community characteristics indicating weak community resilience. The average community score on Infrastructure and Services was 1.76, on Connectedness 1.86, Economic Opportunities 1.76; and Community Social Cohesiveness 1.80.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Assets; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social

Safety Net. Scores against each of these dimensions were calculated as an averaged index from survey responses and secondary data.

As seen in figure 2, based on the residents' perception, 74% of households interviewed consider themselves to have the capacity to adapt to and recover after a disaster. 67% of households are aware of the availability of basic services in their area. However, 79% of the households were found to be dependent on some form of government-supported social program, indicating that dependency on government-supported programs most likely makes households less resilient to a disaster or shock. Additionally, only 18% of the households have diverse sources of income and sufficient access to food, which implies that these households will find it tougher to recover from shocks and disasters.

Faridpur experiences extreme events on a regular basis, so respondents to the survey were able to draw on recent experience about their ability to deal with and recover from shocks. An analysis of households' resilience status validates this point. 58% of households considered their resilience to be low (score between 0-6), followed by 34% households perceiving they had moderate levels of resilience (20-21). This is in line with the overall city level scores (see page 19) which scored Faridpur as having low levels of resilience across all four dimensions.

Responding to shocks and stresses in Faridpur

The residents of Faridpur were asked to recall major

Figure 1

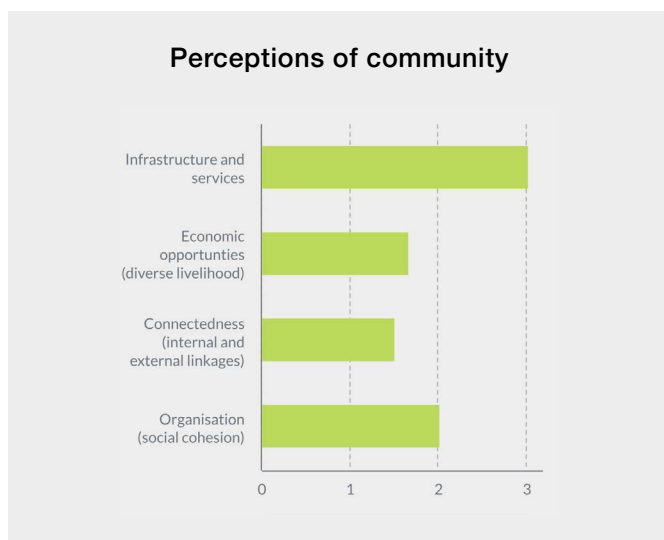
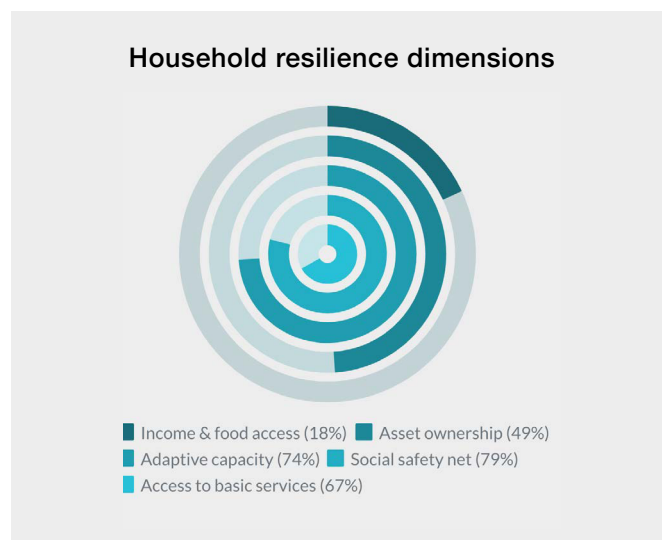


Figure 2



shocks and stresses and disasters that they had faced in the past and their coping mechanisms for each. 36% of households listed heavy rain/hailstorm as a major shock with moderate average impact. 14% of households listed cyclones/hurricanes as a major shock with moderate impact. Waterlogging and flooding affected most households, that is 73%, with moderate impact. Other shocks such as chronic illnesses and loss or reduction of income were found to have, on an average, moderate impact in the area. Unexpected shocks, major illnesses and injuries were listed by residents as a major impact, costing them up to \$439 on an average. The loss of income due to an earning member's death, or reduction in income or loss of or damage to housing infrastructure, was also listed as major shocks costing more than \$150 on an average.

As shown in figure 3 below, 26% of households were unable to recover from disasters or shocks. Less than half of the households interviewed (46%) stated that their state of wellbeing remained the same after experiencing a shock/stress.

Early warning system in Faridpur

According to the households interviewed, only 37% of residents received early warnings regarding an impending natural hazard. Among residents who received early warnings, about 87% listed television as their major source of warning, 18% listed word of mouth (through neighbours or relatives) as a source of warning, about 3% received early warnings through a disaster or

community volunteer and 8% received warnings from any disaster committee. This indicates that there exist a lack of information and a weak community disaster risk management system in the city. More than 90% of households stated that they were unaware of who their trained community volunteers were.

In terms of seeking shelter or support when faced with a natural disaster, only 30% of households indicated that they were aware of where to seek help. This suggests that city-level mechanisms for creating awareness are weak and there is a lack of enhanced protective infrastructure. When asked whether households have a plan in place in case of a disaster, 55% of residents said that they do not have a plan.

Overall, low resilience percentages and lack of awareness and infrastructure for coping with disasters and shocks in the city are a likely result of weak city level systemic resilience dimensions. This implies that household resilience is a function of the city's overarching systemic resilience.

Figure 3

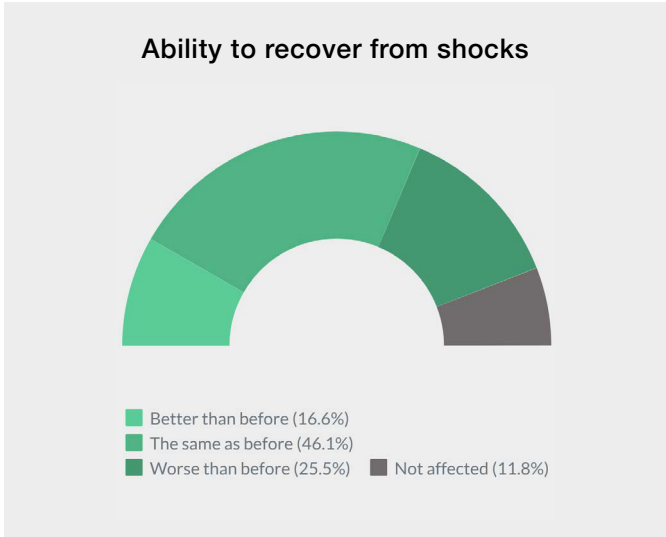


Figure 4



Resilience interventions in Faridpur

ADB and UCCRTF projects in Faridpur

CURRENT ADB PROJECT

Urban Governance and Infrastructure Improvement (Sector) Project III - Additional Financing (Loan 3551)

\$100 million between 35 districts in Bangladesh



Installation of new water meters and pipes



Construction of a new surface water treatment plant



Training and awareness building on water safety



25 km of drainage improvements around road infrastructure



over 55 km of road improvements and new projects

UCCRTF Technical Assistance to Support Climate Resilient Integrated Urban Plans (CRIUPS) \$1.6 million (TA 8913)

Supporting:

- assessments of socio-economic vulnerability, climate risk, and urban systems
- an understanding of urban climate change resilience issues and their relevance in the urban context
- action plans that respond to climate risks on critical urban systems
- identification of feasible soft and hard infrastructure projects to build urban climate change resilience

UCCRTF City Level Clean Air Action Plans (CAAPs) \$1.2 million (TA 9608)*

Supporting:

- policy actions and technological solutions for air quality management
 - the development of CAAPs to guide city-level planning to improve air quality
- *Regional TA covering 5 cities in 5 DMCA

UCCRTF Community-led Project (CLP) (TA 9329)* Climate Resilient Park, Livelihoods Training Center and Community-based Solid Waste Management System \$6.065 million

Supporting:

- Community-based solid waste management system
- Faridpur skills and livelihood resource center
- Climate-smart community park.

According to the baseline assessment, Faridpur demonstrates a low level of resilience, an average of 2 out of 5, across the four key resilience areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. Given the existing socio-economic vulnerabilities and frequency of natural disasters in the city, it is imperative for the city to strengthen its resilience, especially in terms of its critical infrastructure and ecosystems, leadership, planning processes and stakeholder awareness and involvement.

To address issues of governance and lack of robust planning processes for urban infrastructure development, ADB approved additional financing under the \$100 million Third Urban Governance and Infrastructure Improvement (Sector) Project - Additional Financing to help 30 municipalities in Bangladesh improve their infrastructure and make them gender and climate responsive and improve the cities' capacity in urban service delivery, planning and financial management. To date, this loan project has supported the preparation of climate resilient integrated urban plans in seven towns in Bangladesh, including Faridpur.

UCCRTF supported resilience planning in Faridpur via a \$1.6 million technical assistance under TA 8913 which also covers the Bangladeshi cities of Bagerhat, Cox's Bazaar, Gopalganj, Kushtia, Mymensingh, and Patuakhali. The project identifies priority interventions in key areas by undertaking ward-level climate resilience vulnerability assessments, known as Rapid Urban Climate Change Assessments (RUCCAs). These RUCCAs inform the development of Climate Resilience Integrated Urban Plans (CRIUPs), which identify priority interventions, and provide actionable priorities over a five-year investment timetable. The project also includes consultations with local stakeholders, particularly the poor and vulnerable, and articulating the vision of a climate resilient city.

To improve the quality of Faridpur's urban environment ADB is also implementing the Strengthening Knowledge and Actions for Air Quality Improvement project. The technical assistance will support the city to develop policy actions and technological solutions for air quality management. UCCRTF is also supporting 4 other cities in 4 DMCs with the same outputs. As part of this, they are assisting Faridpur to develop City Level Clean Air Action Plans (CAAPs).

In addition, UCCRTF is also implementing a Community-led Project (CLP) on a climate resilient park, livelihoods training center and community-based solid waste management System. Part of TA9329 'Promoting Urban Climate Change Resilience in Selected Asian Cities: Development of Pilot Activities and Project Development Support', the CLP is part of a \$6 million project covering Faridpur and 8 other cities in Bangladesh, Myanmar, Pakistan and the Philippines.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Faridpur, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment.

- 1. Enactment of a strategic, climate-resilience urban development plan and control framework.** Improved municipal governance and technical capacity across all stages of infrastructure planning, development, operations and maintenance is also required.
- 2. Increasing public open spaces, restoring degraded natural areas and improving water quality.** This would benefit the health and wellbeing of Faridpur's residents. Resilience would be increased by improving the city's green infrastructure.
- 3. Upgrading the housing and local environment of the city's remaining eleven slum areas.** This should be a priority to achieve in order to improve resilience to climate hazards in improve public health and livelihoods.
- 4. Investment in infrastructure that offers protection against climate hazards and that which improves basic services.** Priority investments should include improved water supply systems and integrated waste management systems.
- 5. Measures to help to diversify the local economy and create employment opportunities.** This should also be a priority. This includes investment in education and skills training.

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6. Nationwide Climate Vulnerability Assessment in Bangladesh, 2018. Available at: [https://moef.portal.gov.bd/sites/default/files/files/moef.portal.gov.bd/notices/d31d60fd_df55_4d75_bc22_1b0142fd9d3f/Draft %20NCVA.pdf](https://moef.portal.gov.bd/sites/default/files/files/moef.portal.gov.bd/notices/d31d60fd_df55_4d75_bc22_1b0142fd9d3f/Draft_%20NCVA.pdf)
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Mathurapur Deul in Madhukhali Upazila, Wikimedia Commons

Gopalganj

Situated in south-central Bangladesh, Gopalganj has a population of 1.2 million, the majority of which is engaged in agriculture. The city is situated on the banks of the Madhumati river, which was also the main route for transport and trade until the 1980s. Since then, the city has developed its road infrastructure network, connecting Gopalganj to Dhaka in around five hours. However, the city lacks dynamic industries that are critical to economic development, and more than half of its urban population is poor. Existing socio-economic vulnerabilities in the city are exacerbated by frequent flooding, around six times per year, and high frequency of cyclones, with an average of three per year.

Climate change will further aggravate these challenges, so investment to build the city's resilience is urgently required.

ADB is actively working with Gopalganj to strengthen the city's urban planning and critical infrastructure. UCCRTF, through a technical assistance grant, supported the preparation of a Climate Resilient Integrated Urban Plan (CRIUP) to assess climate vulnerability at the city level and identify priority infrastructure projects to improve the resilience of Gopalganj's population, especially the urban poor.¹

KEY FINDINGS

- Gopalganj is highly exposed to climate hazards, including cyclones and related storm surges, urban flooding from extreme rainfall, sea level rise and saltwater intrusion.
- The city has critical infrastructure gaps, especially in water supply, drainage, transport, waste management and sanitation. It also faces governance challenges due to low levels of technical capacity at the municipal level.
- An average score of 3.17 out of 5 across all 4 dimensions of city resilience: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy, indicates the need for resilience improvement across sectors in Gopalganj.
- Gopalganj scored the lowest for its economy and society resilience dimension. The city requires investment to diversify its economy as its population is over-reliant on climate-sensitive industries, including agriculture and fisheries, which account for two thirds of employment.²
- Recent improvements to Gopalganj's urban planning and zoning restrictions are important foundations for future resilience, and investment is required to ensure they are implemented effectively.

Gopalganj in the context of climate change

The city of Gopalganj is susceptible to climate impacts including cyclones and related storm surges, urban flooding from extreme rainfall, sea level rise and saltwater intrusion. Around 57% of the city's urban population is poor,³ making them economically vulnerable to climate-driven shocks and stresses. Socio-economic constraints combined with climate change induced high frequency disasters and low resilience renders the city highly vulnerable. The dependence of majority of the population on agriculture, which is an extremely climate sensitive sector, poses threats in terms of livelihoods and sustenance loss for a largely poor population.

Climate change is expected to lead to more erratic rainfall patterns, with rainfall occurring in shorter, more intense bursts. 90% of Gopalganj's rainfall already occurs from June to September, and the area around the city is prone to seasonal inundation.⁴ Over 90% of Gopalganj's land area is less than 2.5 m above sea level within the floodplain of the Madhumoti River, placing the entire municipal area at high-risk. Increased rainfall will further stress the city's inadequate drainage and flood protection infrastructure with Wards 3, 4, 6, 7, 8 and 9 being especially vulnerable.⁵ Flood events are expected to increase leading to devastating impacts such as those experienced during cyclone Sidr in 2007.

Gopalganj is facing freshwater shortages due to overuse of groundwater sources combined with saltwater intrusion. The area around the city no longer has freshwater above the depth of 400 meters.⁶ Temperatures are also expected to rise in Gopalganj, and the dry season could become longer with more severe droughts. This will put further stress on the city's groundwater reserves.

Rising sea levels and increased salinization are also impacting water supplies. The city's agriculture and fisheries, on which over half of the population depend for income and food security, are increasingly threatened by saltwater intrusion. Freshwater supplies are further degraded by contamination as a result of inadequate waste management, which poses a health risk for the population.

Like most cities in Bangladesh, development in Gopalganj has been largely unplanned and the city requires investment in critical infrastructure to cope with extreme events.⁷ Insufficient water supply, drainage systems, waste management and including sanitation, makes the city sensitive to climate shocks and stresses. Access to adequate housing supply is also a concern in the city, with about 16% of the city's householders living in 'kutchra' houses, built with materials other than bricks, concrete or cement, and located mostly in slum areas.

Resilience context

Climate impacts



Gopalganj is exposed to cyclones and storm surges, urban flooding, sea level rise and saltwater intrusion.



Climate change will lead to more erratic rainfall patterns, with rainfall occurring in shorter, more intense bursts.



The salinity of soils and groundwater is expected to increase during the dry season.

Additional factors



Agriculture and fisheries, on which over half of the population depend, are threatened by saltwater intrusion.

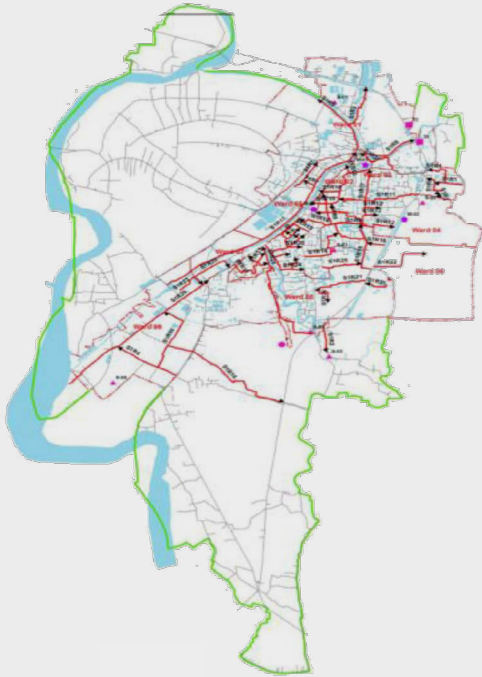


Over extraction of groundwater has eliminated the freshwater layer above 400 m around Gopalganj.



Inadequate drainage and flood protection infrastructure is leading to blocked drains, flooding and pollution.

City Resilience Profile



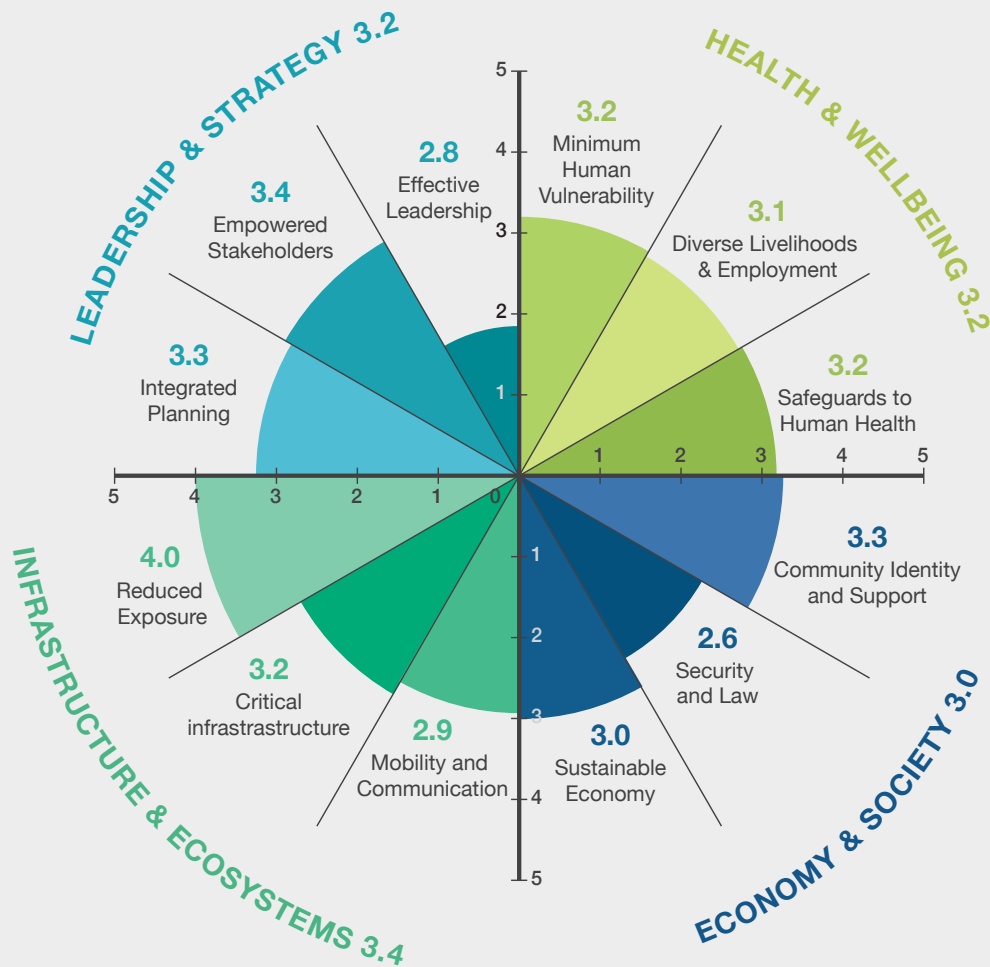
In 2018, the Asian Development Bank's Urban Climate Change Resilience Trust Fund visited Gopalganj city and conducted a baseline assessment of the city's resilience. The study assessed Gopalganj's resilience in four key areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The city was found to have moderate levels of resilience across each of these categories, with some areas of strength but others that require investment to improve resilience to climate-related shocks and stresses. The city's lowest score was for Economy and Society (2.97 out of 5), which indicates that investments that promote a diversified, sustainable economy and strong rule of law will significantly increase resilience.

LEADERSHIP & STRATEGY

Gopalganj's main challenge in this area relates to a lack of technical capacity across its departments and functions especially related to procurement, operations and maintenance capacity ("Effective Leadership and Management": 2.8).⁸ The city has made progress in recent years on its development planning, establishing policy guidelines, and has recently updated its urban development plans that integrate recommendations from UCCRTF's 2016 Climate Resilient Integrated Urban Plan for the city ("Integrated development planning": 3.3).⁹ New zoning plans have also been produced to reduce exposure of the city's population by preventing development in high-risk areas and these have been subject to formal consultation process with residents including minority groups ("Empowered Stakeholders": 3.40).

HEALTH & WELLBEING

Gopalganj could improve its resilience by improving the populations' ability to meet its basic needs in terms of access to clean water, safe shelter, health services, and sanitation ("Minimum Human Vulnerability": 3.2). While there are 32 health facilities in the city, the quality of services remains poor and over 15% of the city lacks access to basic sanitation. High levels of arsenic contamination in the water supply also undermines the populations' health. The city also does provide emergency shelters or mechanisms to support small- and medium-sized business immediately after disaster ("Effective Safeguards to Human Health and Life": 3.2).¹⁰ A high reliance on climate dependent livelihoods reduces the financial capacity of the pourashava and individual households to plan for and address climate related challenges ("Diverse Livelihood and Employment": 3.1).



INFRASTRUCTURE & ECOSYSTEMS

Gopalganj has made significant progress in terms of budget allocation. The city invests 25% of its infrastructure budget for the transport sector while investment in stormwater facilities is close to 20%. Despite these plans, the infrastructure in the city remains in need of significant improvement with insufficient water supply, drainage, waste management, and sanitation (“Provision of Critical Infrastructure”: 3.2).¹¹ The city is poorly served by road networks and within the city the only public transport facilities are outside municipal boundaries. The city centre is congested and the majority of roads lack drainage, lighting or pedestrian footpaths (“Mobility and communications”: 2.9). The city’s resilience has been boosted by improved zoning plans, based on a recent climate vulnerability assessment, to reduce the number of citizens living in high-risk areas (“Reduced Exposure”: 4.0).

ECONOMY & SOCIETY

A diversified economy would contribute to Gopalganj’s resilience in this area. The city does not have an industrial base and the fisheries and agriculture sectors provide over 66% of employment opportunities (“Sustainable Economy”: 3.0). High illiteracy rates of 42% further hampers economic prosperity in the city. The city has taken steps to increase public participation in urban planning and zoning decisions, and the people are highly engaged in local elections, with the turnout in last municipal election standing at 80% (“Collective Identity and Community Support”: 3.3).¹² The city’s lowest score in this area is for “Security and Rule of Law” (2.6) indicating that this is an area where investment could have the greatest impact on resilience outcomes.

Resilience interventions in Gopalganj

ADB and UCCRTF projects in Gopalganj

CURRENT ADB PROJECT

Urban Governance and Infrastructure Improvement (Sector) Project III - Additional Financing (Loan 3551)

\$100 million between 35 districts in Bangladesh



Improvement and construction of 23 roads of over 33 km



Around 10 km of drainage around road infrastructure



Construction of integrated landfill and resource recovery facility

UCCRTF PROJECT

Technical Assistance to Support Climate Resilient Integrated Urban Plans (CRIUPS) (TA 8913)

\$1.6 million

UCCRTF supports ADB's operations departments to integrate urban climate change resilience planning principles into the ADB project cycle.

In Gopalganj, UCCRTF ensured that urban climate change resilience was integrated into urban development plans, which:

- include assessments of socio-economic vulnerability, climate risk, and urban systems;
- provide an overview of urban climate change resilience issues and their relevance in the urban context;
- develop action plans that respond to climate risks on critical urban systems; and
- identify feasible soft and hard infrastructure projects to build urban climate change resilience.

Resilience in Gopalganj

The baseline assessment found that Gopalganj demonstrates limited resilience across the four key resilience areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The city faces combined challenges of weak critical infrastructure systems especially in water supply, drainage, transport, waste management and sanitation, coupled with low levels of technical capacity at the municipal level. Economic development is hampered by limited employment opportunities in sectors outside fishing and agriculture. As the city is highly exposed to climate impacts including frequent flooding, cyclones, and water scarcity, investment in critical infrastructure and urban planning is urgently required.

In saying this, the city has made progress in recent years developing urban plans and zoning regulations that are based on recent climate resilience assessments at the city level. Gopalganj is part of ADB's 'Third Urban Governance and Infrastructure Improvement (Sector) - Additional Financing' project which provides USD 100 million to strengthen urban governance and improve urban infrastructure and service delivery in 35 pourashavas (municipalities) in Bangladesh. The project will invest in priority infrastructure and governance improvement for pourashavas, and governance improvements.

UCCRTF supported resilience planning in Gopalganj via a \$1.6 million technical assistance under TA 8913 which also covers the Bangladeshi cities of Bagerhat, Cox's Bazaar, Kushtia, Mymensingh, and Patuakhali. The project identifies priority interventions in key areas by undertaking ward-level climate resilience vulnerability assessments, known as Rapid Urban Climate Change Assessments (RUCCAs). These RUCCAs inform the development of Climate Resilience Integrated Urban Plans (CRIUPs), which identify priority interventions, and provide actionable priorities over a five-year investment timetable. The project also includes consultations with local stakeholders, particularly the poor and vulnerable, and articulating the vision of a climate resilient city.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Gopalganj, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment including:

- 1. Investing in integrated development planning incorporating climate change risks including a zoning control framework.**
- 2. Increasing accessibility to public open spaces, and restoring degraded natural areas.**
- 3. Improving municipal governance and technical capacity across all stages of infrastructure planning, development, operations and maintenance.¹³**
- 4. Investment in critical infrastructure including water and the urban transport network.**
- 5. Investment in upgrading housing infrastructure services in Gopalganj's slum areas.**
- 6. Taking steps to diversify the local economy and create employment opportunities.**

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13. *ibid.*



Gopalganj Temple, Bangladesh.

Image by: Md. Musavvir Mahmud, Wikimedia Commons

Kushtia

Kushtia is surrounded by a fertile floodplain supporting the region's agriculture industry. Key crops grown in the region include rice, wheat, jute, sugar, potatoes, tobacco, and betel. Benefitting from river and rail connections, Kushtia is a trade center containing cotton-textile and sugar mills and a pottery cottage industry.¹ The results of the baseline study, which collected primary data at the city level, showed that Kushtia demonstrated limited resilience to shocks and stresses against each resilience dimension.

ADB has worked with Kushtia to strengthen the city's urban planning and critical infrastructure. The ADB interventions in the city have been complemented by UCCRTF activities in building climate resilience. UCCRTF intends to undertake another assessment to compare changes in resilience.

KEY FINDINGS

- Kushtia is sensitive to climate change shocks and stresses, particularly increased rainfall and increased frequency and severity of tropical cyclones, which will cause flooding and exacerbate the current poor sanitation conditions in the pourashava.
- An average score of 2.2 out of 5 across all 4 dimensions of city resilience: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy, indicates that Kushtia displays limited resilience.
- The city will be able to strengthen its resilience by investing in effective governance mechanisms and improved sanitation infrastructure.
- Kushtia scored the lowest on Leadership & Strategy, indicating that the city lacks capacity at the municipal level to plan and develop its infrastructure effectively.
- The city can further strengthen its resilience by investing in infrastructure that protects its citizens from flooding and an effective early warning system for disasters.

Kushtia in the context of climate change

Situated south of the Gorai River in western Bangladesh, Kushtia is particularly exposed to flooding. With the rivers Ganges, Mathabhanga and Kumar also flowing through the district, each year houses experience inundations of over 1 meter.² Due to the city's location on rich, fertile soils in the lower Ganges floodplain, the city's economy is dominated by agriculture, which employs 45% of the population.³ The high dependence on agriculture makes Kushtia more sensitive to climate impacts, as the sector is highly exposed to floods, drought, cyclones and other extreme events.

Kushtia is susceptible to increased rainfall and increased frequency and severity of tropical cyclones.⁴ These events have severe socio-economic and environmental impacts resulting in casualties, extensive damage to infrastructure, economic losses, and the displacement of people.

Kushtia is particularly exposed to flooding with at least two major flood events occurring each year.⁵ The impacts of the flooding are exacerbated by poor sanitation and a lack of infrastructure. The city's transport network is not well developed with many roads in poor condition, with heavy traffic congestion, and a lack of adequate drainage.⁶

The impact of climate-related shocks and stresses are exacerbated by existing social and infrastructure issues, such as lack of drainage facilities, lack of sufficient public transport, and heavy traffic congestion.⁷

Over 97% of Kushtia's population have seen an improvement in access and quality of water sources, however the city continues to face key social and infrastructure issues.⁸ With 40% of the population unable to access sanitary toilets, Kushtia is the highest-ranking district across Bangladesh for cases of infectious diarrhoea.⁹ Malaria-carrying mosquitoes which breed in nearby waters also present a health hazard across the municipality.¹⁰

In addition, 36% of households are not connected to electricity supply, and only half of children between the ages of 5 to 24 years old are able to access primary school education.¹¹ These issues limit economic opportunities in the city, increasing its vulnerability to shocks and stresses.

Resilience context

Climate impacts



Kushtia is exposed to river flooding. Residents experience inundations of over 1 meter annually.



Cyclones may become more severe leading to wind damage and coastal flooding.



Drought events are expected to become more common, affecting agriculture which employs 45% of the population.

Additional factors



40% of the population has no access to sanitary toilets

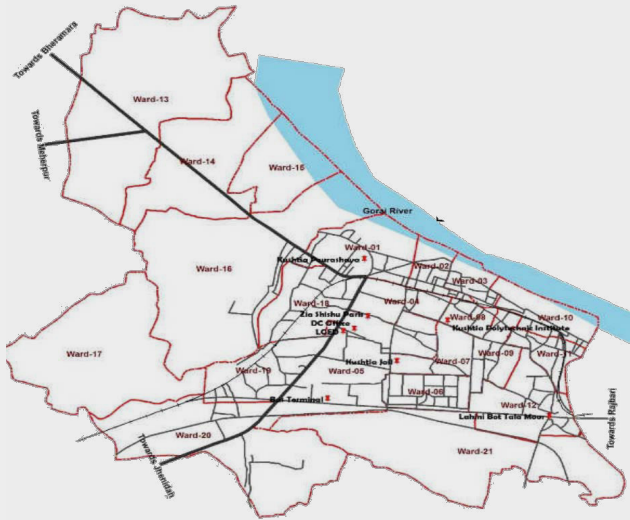


36% of households are not connected to electricity supply



Only 50% of people between the ages of 5 and 24 have access to primary school education

City Resilience Profile



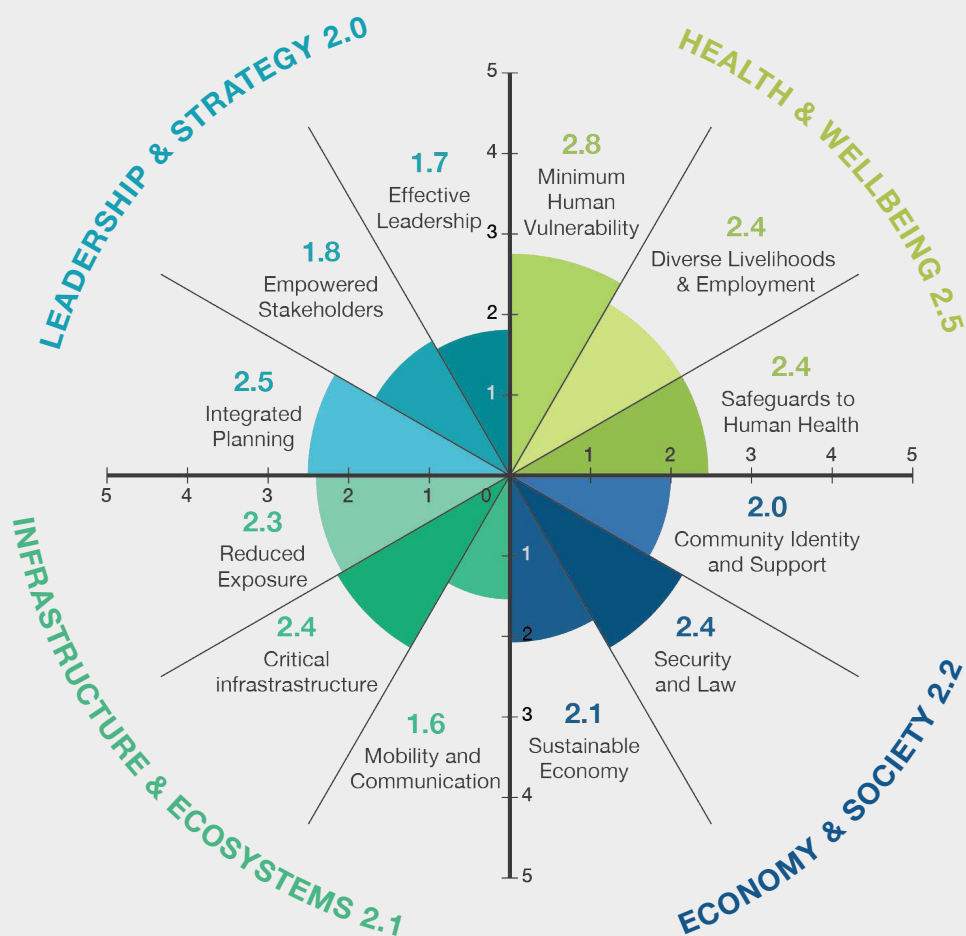
A baseline assessment of Kushtia's resilience was undertaken in 2018. Conducted by the ADB's Urban Climate Change Resilience Trust Fund (UCCRTF), the study assessed resilience across four key dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The overall scores for each resilience dimension and goal are shown in the diagram to the right. Kushtia's resilience was found to be limited across each of these categories suggesting that the city is in need of major improvements to reduce the vulnerability of its residents. The city's lowest-scoring dimension was "Leadership and Strategy", which demonstrates insufficient leadership and management through outdated hazard maps, poor emergency response systems and the lack of an emergency management strategy. The results of this baseline assessment are discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

Kushtia's lowest baseline score of 2.0 (out of 5) for this resilience dimension indicates the city could improve its leadership and management. The city requires investment to build capacity across municipal departments, especially with regards to procurement, operations and maintenance of infrastructure, and urban planning systems and processes ("Effective Leadership and Management": 1.7).¹² Kushtia does not yet have a Master plan governing its development, and the city requires updated hazard maps and emergency management strategies. Around 10% of residential dwellings are situated in areas that are at high risk of flooding (Integrated Development Planning": 2.5). In addition, Kushtia does not have land use and zoning plans, which means they have not engaged with local communities about the future development of the city ("Empowered Stakeholders": 1.8).

HEALTH & WELLBEING

A lack of access to sanitation facilities compounded with health issues attributable to climate change (such as dengue fever or malaria) means that Kushtia requires significant and targeted investment to improve overall health and wellbeing of its residents. The city could increase its resilience in this area by investing in sanitation and wastewater management infrastructure and by upgrading the quality of housing in its remaining slum areas ("Minimum Human Vulnerability": 2.8). The city requires better emergency protection infrastructure, having no cyclone shelters. Emergency protocols have also not been reviewed in the last five years ("Effective Safeguards to Human Health and Life": 2.4). Whilst unemployment in the city is relatively low, the city is highly dependent on agriculture especially rice and tobacco cultivation which employ almost half of the city's population.¹³



INFRASTRUCTURE & ECOSYSTEMS

Kushtia's resilience score for Infrastructure and Ecosystems (2.1) indicates significant investment is required to improve its critical infrastructure systems. Poor drainage capacity leads to urban flooding especially in Wards that border the city's embankments: Wards 1, 2, 3, 10 and 11. Solid waste and faecal sludge management is poor, leading to water contamination and further blockages to open drains ("Provision of Critical Infrastructure": 2.4). 60% of the city's wastewater is untreated. Safe housing is a major concern, especially in the recognized slums and informal areas ("Reduced Exposure": 2.3). Despite Kushtia's importance as a transportation and trade route, regional connectivity is poor, with limited routes into and out of the municipality. The national highway passes through the municipal centre as does a railway line, this adds to traffic congestion and has caused fatal accidents.

ECONOMY & SOCIETY

Kushtia's score of 2.2 for Economy and Society reflects its low levels of collective identity, economic sustainability, and security. With industrial development lagging in Kushtia and a growing population of former-agricultural workers getting squeezed out of their jobs, the population of unemployed people as well as the size of slums are increasing. ("Collective Identity and Community Support": 2.0). Kushtia's police force having not undertaken any disaster response training nor the city having substantial budget for emergency planning, Kushtia is limited in its capability to cope with hazards and shocks ("Security and the Rule of Law": 2.4). Finally, the overreliance on climate sensitive industries including rice production and processing means that the city's economy is not well placed to deal with climate shocks.

Resilience interventions in Kushtia

ADB and UCCRTF projects in Kushtia

CURRENT ADB PROJECT

Urban Governance and Infrastructure Improvement (Sector) Project III - Additional Financing (Loan 3551)

\$100 million between 35 districts in Bangladesh



Construction of 20 new public toilets.



Improved sanitation for poor families



Sanitation public awareness campaign



27 km of drainage improvements around road infrastructure



over 15 km of road improvements and new projects

UCCRTF PROJECT

Technical Assistance to Support Climate Resilient Integrated Urban Plans (CRIUPS) (TA 8913)

\$1.6 million

UCCRTF supports ADB's operations departments to integrate urban climate change resilience planning principles into the ADB project cycle.

In Kushtia, UCCRTF ensured that urban climate change resilience was integrated into urban development plans, which:

- include assessments of socio-economic vulnerability, climate risk, and urban systems;
- provide an overview of urban climate change resilience issues and their relevance in the urban context;
- develop action plans that respond to climate risks on critical urban systems; and
- identify feasible soft and hard infrastructure projects to build urban climate change resilience.

The baseline assessment showed that Kushtia demonstrates limited resilience across the four key resilience areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The city scored the lowest in the 'Leadership and Strategy' dimension, including effective leadership and management, and empowered stakeholders, indicating that the city needs improvements in its governance mechanisms, and consultation with the most vulnerable populations to adequately build resilience against shocks or stresses. Existing socio-economic challenges such as the rise of slum dwellers, the lack of sanitation and wastewater management, the risk of more frequent flooding and dependence on the climate-sensitive agricultural sector make it necessary for the city to build its critical infrastructure, address community support, and strengthen effective leadership to enhance resilience and tackle the impacts of climate change.

Kushtia is one of the 35 pourashavas (municipalities) in Bangladesh where the \$100 million ADB project "Urban Governance and Infrastructure Improvement (Sector) Project III (UGIIP-III) Additional Financing (AF)" is being implemented to strengthen urban governance and improve urban infrastructure and service delivery to strengthen the city's resilience to climate change and disaster preparedness. Specifically, the project intends to:

- i. Improve municipal infrastructure and make it gender- and climate-responsive.
- ii. Improve capacity of the pourashava in urban service delivery, planning and financial management.

As part of its technical assistance, ADB is supporting Kushtia to strengthen urban governance through capacity building programs and improve urban infrastructure by investing in key infrastructure including roads, drainage systems, water supply and slum improvements.

UCCRTF supported resilience planning in Kushtia via a \$1.6 million technical assistance under TA 8913 which also covers the Bangladeshi cities of Bagerhat, Cox's Bazaar, Gopalganj, Mymensingh, and Patuakhali. The project identifies priority interventions in key areas by undertaking ward-level climate resilience vulnerability assessments, known as Rapid Urban Climate Change Assessments (RUCCAs). These RUCCAs inform the development of Climate Resilience Integrated Urban Plans (CRIUPs), which identify priority interventions, and provide actionable priorities over a five-year investment

timetable. The project also includes consultations with local stakeholders, particularly the poor and vulnerable, and articulating the vision of a climate resilient city.

Overall, the core objective of UCCRTF support is to identify risks for vulnerable population and ensure that climate change concerns are integrated across all stages of infrastructure development and inform decision making.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Kushtia, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment:

- 1. Improved city-level strategic development planning that considers climate-driven shocks and stresses.** This is foundational to build resilience in Kushtia. The city should strengthen its community engagement in its development plans, increasing local-level planning in implementing local projects and involving citizens including vulnerable groups and women in the planning process.
- 2. Significant investment to build the resilience of its critical infrastructure systems.** Priority areas of investment include improving clean water supply, waste management facilities and flood protection infrastructure.
- 3. Investment in upgrading its housing supply, with a focus in the thirteen remaining recognised informal settlements.** The settlements are at high risk of flooding as they are located along the river in wards 1, 2, 3, 10 and 11.
- 4. Improvement in the amount and diversity of employment opportunities.** This is building on the Bangladesh Small and Cottage Industries Corporation (BSCIC) industrial zone which sits less than 5 km from Kushtia's municipal boundaries. This is currently occupied by businesses including rice mills; however it offers the opportunity for further expansion into other industries, especially considering the city's good transport links to other parts of Bangladesh.

ENDNOTES

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*Kushtia City, Bangladesh.
Image by: Tselim Rezaa, Wikimedia Commons*

Patuakhali

A trading center for rice, flour, jute, textiles, and milled wood, Patuakhali is connected by road and river with Barisal. It is home to the Patuakhali Science and Technology University. Agriculture forms the main source of income for the city. Rice, jute, potatoes, sugarcane, chillies, and assorted vegetables are among the chief crops of the city. Both freshwater and saltwater fishes are also abundant.¹ It is famous for Kuakata Beach to watch both sunrise and sunset.²

Patuakhali is particularly exposed to tidal flooding, sea-level rise, and cyclone-related storm surges, the impacts of which are exacerbated by poor infrastructure. Extreme weather events are likely to become more frequent and severe in the future, thanks to climate change. Improvements to Patuakhali's infrastructure, urban planning, residents' economic security and community preparedness are essential in strengthening its resilience

This study is a baseline assessment of Patuakhali's resilience based on a series of structured interviews with city officials and on surveys that were conducted with 103 households. The results of the baseline study, which collected primary data at the city and household levels, showed that Patuakhali demonstrated limited resilience to shocks and stresses. As such, there is broad scope for making improvements that could be made to increase resilience, including urban development planning and the quality of infrastructure for disaster mitigation, particularly in relation to flood prevention.

ADB is actively working with Patuakhali to strengthen the city's urban planning and critical infrastructure. ADB interventions in the city are complemented by UCCRTF activities to build climate resilience. UCCRTF intends to undertake another assessment to compare changes in resilience.

KEY FINDINGS

- Patuakhali is sensitive to climate change shocks and stresses, including sea level rise, surface water flooding, more intense dry seasons, and aquifer salination. The city can strengthen its resilience by investing in improved infrastructure and urban planning.
- Despite having an early warning system that reaches almost the entire population, much of the community does not take shelter when disasters occur. The city could improve in this area by investing in more accessible shelters, improving education and awareness, and helping the most vulnerable become more financially secure.
- Patuakhali's economic and social resilience is held back due to the lack of security and the rule of law in the city.
- Household-level surveys found that households in Patuakhali reported that they perceived themselves as having weak community resilience (a score of 2.21 out of 5) and reported a mix of both strong and weak resilience in different areas at the household level. Households perceived themselves as having a high ability to adapt to climate shocks (scored as 90%). However, this is likely to be undermined by low-income and food access (57%) and low asset ownership (54%).
- 85% of households are dependent on some form of government-supported social program, which makes them susceptible to economic hardship when disasters hit.

Patuakhali in the context of climate change

Patuakhali is very exposed to climate change related extreme events such as flooding and cyclones. Its vulnerability is exacerbated by poor quality infrastructure systems especially transport, water and sanitation and the reliance on agriculture as a main source of income. Patuakhali's citizens, of which 23% are classified as being urban poor,³ experience socio-economic instability and food insecurity as a result of declining agriculture productivity in the region.⁴

Patuakhali is surrounded by the Bay of Bengal on three sides and has low lying topography, exposing it to tidal flooding, sea-level rise, and cyclone related storm surges. Increasing temperatures as a result of climate change accompany an increase in monsoon flooding, flash flooding, and tidal flooding, which is exacerbated by the poor drainage systems in the city. Wards 1, 2, and 9 have no drainage systems, and those in the remaining wards are of low quality with no sluices, uncovered drains, and poorly designed drain outlets.⁵

In January 2019, cyclone Fani triggered storm surges that were 4-5 feet higher than normal along the Patuakhali coastline, displacing 1.24 million people to other parts of Bangladesh. In 2007, cyclone Sidr claimed the lives of 4,000 people across the country with storm surges six feet above average. With wind speeds of 260 kilometres per hour, Sidr also resulted in economic losses of \$1.7 billion (2.6% of gross domestic product).⁶

Along with irregular and extreme rainfall as a result of climate change, the extent and depth of inland

flooding associated from powerful storms will also increase with sea-level rise. Summer high tides, already 1.3 m, are likely to increase. With repeated inundation, the soil becomes degraded with salts. As a result, agricultural productivity in the area is decreasing. This is particularly concerning given Patuakhali's high dependence on agriculture as a source of income.⁷

The salinity of Patuakhali's water supply is also increasing during the dry season and is likely to get worse with climate change as dry seasons become longer and more severe. Aquifer salination affects the water supply and is directly linked to the number of people suffering from contagious diseases.⁸

Climate change is also expected to bring hotter temperatures. With average daily maximum temperatures currently standing at 31°C, further temperature rises will increase both the demand for clean water and the health risks posed by inadequate waste management.⁹

Resilience context

Climate impacts



Climate change is expected to bring hotter temperatures.



The salinity of Patuakhali's water supply is increasing as dry seasons become longer and more severe.



Coastal flooding will increase as sea-levels rise. Summer high tides, already reaching 1.3 m, are likely to increase.

Additional factors



Over 1 in 5 people in Patuakhali are classified as urban poor.

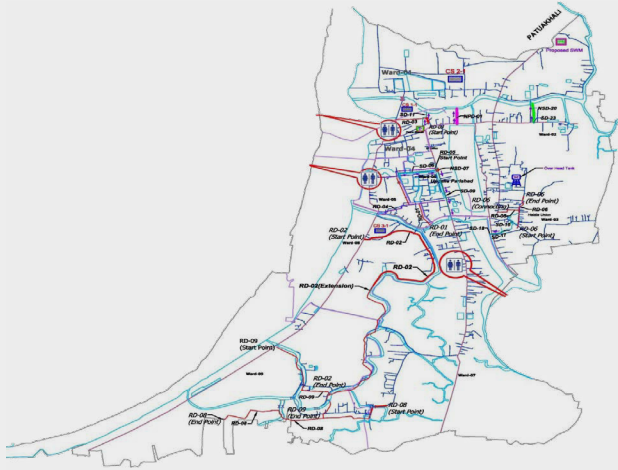


Drainage infrastructure in the city is either non-existent or of poor quality.



Agriculture is the main source of income for the city. The sector is highly exposed to climate impacts.

City Resilience Profile



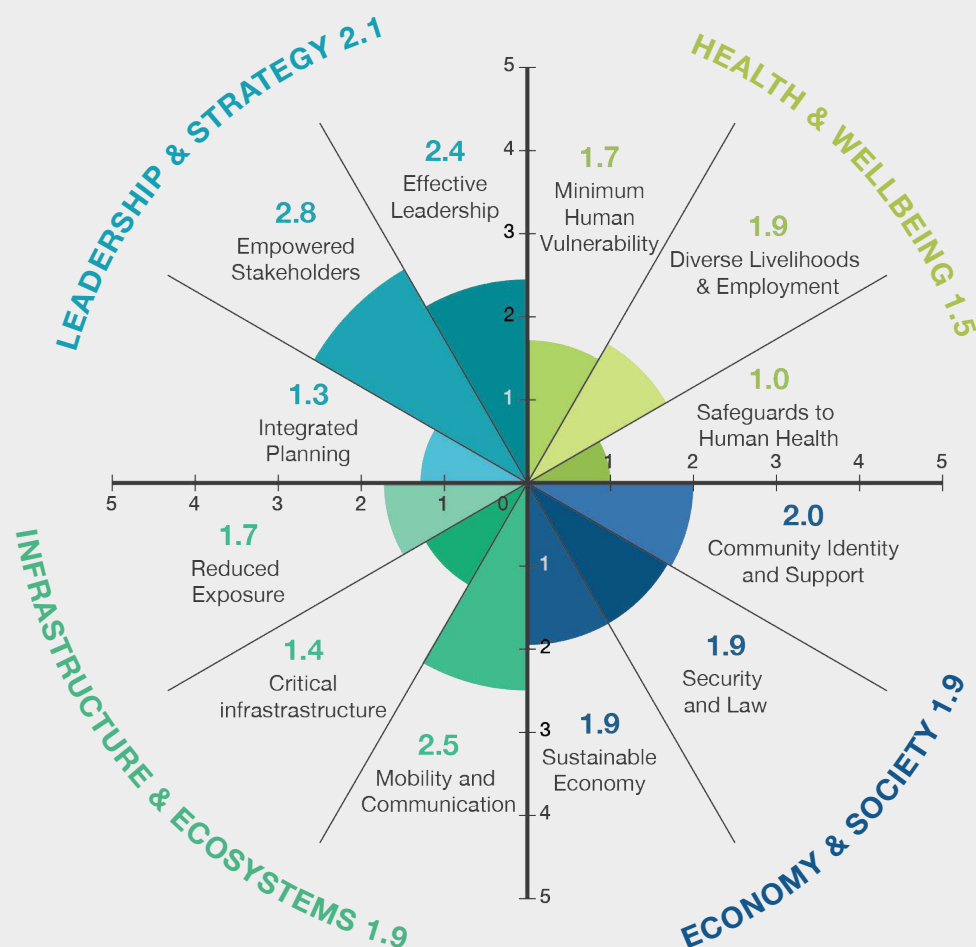
In 2018, ADB's Urban Climate Change Resilience Trust Fund (UCCRTF) visited Patuakhali and conducted a baseline assessment of the city's resilience. The study assessed Patuakhali's resilience in four key areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe for a city.¹⁰ The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis shows that Patuakhali was perceived as requiring investment to strengthen resilience across each of the categories. Patuakhali's lowest score was for the extent to which effective safeguards to human health and life are in place, whilst its highest score was for how it empowered the city's residents as stakeholders. This is discussed according to each dimension in the colored boxes below.

LEADERSHIP & STRATEGY

The baseline results indicate that the city requires considerable investment to bolster its resilience around leadership and strategy. The city needs to improve its integrated planning (1.3), as considerable informal development and unplanned expansion in key areas is currently underway. The city's Master Plan has been pending approval since 2014¹¹ and Patuakhali is yet to prepare a disaster preparedness plan. To build trust between city officials and empower residents Patuakhali's planning and development processes should encourage proactive multi-stakeholder co-operation ("empowered stakeholders": 2.8). Improved coordination between government bodies, and emergency management plans would lend the city more resilience to shocks and stresses ("effective leadership": 2.4).

HEALTH & WELLBEING

Patuakhali's lowest scoring area, the perceived levels of health and wellbeing of the city's residents, was found to undermine its resilience. This indicates that many of the city's residents are unable to meet their basic needs, with limited access to food, livelihood, water, shelter, health services, and sanitation ("minimum human vulnerability": 1.7). A particular area of weakness was "safeguards to human health" (1.0), as the city has just one government hospital and its other health facilities are poorly staffed. According to the Municipal Master plan, there is no specific mechanism to support local and small businesses in disaster affected areas, this restricts private sector activity and reduces employment opportunities ("Diverse livelihoods and employment": 1.9).¹²



INFRASTRUCTURE & ECOSYSTEMS

The city's infrastructure is in poor condition. While most households have access to improved water sources, safe drinking water is limited, and only 71% have access to sanitary toilets. 32% of households have reliable electricity, but it is unavailable for 2-3 hours per day due to load sharing ("provision of critical infrastructure": 1.4). Transport infrastructure remains poor, with 82% of roads flooding frequently. In 2017, only 0.29% of total municipal budget was allocated to transportation infrastructure (Mobility and communications: 2.5).¹³ There is a lack of infrastructure to protect the population from climate hazards. Only 20% of residents have access to emergency shelter ("reduced exposure": 1.7). The municipality has not conducted an assessment on the health of its ecosystems, and there is considerable encroachment on natural water bodies including khals, and rivers.

ECONOMY & SOCIETY

Patuakhali's security and law enforcement require strengthening to build the city's resilience. The city has limited social safety nets, with levels of collective identity perceived to be low ("collective identity and community support": 2.0). This can undermine a community's ability in responding to shocks. Law enforcement agencies have limited capacity and have not received sufficient disaster response training ("Security & rule of law": 1.9).¹⁴ The population lacks diverse employment and is overly dependent on agriculture which is a climate-vulnerable sector ("sustainable economy": 1.9). While there is good provision of primary and secondary education, only half (54%) of the urban population is literate, and around the same number (57%) have a primary school education, limiting economic prosperity.

Household perceptions of resilience

Alongside the city-level baseline study, UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain sections of the city's population. The data collection was limited to 103 respondents from wards where ADB infrastructure investments are planned or underway. Due to the sample size, the results provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' perceptions of the local community in Patuakhali, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the highest against five characteristics: Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As shown in figure 1 at the bottom of the page, respondents scored Patuakhali fairly low across all the general community characteristics with the highest for being Organized (2.28), and the lowest for Economic Opportunities (2.03). This may reflect perceptions of municipal-level organisation. For example, the city has a disaster management committee at the municipal level, but a focus group discussion said it was not functional, and that community-based volunteers and the NGO Red Crescent society are the first responders after a disaster. This is also supported by the household perception of the Social Safety Net index (85.4%).

The survey also assessed perceptions of resilience against five commonly used dimensions: i) Access

to Basic Services; ii) Assets; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social Safety Net. Scores against each of these dimensions were calculated as an averaged index from survey responses and secondary data.

As shown in figure 2, perceived household resilience was highest for "Adaptive Capacity" with 90% of households having the capacity to adapt and recover after a disaster. However, a high dependency on government support programs, low levels of asset ownership (54%), and limited access to income and food (57%) suggest lower resilience when faced with a natural disaster or similar shock. Therefore, perceptions may be influenced by a household's frequent exposure to disruptive events. The city has an average of 12 cyclones and 3 earthquakes a year. With only three to four cyclone shelters for all nine wards, the city is unable to accommodate even just the most vulnerable members of the population.

When asked about the disasters and unexpected shocks and stresses experienced in the past 5 years, "heavy rains/hailstorms" (78% of respondents), and "cyclones/hurricanes" (58% of respondents) were considered to be major shocks/stresses having a moderate impact. Whilst water logging and flooding affected the most households (89%), economic shocks and stressors were the most impactful. Reduction in income had, on average, a strong impact in Patuakhali (57%) and a sudden or dramatic increase in food prices affected 65% of households. As a result, 68% used their savings to recover, and 52% would take loans with interest from a non-formal source. As well as requesting local government assistance, some respondents also

Figure 1

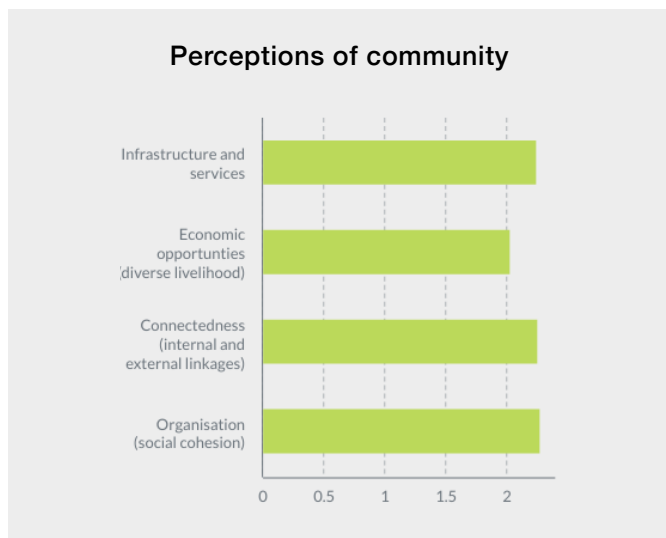
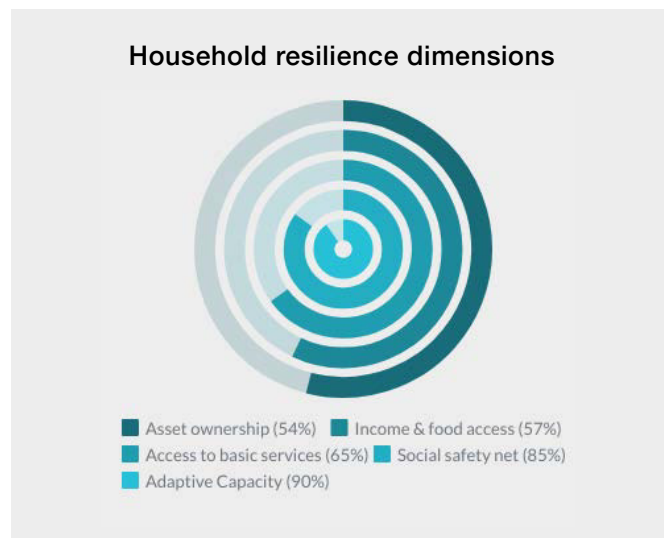


Figure 2



described how they would decrease their expenditure on health and education, or reduce their food intake, which are considered to be severe strategies to take and negatively affect households' wellbeing.

Responding to shocks and stresses in Patuakhali

As Patuakhali has experienced several shocks and stresses in its recent history, respondents were able to draw on recent experience in answering the survey. Almost half of respondents felt their level of resilience was “low” (50%) compared with 9% who felt they had relatively high levels, and 42% who saw their resilience as “medium”. This mostly reflects the city's low-medium level scores (see page 45) which scored Patuakhali as having low-to-moderate levels of resilience across all four dimensions. As most of the households have low or medium resilience status (91%), this suggests that weaknesses in resilience happen at the household level and are likely to be more closely related to access to basic services and financial security.

As shown in figure 3 below, perceptions about the ability to recover show that 22% of Patuakhali households felt they were unable to recover, around half of respondents reported that their wellbeing was the same as before (49%) with 21% saying that their wellbeing was somewhat better.

Almost all respondents in Patuakhali reported that they had received an early warning before the last natural disaster (96%). These warnings were communicated effectively via multiple channels, the most popular by far was by television (77%), followed by disaster volunteers



Kuakata Sea Beach Patuakhali Bangladesh, Wikimedia Commons

(44%) and NGOs (37%). Most people (66%) moved to another place to take shelter either before or after the last natural disaster they experienced. Of those who did not move to shelter, it was because the shelter was not functional (26%), they did not want to (23%) they wanted to protect their assets (23%), or they felt shelter was not needed (26%). When asked about what course of action they would take in case of a disaster, 35% said they had no plan. Others planned to identify a safe shelter (35% of respondents), stock dry food (38%) or would take steps to protect their household and their assets (24%).

Figure 3

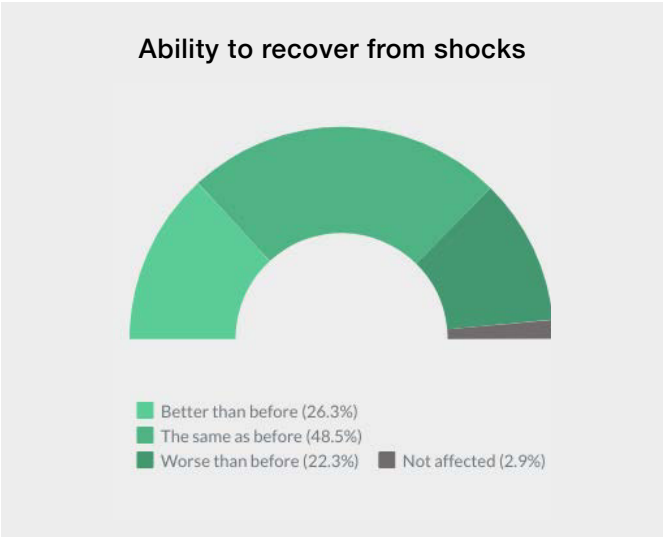


Figure 4



Resilience interventions in Patuakhali

ADB and UCCRTF projects in Patuakhali

CURRENT ADB PROJECT

CTEIP (Loan 3133 and Loan 8284)

\$82 million loan covering 8 coastal towns in Bangladesh



Improved climate resilient municipal infrastructure, including climate and disaster risk-reducing infrastructure and local economic infrastructure



Strengthened institutional capacity, governance and awareness



Project management and administration supported

UCCRTF Technical Assistance to Support Climate Resilient Integrated Urban Plans (CRIUPS)
\$1.6 million (TA 8913)

Supporting:

- assessments of socio-economic vulnerability, climate risk, and urban systems
- an understanding of urban climate change resilience issues and their relevance in the urban context
- action plans that respond to climate risks on critical urban systems
- identification of feasible soft and hard infrastructure projects to build urban climate change resilience

UCCRTF Investment Grant CTEIP - Additional Financing (Grant 0524)
\$6 million

Supporting:

- construction of one (1) Cyclone Shelter Road drainage improvements
- 6.5kms of emergency access road improvements
- preparation of integrated drainage, solid waste and fecal sludge management plans

UCCRTF Spatial Data Analysis Explorer (SPADE) (TA 8913)

Supporting:

- improved city-level climate and geospatial data
- project preparation, consultation and map production

UCCRTF Community-led Project Integrated Community-based Solid Waste Management (SWM)
\$6.065 million (TA 9329)*

Supporting:

- establishment of an improved community-based SWM system with a capacity development and awareness building program
- construction of SWM Facility (Compost Plant and Materials Recovery Facility)

According to the baseline assessment, Patuakhali demonstrates a low level of resilience across four key areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. A lack of strategic urban planning in the city has meant that development of new infrastructure has not taken account of the most significant climate impacts especially flooding and sea level rise. The city's Master Plan, the key document to guide climate resilient urban development, has been pending approval since 2014.¹⁵

The city also lacks a comprehensive disaster preparedness plan based on hazard-specific risk maps. Informal settlements encroaching in flood-prone parts of the city continue to expand, and there are insufficient zoning regulations that are poorly enforced. These issues are compounded by poor infrastructure, particularly housing, electricity, water supply, sanitation and roads.

The poor state of the city's infrastructure restricts employment opportunities, and the residents' high dependency on agriculture leaves them exposed to climate impacts such as salinization of soils and aquifers which continues to worsen. Given the high level of exposure to climate change and its impacts, Patuakhali requires substantial investment in its infrastructure, disaster response processes, and governance in order to build its resilience.

To begin to address these issues, ADB is supporting Patuakhali's Coastal Town Environmental Infrastructure Project (CTEIP) initiative.¹⁶ This programme is facilitated by an \$82 million loan and focusses on strengthening the climate resilience and disaster preparedness in eight vulnerable coastal pourashavas,¹⁷ including Patuakhali.

By taking a holistic, integrated approach to urban development, the project will provide climate-resilient municipal infrastructure, strengthen institutional capacity of local government, and raise public awareness about improved urban planning and service delivery that can respond to climate change and disaster risks. Infrastructure investments include drainage and water supply, sanitation facilities, drainage systems, cyclone shelters, and emergency access roads and bridges. CTEIP aims to improve the wellbeing in coastal towns, increasing the climate and disaster resiliency particularly of the poor and women.

UCCRTF supported resilience planning in Patuakhali via a \$1.6 million technical assistance under TA 8913 which also covers the Bangladeshi cities of Bagerhat, Cox's Bazaar, Gopalganj, Kushtia, Mymensingh, and Faridpur. The project identifies priority interventions in key areas by undertaking ward-level climate resilience vulnerability assessments, known as Rapid Urban Climate Change Assessments (RUCCAs). These RUCCAs inform the development of Climate Resilience Integrated Urban Plans (CRIUPs), which identify priority interventions, and provide actionable priorities over a five-year investment timetable. The project also includes consultations with local stakeholders, particularly the poor and vulnerable, and articulating the vision of a climate resilient city.

To improve infrastructure, UCCRTF allocated a \$6 million grant for the Cities of Bagerhat and Patuakhali under the CTEIP loan for integrating climate resilience into urban development in vulnerable coastal areas. The project, takes a holistic and integrated approach to urban resilience by simultaneously providing climate-resilient municipal infrastructure (such as drainage, water supply, sanitation, cyclone shelters, and transport infrastructure) and strengthening institutional capacity, local governance, and public awareness for improved urban planning and considering climate change and disaster risks.

UCCRTF is also piloting SPADE; a web-based tool and data repository that contains various geospatial data that can be used for consultation, project preparation, production of maps, and analysis of climate change impacts. UCCRTF is providing technical assistance to Bangladesh in order to help build capacity in preparing and responding to climate change-induced shocks and stresses in medium-sized and secondary cities, such as Patuakhali. The maps and socio-economic surveys carried out in the city have been digitized and available on SPADE.

This project offers the resources for piloting approaches to integrate community-led projects into ongoing or planned ADB projects, contributing to resilience building at multiple scales. These initiatives will support a range of activities to improve the resilience of the most vulnerable communities. While the specific interventions supported by the investment grant will be defined by the communities themselves, the project will support the preparation of community resilience plans; the implementation of the projects; and sustaining the plans in the long term. community-led initiatives to

support vulnerable communities in the city, strengthen participation, good governance, and build collective identity and community support.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Patuakhali, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment.

1. Improve municipal services and make them more accountable to residents. This requires strengthening technical and administrative capacity for operation and maintenance of facilities and infrastructure, and for urban planning. A disaster management plan based on local risk mapping is also required.

2. Increase public open space and restore degraded natural areas. Providing green infrastructure to complement investments in drainage networks and other infrastructure projects will improve performance and yield multiple benefits for Patuakhali and its residents, including health, quality of life improvements, and livelihood support.

3. Improved housing, livelihood opportunities and financial stability. Investment is needed to create opportunities for low-income residents to find employment. Improved access to safe and affordable housing is required, and a housing resettlement programme is needed to move housing away from areas that are most exposed to flooding.

4. Increase public open space and restore degraded natural areas. Providing green infrastructure to complement investments in drainage networks and other infrastructure projects will improve performance and yield multiple benefits for Patuakhali and its residents, including health, quality of life improvements, and livelihood support.

5. Attract and retain business investment, create employment and diversify the municipal economy. Improved tourism infrastructure is required alongside improved co-ordination of economic development planning at the municipal level. There is also an opportunity to establish Patuakhali as a logistics centre for ship maintenance and servicing, distribution, and goods movement.

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City Resilience Profiles

Pakistan



URBAN CLIMATE
CHANGE RESILIENCE
TRUST FUND
Asian Development Bank

Abbottabad

Abbottabad is exposed to climate-related shocks and stresses, such as heavy rainfall, flooding, landslides, avalanches, and extreme temperatures. Climate projections suggest that these climate exposures will become more severe in the future. Improvements to Abbottabad's infrastructure, urban planning, and community preparedness are essential to ensure its resilience.

The baseline study collected primary data at a city level through interviews with city officials and surveys that were conducted with 100 households. The results

indicate that Abbottabad requires significant investment to build its resilience across each of the four resilience dimensions.

ADB is actively working with Abbottabad to strengthen the city's urban planning and critical infrastructure. These projects in the city are complemented by UCCRTF activities to build climate resilience in Abbottabad by supporting climate-resilient infrastructure development and community-led resilience projects. UCCRTF intends to undertake another assessment to compare changes in resilience.

KEY FINDINGS

- Abbottabad is vulnerable to climate change hazards due to its increasing population and lack of adequate infrastructure and resources. The city is also vulnerable to earthquakes and landslides. These hazards threaten the region's rich biodiversity, which is the foundation for its ecological resilience.
- Climate change is not considered in the city's infrastructure planning and development. The city suffers from poor wastewater and solid waste disposal.
- Abbottabad has low levels of resilience. It needs major improvement in its "Infrastructure & Ecosystem" and "Leadership & Strategy" dimensions to reduce the vulnerability of its residents, especially given the city's exposure to climate change and its impacts.
- 71% of households surveyed are dependent on some form of government-supported social program, indicating limited internal resilience when faced with a disaster or shock. Almost two-thirds of respondents stated that they have low levels of resilience.
- The disaster early warning systems in the city need to be improved. 90% of households stated that they did not receive early warnings regarding an impending natural hazard.
- ADB and UCCRTF are actively investing in Abbottabad to improve urban planning, governance systems and critical infrastructure to build resilience.

Abbottabad in the context of climate change

The city of Abbottabad is located in the Abbottabad district in the province of Khyber Pakhtunkhwa (KP), 61 kilometres (km) northeast of Rawalpindi. Situated at over 1250 meters above sea level, the city lies on a plateau at the southern corner of the Rash (Orash) Plain and is the gateway to the picturesque Kagan Valley. It is connected by road to the Indus Plain and the Kashmir region and by rail to Peshawar. According to Census results in 2017, the city's estimated population was 208,491.¹

The city is vulnerable to a range of climate related shocks and stresses.² A multi hazard vulnerability assessment in the 2016 Khyber Pakhtunkhwa Climate Change Policy classifies Abbottabad district as 'medium-hazard'.³ The city's poverty rate is the lowest in KP, but still stands at over 17% with much of this population concentrated in inner-city areas close to rivers and living in informal settlements.⁴

The district scores very high for incidences of landslides and avalanches and medium for flooding, mainly due to projected increases in intensity of rainfall in the area, and its mountainous terrain. These hazards pose a threat to the area's rich biodiversity and threaten its ability to deliver services to a growing population.⁵ Abbottabad's economy is sensitive to climate change as agriculture, forestry and fishing remains a significant industry for employment.⁶

Climate change is expected to increase the city's vulnerability. Country-level observed data indicate that Pakistan's average annual temperature has increased by 0.75°C, with higher temperatures observed during winters. According to ADB's Pakistan District-Level Climate Risk and Hazard Assessment Classification, average annual precipitation has also increased by 25%.⁷ The country's projected temperature increase is expected to be higher than the global average with higher temperature increases in northern

regions.⁸ The region has experienced several severe earthquakes, including the 2005 Kashmir earthquake that destroyed many buildings.⁹

Climate change will exacerbate existing infrastructure challenges in the city. Abbottabad generates an estimated 25,067 tonnes of solid waste annually, and the city's solid waste management infrastructure lacks capacity for proper waste disposal. The city's flat terrain adds to the challenge preventing drainage and allowing wastewater and sewage to accumulate. Increases in rainfall and flash floods will further exacerbate the problem, causing overflows of existing wastewater and sewage infrastructure, clogged drains and flooding. Most of the city's waste is discharged in the Banda Ali Khan stream which is used for drinking water and irrigation.

Access to clean drinking water is another major issue with only 30% of the population in the Abbottabad district having piped water within households. Increasing demand and pressure on water resources, high pollution levels, lack of adequate infrastructure and the impacts of climate change will make it increasingly difficult to meet water requirements for the city's population and economy. Presently, the city's infrastructure planning and development is carried out without assessing potential impacts to the environment and local communities.¹⁰

Resilience context

Climate impacts



Incidences of flooding are expected to increase, posing a threat to the area's rich biodiversity



Rainfall is expected to intensify, increasing the risk of avalanches and landslides



Temperatures are likely to increase. The average **annual temperature** has increased by 0.75°C

Additional factors

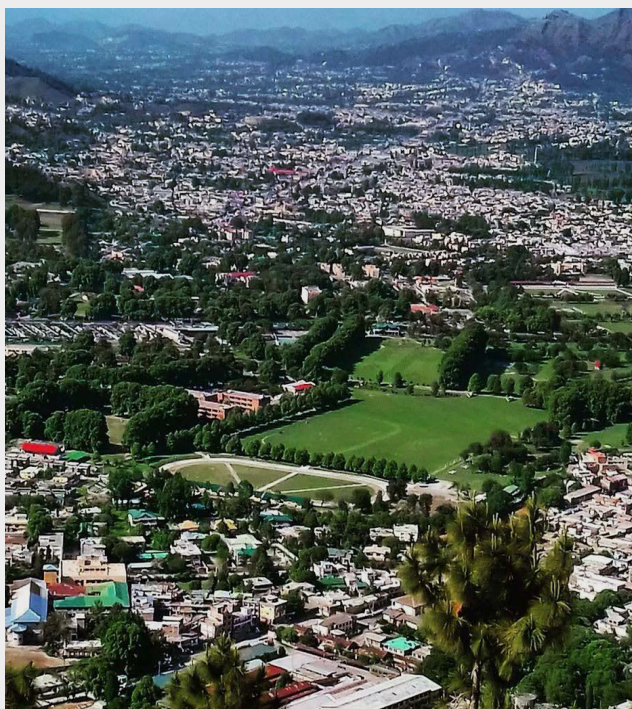


Abbottabad's economy is sensitive to climate change as agriculture, forestry and fishing remains a significant industry in terms of employment



Inadequate solid waste systems mean that waste is disposed of in nearby water bodies that are also used for drinking water and irrigation

City Resilience Profile



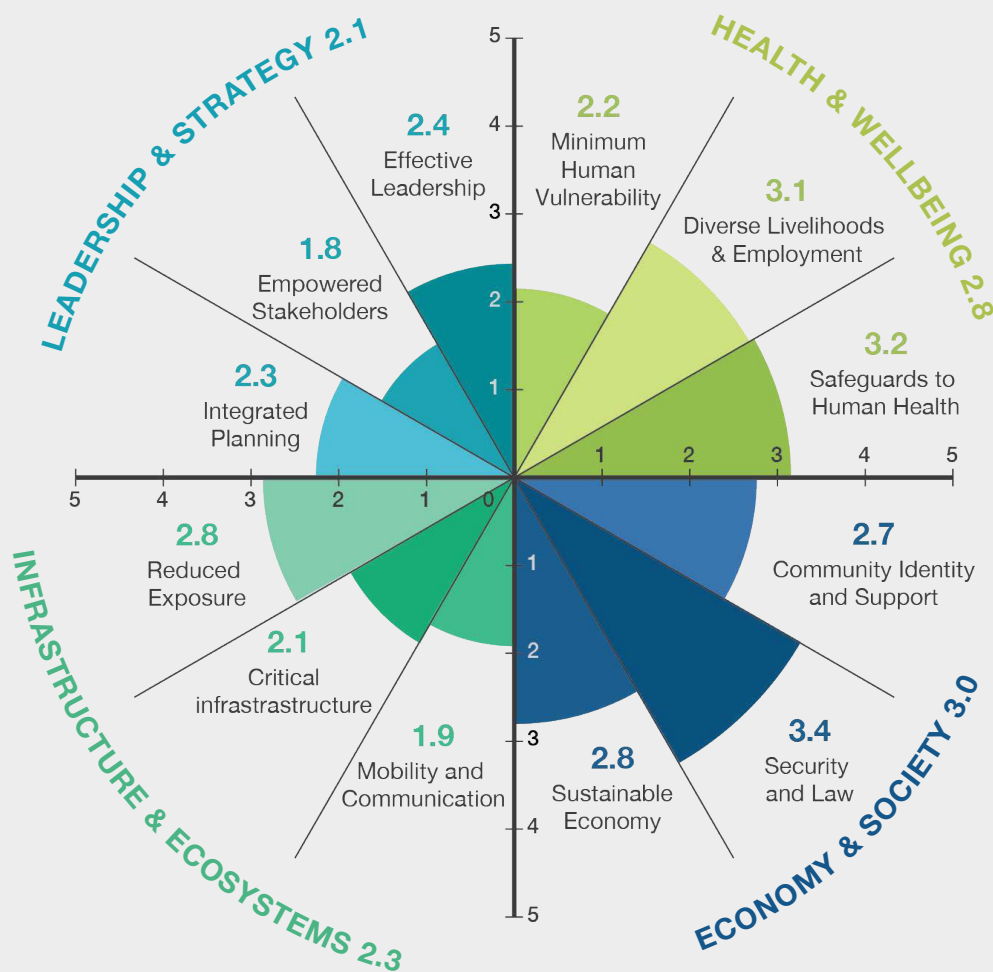
In 2018, the ADB's UCCRTF visited Abbottabad and conducted a baseline assessment of the city's resilience. The study assessed Abbottabad's resilience relating to four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to 12 relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe for a city. The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis showed that Abbottabad has low levels of resilience suggesting that the city needs major improvements to its Infrastructure and Ecosystem and Leadership and Strategy dimensions to reduce the vulnerability of its residents, considering the city's existing socio-economic vulnerabilities, inadequate infrastructure and exposure to climate change and its impacts. This is discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

Abbottabad requires investment in its governance processes and urban development strategy to increase its resilience. The city lacks land-use planning and zoning regulations, and environmental degradation is increasing.¹¹ It has started to address this through a 15-year City Development Plan (CDP), published in 2019 ("integrated development planning": 2.25).¹² The CDP highlights governance challenges, including low overall capacity in city planning which undermines service provision. Local government lacks sufficient capacity and expertise to manage public services and infrastructure ("effective leadership and management": 2.36). Most city-level departments do not have formal public engagement plans ("empowered stakeholders": 1.80).¹³ Therefore, there is a need to empower communities and make urban development planning more integrated and inclusive.

HEALTH & WELLBEING

One-third of Abbottabad's population is defined as multidimensionally poor.¹⁴ The poverty rate, combined with a lack of access to adequate sanitation infrastructure and clean drinking water undermine Abbottabad's resilience ("minimum human vulnerability" 2.20). The private sector is a significant provider of health services, however there are no available data for the number of private clinics and maternity centres in the city. There is a basic level of public health provision with the district having 116 public health facilities with 1,438 beds. The bed-to-population ratio of 10.58 is nearly double the national average (6.0) but is around one-third of the world average ("effective safeguards to human health and life" (3.20).¹⁵ A score of 3.13 for "diverse livelihood and employment" reflects that agriculture, which is highly sensitive to climate change, is the second most important source of livelihood.



INFRASTRUCTURE & ECOSYSTEMS

Overall, the urban infrastructure is inadequate and aged, making it ineffective in maintaining basic services or stimulating economic growth and creating jobs.¹⁶ The city lacks adequate solid waste and wastewater management, and public infrastructure such as city water supply and drainage systems are either lacking or of poor quality (“Provision of critical infrastructure”: 2.10). A weak score of 1.9 for the “mobility and communication” sub-dimension suggests limited capacity of residents to move and seek help when faced with natural hazards. The city’s roads are highly congested and poorly maintained, and the city lacks public transportation facilities and integrated transportation systems. The lack of drainage infrastructure combined with poor-quality housing often built in areas of high exposure greatly increase the vulnerability of the city’s population (“reduced exposure”: 2.83).

ECONOMY & SOCIETY

Abbottabad maintains reasonable levels of law and order in the city with “security and rule of law” scoring the highest among all sub dimensions (3.43). Overall, the city scores the highest for the economy and society dimension at 2.97. Out of the three sub dimensions, “collective identity and community support” scores the lowest (2.67), indicating lack of community-based awareness and mobilisation, and residents’ inclusion and scope for participation in the city’s social and economic structures. This could be due to high levels of urban poverty. In addition, only 33% of the labour force participate in the Abbottabad economy and 74% of the urban population is considered economically inactive. Increased resource and environmental degradation arising from a lack in adequate infrastructure and a increasing population density, put livelihoods at risk and reduce the population’s ability to cope (“sustainable economy”- 2.80).

Household perceptions of resilience

UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain sections of the city's population. The data collection was limited to 100 respondents. With the assistance of city officials, UCCRTF and ADB staff identified households in areas that were exposed to climate impacts and were deemed socio-economically vulnerable. The results provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community in Abbottabad, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the best against four characteristics: Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive). As shown in figure 1, Abbottabad scored low (2.07) on community characteristics, indicating weak community resilience. The average community score on Infrastructure and Services was 2.22, 2.17 on Connectedness, Economic Opportunities (Diverse Livelihoods) 1.93; and Community Social Cohesiveness 1.98.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Assets; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social Safety Net. Scores against each of these dimensions were calculated as an averaged index from survey responses and secondary data.

As shown in figure 2, perceived household resilience was highest for "income and food security" with 94% of households having diverse sources of income and sufficient access to food. Levels of asset ownership were also relatively high, with 60% reporting that they owned assets, which may help to mitigate the effects of a possible natural hazard. About 77% of households felt they have the capacity to adapt and recover after a disaster, and 68% of households are aware of the availability of basic services in their area. However, 71% of households surveyed are still dependent on some form of government-supported social program, despite the perception of relative financial security. Dependency on government support programs suggests households are most likely limited in their internal resilience when faced with a disaster or shock.

Abbottabad has experienced shocks and stresses in its recent history, such as earthquakes and heavy rainfall and hailstorm events, which helped respondents draw on recent experience about their ability to deal with and recover from shocks. An analysis of households' resilience status shows that almost two thirds of respondents felt that their level of resilience was "low" (63%) compared with a mere 5% who felt they had relatively high levels of resilience and 32% who saw their resilience as "medium". However, the overall city level scores (see page 56) scored Abbottabad as having moderate levels of resilience across all four dimensions. This may be due to high dependence on government support programs, lack of awareness and inclusion of residents in urban development planning processes, and existing socio-economic vulnerabilities.

Figure 1

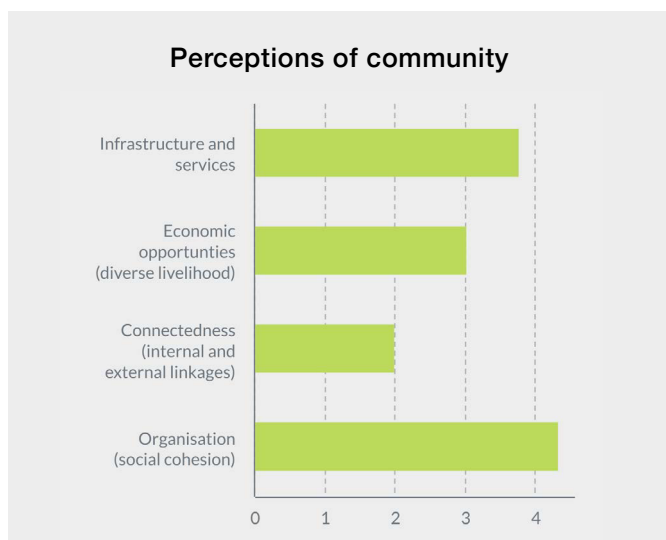
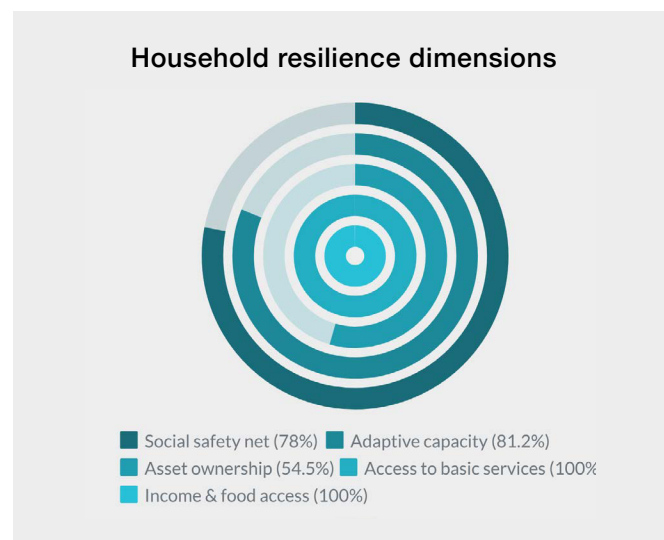


Figure 2



Perceptions of the ability to recover are context specific and depend on the type of hazard or unexpected shock/stress experienced. 14% of households indicated they were unable to recover, whereas 28% reported that their state of wellbeing remained the same. 8% reported to be somewhat better after a shock/stress was experienced and 50% were not affected in any significant way.

Early warning system in Abbottabad

Only 2% of households received early warnings regarding an impending natural hazard. Among those who did receive early warnings, 50% listed television as their major source of this warning. 50% also listed a church/mosque as another major source of warning. None of the households interviewed received early warnings through a disaster or a community volunteer or a disaster committee, suggesting that community disaster management systems are absent in Abbottabad. More than 90% of households said that they were unaware of who their trained community volunteer was or if anyone in their household may have received disaster training. Only 2% indicated they were aware of where to seek shelter or help when faced with a natural disaster. This is most likely due to lack of awareness and lack of nearby shelters in their immediate communities. This also suggests weak city-level mechanisms to create awareness, and that these cities lack protective infrastructure.

During disaster occurrences, 99% of householders did not seek shelter, while 39% said there was no shelter in the area. 3% of respondents stayed to protect their household assets and 49.5% said that moving to a shelter was not required. This suggests general lack of awareness and local government support for these communities, as well as lack of disaster protection infrastructure. 76% of households said they did not have a plan to cope with the possible advent of shocks. However, 14% said they planned to evacuate vulnerable household members.

Figure 3

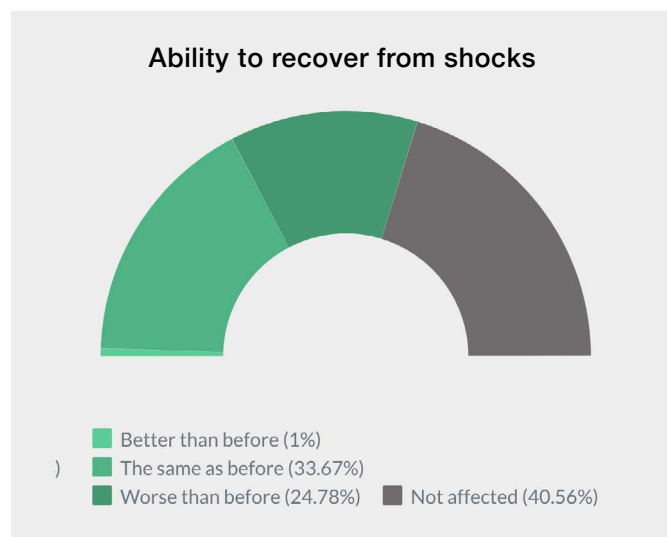


Figure 4



Resilience interventions in Abbottabad

ADB and UCCRTF projects in Abbottabad

CURRENT ADB PROJECTS

Khyber Pakhtunkhwa Cities Improvement Project (KPCIP)

Improving livability through investments in urban infrastructure, and institutional strengthening for urban services providers.

KPCIP Project Readiness Financing

Financing the preparation and engineering design of the KPCIP and ensuring the timely and cost-effective achievement of the project outcomes.

Supporting the Cities Development Initiative for Asia

Supporting CDIA's work conducting infrastructure pre-feasibility studies and producing knowledge products featuring innovative approaches to project design.

UCCRTF project incorporating urban climate change resilience principles into urban development plans

Supporting:

- assessment of socio-economic vulnerability, climate risk, and urban systems;
- action plans that respond to climate risks on critical urban systems; and
- identification of feasible soft and hard infrastructure projects to build climate resilience.

UCCRTF project integrating climate resilient technologies into designs of infrastructures under KPCIP

Supporting:

- Identification of climate-resilient urban infrastructure;
- Climate resilience measures and technologies to be reflected in detailed engineering designs;
- Improved institutional climate resilience capacity.

UCCRTF support to Cities Development Initiative for Asia

Supporting:

- Prefeasibility study of urban infrastructure and services

UCCRTF community-led project

Supporting:

- Community-based solid waste management and water infiltration facilities

UCCRTF Spatial Data Analysis Explorer (SPADE)

Supporting:

- improved city-level climate and geospatial data
- project preparation, consultation and map production

According to the baseline assessment, Abbottabad demonstrates a low level of resilience. Abbottabad received an average of 2.56 out of 5 across the four key resilience areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. Given the existing socio-economic vulnerabilities, lack of adequate infrastructure and frequency of heavy rainfall in the city, it is imperative for the city to strengthen its resilience, especially in terms of its critical infrastructure and ecosystems, leadership and planning processes and stakeholder awareness and involvement. Despite the perception of relative financial security, residents are heavily dependent on government support programs, limiting their resilience when faced with shocks and hazards.

To contribute to improved resilience in Abbottabad, ADB has approved the Khyber Pakhtunkhwa Cities Improvement Project (KPCIP), which will support governments in five cities in the Khyber Pakhtunkhwa Province, namely, Abbottabad, Kohat, Mardan, Mingora, and Peshawar to improve liveability through improvements in: (i) urban infrastructure, and (ii) institutional strengthening for urban services providers. ADB has also approved KPCIP- Project Readiness Financing (PRF), with the objective of financing the preparation and engineering design of KPCIP and future urban projects in KPK. The PRF will ensure high project readiness of KPCIP, thereby facilitating the timely and cost-effective achievement of the project outcomes.

ADB is supporting the Cities Development Initiative for Asia, a multi donor trust fund managed by ADB, to strengthen its sustainable urban development orientation for conducting infrastructure pre-feasibility studies and disseminating knowledge products featuring innovative approaches to project design in CDIA project cities including Abbottabad, Sahiwal and Sialkot. This includes maintaining a core management team capable of administering the program and providing outreach to cities and national and regional urban development partners. The overall objective of the project is to strengthen the CDIA network and partnerships with national partner organizations in DMCS.

Resilience Building and the Urban Climate Change Resilience Trust Fund

Alongside ADB's loan investment in the city, UCCRTF supported the following interventions: i) Urban resilience planning; ii) Prefeasibility study of urban infrastructure and services; iii) Climate-resilient infrastructure; iv) A geo-spatial data tool the 'Spatial Data Analysis Explorer (SPADE) to increase data access; and v) Community-led project on community-based solid waste management and water infiltration facility. These projects contribute to improving key areas where Abbottabad's resilience might be increased.

Urban resilience planning: UCCRTF supported three KPK cities, Abbottabad, Mardan and Peshawar as part of the KPCIP to develop integrated urban plans and incorporate climate resilience in them. UCCRTF supported the integration of Urban Climate Change Resilience (UCCR) inputs into integrated urban development plans, which (i) include Urban Resilience Assessments (URAs) of socio-economic vulnerability, climate risk, and urban systems; (ii) provide an overview of UCCR issues and their relevance in the urban context; (iii) develop action plans that respond to climate risks on critical urban systems; and (iv) identify feasible soft and hard infrastructure projects to build UCCR. The URA for Mardan combined regional climate data and city-level information from focus group discussions. The URA found that all districts (union councils) in the city experience some degree of vulnerability to climate impacts with the union councils of Central Abbottabad experiencing 'extreme vulnerability' and Malik Pura, Kehal, and Salhad experiencing 'very high' vulnerability.¹⁷

Prefeasibility study of urban infrastructure and services: UCCRTF conducted urban climate change resilience assessments in Abbottabad, Mardan and Peshawar as part of its support to CDIA. CDIA was involved in the early part of project preparation of KPCIP by developing investment packages for the three cities, facilitated the completion of 10- to 15-year investment plans, identified infrastructure sub-projects and pre-feasibility studies. The outputs of the urban resilience assessment conducted by UCCRTF are integrated in CDIA's plans, studies and recommendations for the cities.

Project Readiness Financing, UCCRTF implemented a \$2M intervention focused on integrating climate resilient (CR) technologies into detailed designs of urban infrastructures in Abbottabad, Kohat, Mardan, and Peshawar. This included identifying CR urban infrastructures for KPCIP, ensuring reflection of innovative CR measures and technologies in the DEDs of KPCIP and improving institutional CR capacity.

SPADE support (production of maps): SPADE (Spatial Data Analysis Explorer) is a web-based platform that can be utilized for consultation, project preparation, the production of maps, and for analysis of climate change impacts. For Abbottabad, SPADE can display layers/ information on various infrastructure (e.g., roads, sewage, water treatment plants, solid waste), location of social facilities (e.g., health, and education, park), and future urban areas.

Community-led project on Community-Based Solid Waste Management and Water Infiltration Facility:

SP3 will provide resources for pilot interventions and project development, which will help integrate UCCR into projects that are at risk from climate change and seek to build more resilient urban systems. This component currently supports the implementation of community-led projects in 9 cities from Bangladesh (Patuakhali and Faridpur), Myanmar (Yangon), Pakistan (Sialkot and Abbottabad), and Philippines (Del Carmen, Janiuary, Malay, and La Trinidad).

3. Strengthened disaster management infrastructure and facilities and increased local government support and communities' awareness on disaster resilience and contingency measures.

4. Improved access to adequate sanitation infrastructure and clean drinking water.

Potential areas for investment to strengthen Abbottabad's resilience

The baseline assessment provides a snapshot of perceived levels of resilience in Abbottabad city and does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study suggest possible areas of focus for resilience investment, these include:

1. Strengthened efforts to foster community engagement and support in resilience planning and urban development. Abbottabad's infrastructure planning and development must be informed by the assessment of potential climate impacts of and to the environment and local communities.

2. Improved public infrastructure facilities such as wastewater, drainage, and solid waste treatment facilities. The city's infrastructure is aging and does not provide basic services, especially when faced with shocks and stresses associated with climate change. Poor quality infrastructure remains a brake on economic growth.

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Mardan

Mardan is exposed to climate-related shocks and stresses, such as heavy rainfall, hailstorms and urban flooding. Climate projections suggest that these issues will become more severe in the future. Therefore, improvements to Mardan's infrastructure, urban planning, and community preparedness are essential to ensure its resilience.

This study provides a baseline assessment of Mardan's resilience, drawing on a series of structured interviews with city officials and on surveys that were conducted with 104 households in the city. The results show that Mardan requires significant investment to build its

resilience across each of the four resilience dimensions.

ADB is actively working with Mardan to strengthen the city's urban planning and critical infrastructure. These projects in the city are complemented by UCCRTF activities to build climate resilience in Mardan by supporting climate-resilient infrastructure development and community-led resilience projects. UCCRTF intends to undertake another assessment to compare changes in resilience.

KEY FINDINGS

- Mardan is exposed to climate hazards such as frequent heavy rainfall events and flooding. The city's vulnerability is increased by high population density, unplanned urban development, and inadequate drainage facilities.
- The city's early warning system is outdated, limiting the region's ability to plan for natural disasters. Most households stated that they did not receive early warnings regarding an impending natural hazard. Mardan's transportation system is congested, and the railway system is not equipped to allow for mobility, access to supplies and evacuation in case of disasters.
- Due to a deadlock between the government and the largest insurgent group (Tehreek i Taliban) in 2009, communities were displaced, leading to limited livelihood opportunities and a lack of livelihood diversification.
- Mardan has low levels of resilience. The city needs major improvements to its 'Leadership and Strategy' and 'Infrastructure & Ecosystem' dimensions to reduce the vulnerability of its residents, especially considering its exposure to climate change and its impacts.
- 69% of households surveyed depend on some form of government-supported social program, indicating limited internal resilience when faced with a disaster or shock. More than half of the respondents stated that they have low levels of resilience.

Mardan in the context of climate change

Mardan is the second most populous district in the province of Khyber Pakhtunkhwa (KP) with the city's estimated population reaching 335,000.¹ Centred on a densely populated urban core, Mardan has been growing at a rate of over 2.5% between 1998-2017.² Much of the growth has occurred away from the city centre along transport corridors on the agricultural land surrounding the city. This has mainly been unplanned expansion, characterised by informal settlements and low-quality housing.³

For much of the year, Mardan experiences a hot semi-arid climate with average temperatures of 22°C climbing to 33°C in June. Like many other cities in KP, Mardan is prone to floods from nullahs, rivers and streams, exacerbated by the expansion of paved and roofed surfaces, as well as poorly maintained and inadequate drainage systems.⁴

The city's population is vulnerable to climate impacts. Around 44% of the employed population depends on the highly climate sensitive agriculture sector. In addition, according to the KP's Integrated Development Strategy (2014-2018),⁵ the percentage of people living below the poverty line in KP is estimated to be 39%, considerably higher than the national average of 30%. Mardan itself may have even higher levels of poverty than this. According to a study from 2015, the poverty incidence for urban areas of Mardan was estimated to be 55%.⁶

The multi-hazard vulnerability assessment in the 2016 Khyber Pakhtunkhwa Climate Change Policy classifies Mardan district under 'low-hazard', however, it scores 'high' for flooding.⁷ The ADB Pakistan District Level Climate Risk and Hazard Assessment scores the Mardan District 5 (very high) on flood risk, earthquake risk and incidence of avalanches.⁸

One of the biggest challenges in Mardan district is the lack of an up-to-date early warning system. This limits the region's ability to forecast sudden weather changes and plan for weather-related hazards, despite the region facing high incidence

of heavy rainfall and flooding.⁹ The region's railway system is also not adequately functional, restricting people's mobility, access to supplies and movement to safer places during incidence of disasters.¹⁰ The city's public infrastructure is largely unplanned and inadequate for a rapidly growing population, with a congested transport network, and lack of sidewalks and street lighting. High intensity rainfall-induced urban flooding is further exacerbated by the lack of a proper drainage system and the overflowing of the Swat River.

Only 18% of the district's population has access to piped water within households and while 84% of the city's population has access to electricity, the city experiences frequent power outages.¹¹ Despite being the second most populous city, Mardan has only 94 health institutions, compared to neighbouring city Peshawar which has 129.

Farmers' perception of climate change in the district indicates that heavy rainfall and hailstorms have led to heavy losses with 83% farmers facing complete crop failure due to floods, 63% farmers were severely impacted due to livestock disease or death, and heavy rains caused damage to food and fodder stocks for around 67% households.¹² Farmers identified rising temperatures as a key factor for the incidence of livestock diseases.¹³

These existing vulnerabilities, coupled with lack of adequate infrastructure, early warning systems and the incidence of flooding, earthquakes and avalanches, make the city highly vulnerable to the impacts of climate change.

Resilience context

Climate impacts



Mardan is at high risk of **surface and river flooding**



Rainfall may decrease overall, but fall in more concentrated spells **increasing flood risk**



Maximum temperatures could rise by 1.55°C- 5.5°C, while **minimum temperatures could rise by 1.96°C to 6.61°C**

Additional factors



Around 44% of the city's employed population depends on the **highly climate sensitive agriculture sector**



Urban flooding is exacerbated by **inadequate infrastructure** such as a lack of a proper drainage system



Mardan lacks an up-to-date **early warning system**

City Resilience Profile



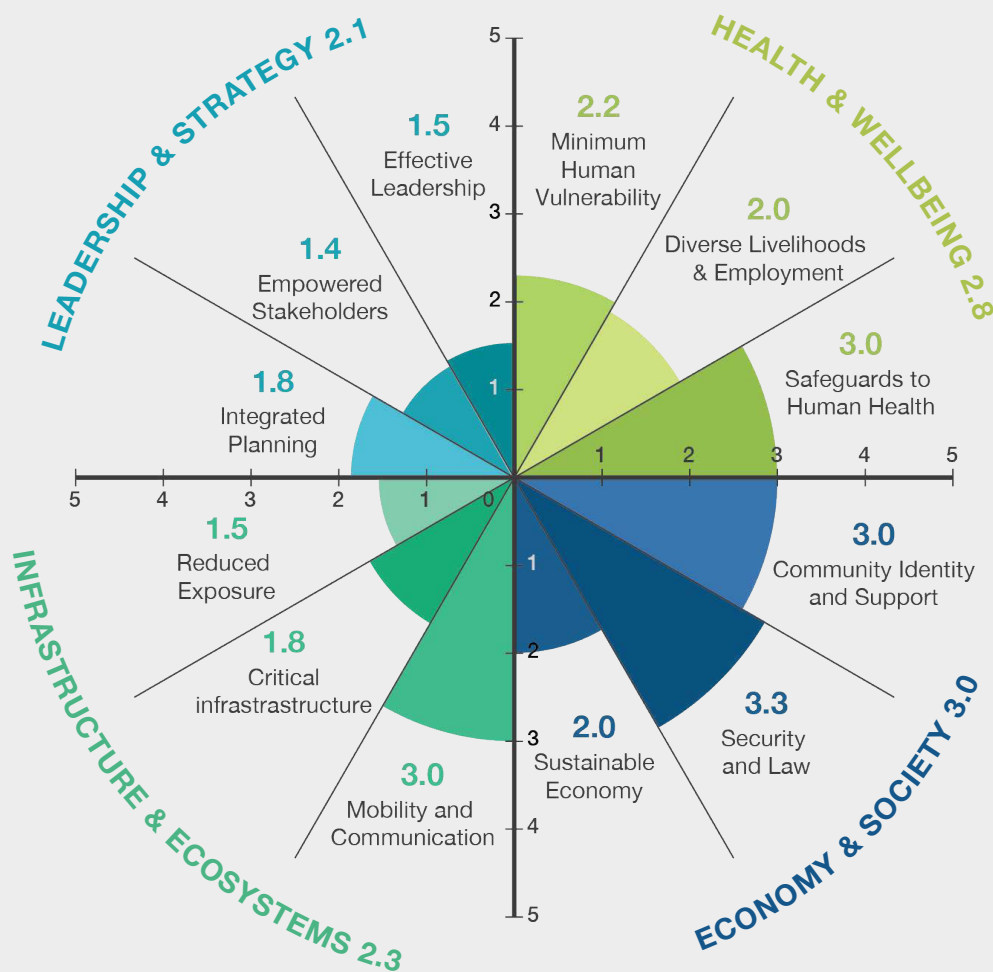
In 2018, ADB's UCCRTF visited Mardan city and conducted a baseline assessment of the city's resilience. The study assessed the city's resilience relating to four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe for a city. The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis showed that Mardan has low levels of resilience suggesting that the city is in need of major improvements to its Infrastructure & Ecosystem and Leadership and Strategy dimensions to reduce the vulnerability of its residents, considering the city's existing socio-economic vulnerabilities, inadequate infrastructure, frequent flooding and exposure to climate change and its impacts. This is discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

Mardan requires considerable improvement in its "leadership & strategy" dimension. Out of the three indicators for this dimension, "effective leadership and management" scores 1.5, "empowered stakeholders (city residents)" 1.4 and "integrated development planning scores 1.8. This indicates the existence of considerable systemic weaknesses, and which undermine the ability of the government to deal with disasters. The city also faces the challenge of largely unplanned development, with inadequate public infrastructure to support a rapidly growing population and improve resilience of its residents, and an outdated early warning system. There is therefore a need to empower communities and make urban development planning more integrated and inclusive.

HEALTH & WELLBEING

Mardan's high levels of urban poverty, lack of adequate health infrastructure, low access to piped water and high incidence of urban flooding undermines its resilience for the "minimum human vulnerability" sub-dimension (2.2). The city scores comparatively higher on "effective safeguards to human health and life" (3.0). However, this needs to be strengthened further to improve existing infrastructure and access to basic resources. Conflict in the region, between the government and the largest insurgent group (Tehreek i Taliban) in 2009 prompted the displacement of people in Mardan city. This contributed to limited livelihood opportunities and diversification for the communities. Alongside, 31% of the province's population is considered poor, and the city has high levels of gender disparity, with only 35% of women aged 10 years and above being literate ("diverse livelihood and employment" - 2.0).¹⁴



INFRASTRUCTURE & ECOSYSTEMS

One of the biggest challenges in Mardan city is the lack of adequate drainage and health infrastructure ("critical infrastructure" - 1.8). The city also has a congested transport system and an outdated early warning system, leading to a score of 3.0 on the "mobility and communication" sub-dimension. This suggests limited capacity of residents to evacuate and seek help when faced with natural hazards. These challenges, along with the incidence of heavy rainfall and the city's proximity to the Swat River makes the people highly vulnerable to urban flooding. This is further exacerbated by the lack of an adequately functional railway system. The city scores the lowest for "reduced exposure" (1.5) indicating that urban infrastructure needs to be strengthened to ensure an up-to-date and functional early warning system to cope with emergencies, better mobility, and access to other basic services.

ECONOMY & SOCIETY

Mardan scores low in the economy and society dimension as well, with an overall score of 2.8. A score of 3.3 for the "security and rule of law" dimension indicates that the residents of Mardan are likely to have some access to police and justice systems, though there is room for improvement. Out of the three sub dimensions, "collective identity and community support" scores 3.0, indicating lack of community-based awareness and mobilisation, and residents' inclusion and scope for participation in the city's social and economic structures. This could be attributed to high levels of urban poverty and lack of access to infrastructure and resources in the city. Lack of resources such as piped water, inadequate infrastructure facilities and conflict, leading to lack of livelihood opportunities and diversification, reduces the population's ability to cope with disasters ("sustainable economy"-2.0).

Household perceptions of resilience

At the same time as the city-level baseline study, UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain sections of the city's population. The data collection was limited to 104 respondents. UCCRTF team and ADB staff, jointly with city officials, identified households in areas that were exposed to climate impacts and were deemed socio-economically vulnerable. The results provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community in Mardan, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the highest against four characteristics: Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As shown in figure 1, Mardan scored low (2.7) on community characteristics indicating weak community resilience. The average community score on Infrastructure and Services was 3.75, 2.7 on Connectedness, Economic Opportunities (Diverse Livelihoods) 2.3; and Community Social Cohesiveness 2.27.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Assets; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social

Safety Net. Scores against each of these dimensions were calculated as an averaged index from survey responses and secondary data.

As shown in figure 2, perceived household resilience was highest for "income and food security" with 88.5% of households perceived as having diverse sources of income and sufficient access to food. Levels of asset ownership were also relatively high, with 71% reporting that they owned assets, which may help to mitigate the effects of a possible natural hazard. About 84% of households have the capacity to adapt and recover after a disaster. 69% of households are aware of the availability of basic services in their area. However, 88% of households surveyed are still dependent on some form of government-supported social program, despite the perception of relative financial security. Dependency on government support programs suggests households are most likely limited in their internal resilience when faced with a disaster or shock.

Mardan has experienced shocks and stresses in its recent history, such as heavy rainfall, hailstorms and urban flooding so respondents to the survey were able to draw on recent experience about their ability to deal with and recover from shocks. An analysis of households' resilience status shows that more than half of respondents felt that their level of resilience was "low" (51%) compared with a mere 12.2% who felt they had relatively high levels of resilience and 37.5% who saw their resilience as "medium". However, the overall city level scores (see page 66) scored Mardan as having moderate levels of resilience across all four dimensions.

Figure 1

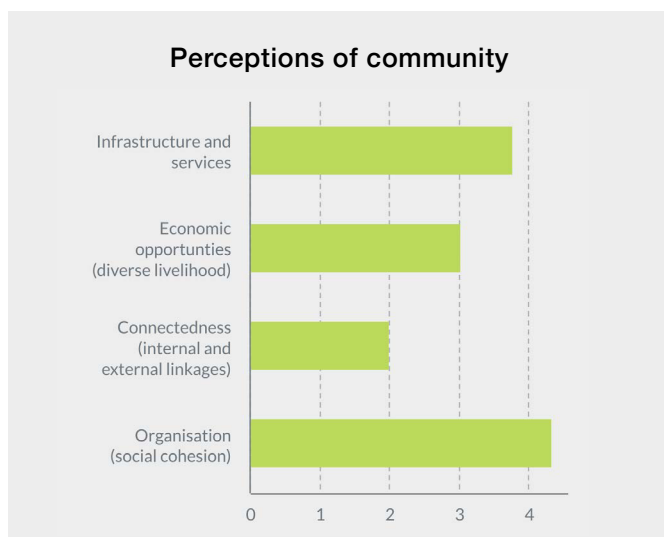
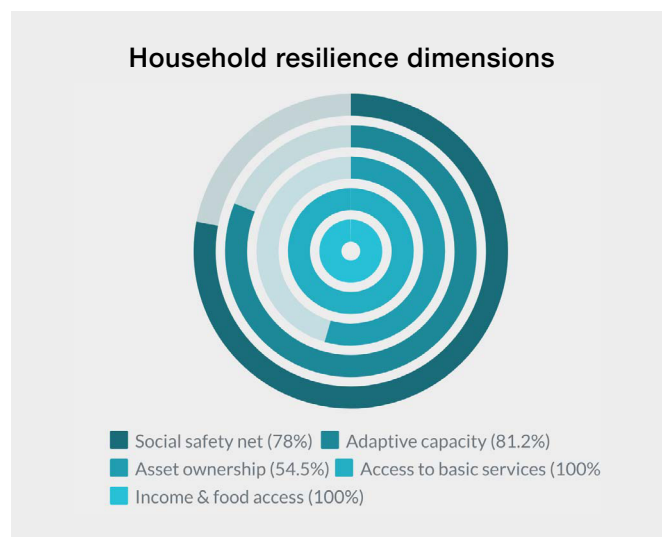


Figure 2



This may be due to high dependence on government support programs, lack of awareness and inclusion of residents in urban development planning processes and existing socio-economic vulnerabilities.

Perceptions of the ability to recover are context specific and depend on the type of hazard or unexpected shock/stress experienced. 10% of households indicated they were unable to recover. The percentage of households reporting that their state of wellbeing remained the same after experiencing a shock/stress was 31%. 50% reported to be somewhat better after a shock/stress was experienced. 10% were not affected in any significant way.

Early warning system in Mardan

Only 7% of households received early warnings regarding an impending natural hazard. Among those who did receive early warnings, about 14% listed television as their major source of this warning. 43% listed a neighbour or relative as another major source of warning. About 57% of households received early warnings through a general community volunteer. None received warning from a disaster committee or volunteer, suggesting a non-existent community disaster management system in Mardan. More than 90% of households stated that they were unaware of who their trained community volunteer was, or of anyone in the household who may have received disaster training.

Only 3% indicated they were aware of where to seek shelter or help when faced with a natural disaster.

This is most likely due to lack of awareness and lack of nearby shelters in their immediate communities. This also suggests weak city-level mechanisms to create awareness, and that the city lacks protective infrastructure.

During occurrences of disasters, 97% of the householders did not seek emergency shelter, while 14% said there was no shelter in the area and 18% said that moving to a shelter was not required. This suggests general lack of awareness and local government support for these communities, as well as lack of disaster protection infrastructure. Of those who did not move to another place during a disaster event, 59% said that they did not receive any messages regarding a natural hazard or where to seek shelter or help. 60% of households said they did not have a plan to cope with the possible advent of shocks. However, 29% stated that they plan to stay to protect household assets.

Figure 3

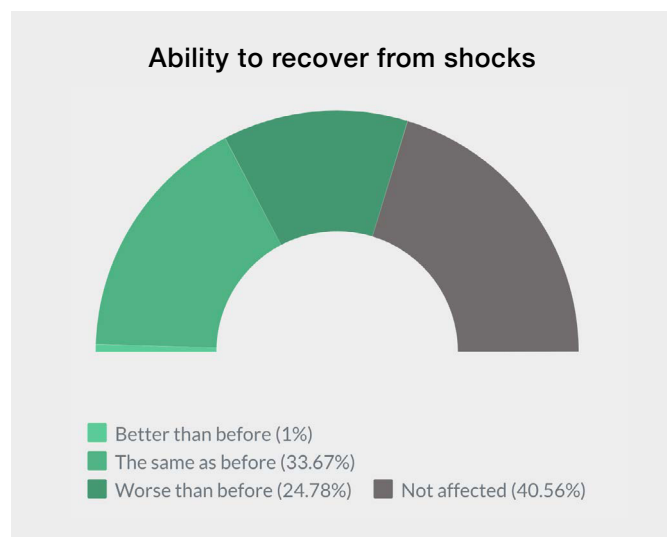


Figure 4



Resilience interventions in Mardan

ADB and UCCRTF projects in Mardan

CURRENT ADB PROJECTS

Khyber Pakhtunkhwa Cities Improvement Project (KPCIP)

Improving livability through investments in urban infrastructure, and institutional strengthening for urban services providers.

KPCIP Project Readiness Financing

Financing the preparation and engineering design of the KPCIP and ensuring the timely and cost-effective achievement of the project outcomes.

Supporting the Cities Development Initiative for Asia

Supporting CDIA's work conducting infrastructure pre-feasibility studies and producing knowledge products featuring innovative approaches to project design.

UCCRTF project incorporating urban climate change resilience principles into urban development plans

Supporting:

- assessment of socio-economic vulnerability, climate risk, and urban systems;
- action plans that respond to climate risks on critical urban systems; and
- identification of feasible soft and hard infrastructure projects to build climate resilience.

UCCRTF project integrating climate-resilient technologies into designs of infrastructures under KPCIP

Supporting:

- Identification of climate-resilient urban infrastructure;
- Climate resilience measures and technologies to be reflected in detailed engineering designs;
- Improved institutional climate resilience capacity.

UCCRTF support to Cities Development Initiative for Asia

Supporting:

- Prefeasibility study of urban infrastructure and services

UCCRTF Spatial Data Analysis Explorer (SPADE)

Supporting:

- improved city-level climate and geospatial data
- project preparation, consultation and map production

According to the baseline assessment, Mardan demonstrates a low level of resilience, an average of 2.2 out of 5, across the four key resilience areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. Given the existing socio-economic vulnerabilities, lack of adequate infrastructure, and frequency of urban flooding in the city, it is imperative for the city to strengthen its resilience, especially in terms of its critical infrastructure and ecosystems, integrated development planning, leadership, planning processes and stakeholder awareness and involvement. Despite the perception of relative financial security, residents are heavily dependent on government support programs, limiting their resilience when faced with shocks and hazards.

To contribute to improved resilience in Mardan, ADB has approved the Khyber Pakhtunkhwa Cities Improvement Project (KPCIP), which will support governments in five cities in the Khyber Pakhtunkhwa Province, namely, Mardan, Peshawar, Abbottabad, Kohat and Mingora, to improve liveability through improvements in: (i) urban infrastructure, and (ii) institutional strengthening for urban services providers. Alongside, ADB has approved the KPCIP- Project Readiness Financing (PRF), with the objective of financing the preparation and engineering design of KPCIP and possible future pipeline of urban projects in KPK. The PRF will ensure high project readiness of KPCIP, thereby facilitating the timely and cost-effective achievement of the project outcomes.

ADB is supporting the Cities Development Initiative for Asia, a multi donor trust fund managed by ADB, to strengthen its sustainable urban development orientation for conducting infrastructure pre-feasibility studies and disseminating knowledge products featuring innovative approaches to project design in CDIA project cities including Mardan. This includes maintaining a core management team capable of administering the program and providing outreach to cities and national and regional urban development partners. The overall objective of the project is to strengthen the CDIA network and partnerships with national partner organizations in DMCs.

Resilience Building and the Urban Climate Change Resilience Trust Fund

Alongside ADB's loan investment in the city, UCCRTF supported the following interventions: i) Urban resilience planning; ii) Prefeasibility study of urban infrastructure and services; iii) Climate-resilient infrastructure; iv) A geo-spatial data tool the 'Spatial Data Analysis Explorer (SPADE)' to increase data access. These projects contribute to improving key areas where Mardan's resilience might be increased, according to the baseline study.

Urban resilience planning: UCCRTF supported three KPK cities, Peshawar, Abbottabad and Mardan, as part of the KPCIP to develop integrated urban plans and incorporate climate resilience in them. UCCRTF supported the integration of Urban Climate Change Resilience (UCCR) inputs into integrated urban development plans, which (i) include Urban Resilience Assessments (URAs) of socio-economic vulnerability, climate risk, and urban systems; (ii) provide an overview of UCCR issues and their relevance in the urban context; (iii) develop action plans that respond to climate risks on critical urban systems; and (iv) identify feasible soft and hard infrastructure projects to build UCCR. The URA for Mardan combined regional climate data and city-level information from focus group discussions. The URA found that all districts (union councils) in the city experience some degree of vulnerability to climate impacts with the union councils of Baghdada, Kas Korona and Hoti experiencing 'extreme vulnerability'.¹⁵

Prefeasibility study of urban infrastructure and services: UCCRTF conducted urban climate change resilience assessments in Abbottabad, Mardan and Peshawar as part of its support to CDIA. CDIA was involved in the early part of project preparation of KPCIP by developing investment packages for the three cities, facilitated the completion of 10- to 15-year investment plans, identified infrastructure sub-projects and pre-feasibility studies. The outputs of the urban resilience assessment conducted by UCCRTF are integrated in CDIA's plans, studies and recommendations for the cities. The overall value of this project was \$5M.

Climate resilient infrastructure: As part of KPCIP-Project Readiness Financing, UCCRTF implemented a \$2M intervention focused on integrating climate resilient (CR) technologies into detailed designs of urban infrastructures in Mardan, Peshawar, Abbottabad and Kohat. This included identifying CR urban infrastructures for KPCIP, ensure reflection of innovative CR measures and technologies in the DEDs of KPCIP and improving institutional CR capacity.

SPADE support (production of maps): SPADE (Spatial Data Analysis Explorer) is a web-based platform using open-source technology hosted on a centralized cloud-based server that contains various geospatial data that can be utilized for consultation, project preparation, production of maps, and analysis of climate change impacts. For Mardan, SPADE can display layers/information on vulnerability, various infrastructure (e.g., roads, solid waste facilities, sewage), location of social facilities (e.g., health, and education), water utilities, hydrological networks, and future urban areas.

Potential areas for investment to strengthen Mardan's resilience

The baseline assessment provides a snapshot of perceived levels of resilience in Mardan city. It does not represent a full assessment of the investment needed to strengthen urban resilience. However, the results of the study suggest possible areas of focus for resilience investment, including:

- 1. Investment in urban planning to support integrated and inclusive urban development and build a robust case for investment in infrastructure to provide basic services and increase resilience to climate shocks and stresses.** Such planning should seek to foster community engagement and support for such

development.

- 2. Improved public infrastructure facilities such as drainage and transportation systems.**
- 3. Improvement in Mardan's early warning system and its protective infrastructure.**
- 4. Improved access to basic services, such as water, food, and shelter to better improve the community's ability to cope with natural hazards.**

ENDNOTES

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10. *ibid.*
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15. *ibid.*

Peshawar

Peshawar is exposed to climate-related shocks and stresses, such as urban flooding, landslides, avalanches, and extreme temperatures. Climate projections suggest that these issues will become more severe in the future. Improvements to Peshawar's infrastructure, urban planning, and community preparedness are essential to ensure its resilience.

This study provides a baseline assessment of Mardan's resilience, drawing on a series of structured interviews with city officials and on surveys that were conducted with 102 households in the city. The results showed that

Peshawar requires significant investment to build its resilience across each of the four resilience dimensions.

ADB is working actively in Peshawar to strengthen the city's critical infrastructure. The urban resilience projects in the city are complemented by UCCRTF activities to build climate resilience in Peshawar by supporting climate-resilient infrastructure development and community-led resilience projects. UCCRTF intends to undertake another assessment to compare changes in resilience.

KEY FINDINGS

- Peshawar is vulnerable to climate change hazards due to frequent urban flooding, increasing population density and unplanned urban development. The city is also highly vulnerable to earthquakes and epidemics caused by inadequate sanitation infrastructure.
- Urban development mandates such as the Peshawar Development Authority's building codes are often not complied with. One of the most significant infrastructure challenges in the city is the absence of proper wastewater and solid waste disposal.
- Peshawar's existing socio-economic vulnerabilities, inadequate infrastructure and exposure to climate change undermine its resilience. It requires improvements to its 'Leadership and Strategy' and 'Infrastructure & Ecosystem' resilience dimensions to reduce the vulnerability of its residents. Over 88% of households surveyed depend on some form of government-supported social program, despite the perception of relative financial security, indicating limited internal resilience when faced with a disaster or shock.
- More than two-thirds of respondents stated that they have low levels of resilience.
- The early warning systems in the city need to be improved and awareness about them needs to be raised. Most households stated that they did not receive early warnings regarding an impending natural hazard.

Peshawar in the context of climate change

The city of Peshawar, located in the Peshawar district in the province of Khyber Pakhtunkhwa (KP), is thought to be one of the oldest living cities in the world with its origins traceable to 1700-1200 BC.¹ Peshawar is situated near the eastern end of the Khyber Pass on the Iranian plateau, along with the rest of the KP province. The city is bounded by the River Bara to the southwest, the Budni Nala rivulet, an offshoot of the Kabul River to the northeast, and the Khyber Hills to the west. Cutting between the river channels and across the line of hills is the GT Road, which provides a major onward access route to Central Asia.

A multi hazard vulnerability assessment in the 2016 Khyber Pakhtunkhwa Climate Change Policy, classifies Peshawar district under 'medium-hazard'.² Specifically, the district scores very high for flooding and high for incidence of landslides and avalanches. Climate projections indicate that annual precipitation and annual average temperature are projected to increase in the future.³ Peshawar is exposed to high temperatures, urban flooding and earthquakes, and its population is vulnerable thanks to high levels of urban poverty and populations density.⁴

Cities drive the economy of KP, contributing an estimated 73% of provincial GDP. Along with Mardan, Peshawar is a centre of economic growth in the region.⁵ As of 2017 census the city population was estimated to be 1.9 million, with one third of the population classified as urban poor.^{6,7} By 2035, some estimates predict that Peshawar, Mardan and Abbottabad will represent contiguous settlements, and the existing population of over 2 million people will multiply to nearly 5 million.⁸

However, a lack of investment in infrastructure and maintenance has resulted in low coverage and poor quality of services. Peshawar faces combined challenges of unplanned urban expansion, inadequate infrastructure services to support a rapidly growing population, and degradation of

natural resources and associated services.⁹ Only 48% of the population in the Peshawar district has access to piped water in households¹⁰ and most of the district's piped water supply system is old and in poor condition.¹¹ Consequently, 77% of drinking water sources in the city is unsafe due to bacterial contamination and metal concentration.¹²

The city's wastewater treatment plants are not functional, leading to flows being discharged into Kabul, Bara river, irrigation canals and agricultural lands.¹³ The effluent from the city's industries, comprising of cement, soap, and marble production, are also discharged into Kabul and Bara rivers, adding to the contamination.¹⁴

The city also lacks adequate solid waste management facilities. The situation is further exacerbated by frequent urban flooding. The occurrence of diseases in the city has also been linked to urban flooding, with two major epidemics caused by stagnant water, poor drainage systems and inadequate disposal of waste.¹⁵ Increase in annual rainfall and temperature due to climate change therefore poses a serious challenge to the city's infrastructure and people. Though the region is vulnerable to earthquakes and floods, the Peshawar Development Authority's building codes are not strictly implemented and buildings in the city are often not earthquake resistant.¹⁶

Resilience context

Climate impacts



Flooding is projected to increase, potentially resulting in disease outbreaks



The region is particularly vulnerable to landslides and earthquakes



Annual precipitation and annual average temperature are projected to increase

Additional factors

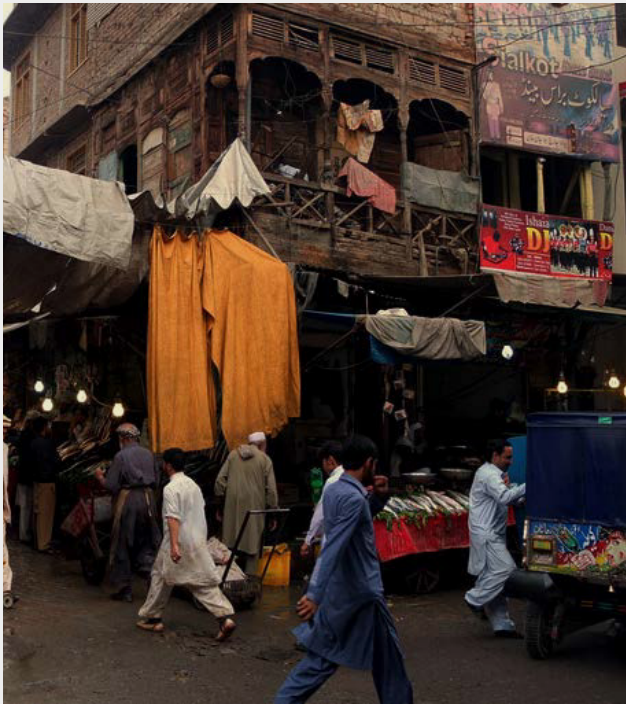


Vulnerability is exacerbated by high levels of urban poverty and population density



Inadequate water supply means that 77% of drinking water is unsafe

City Resilience Profile



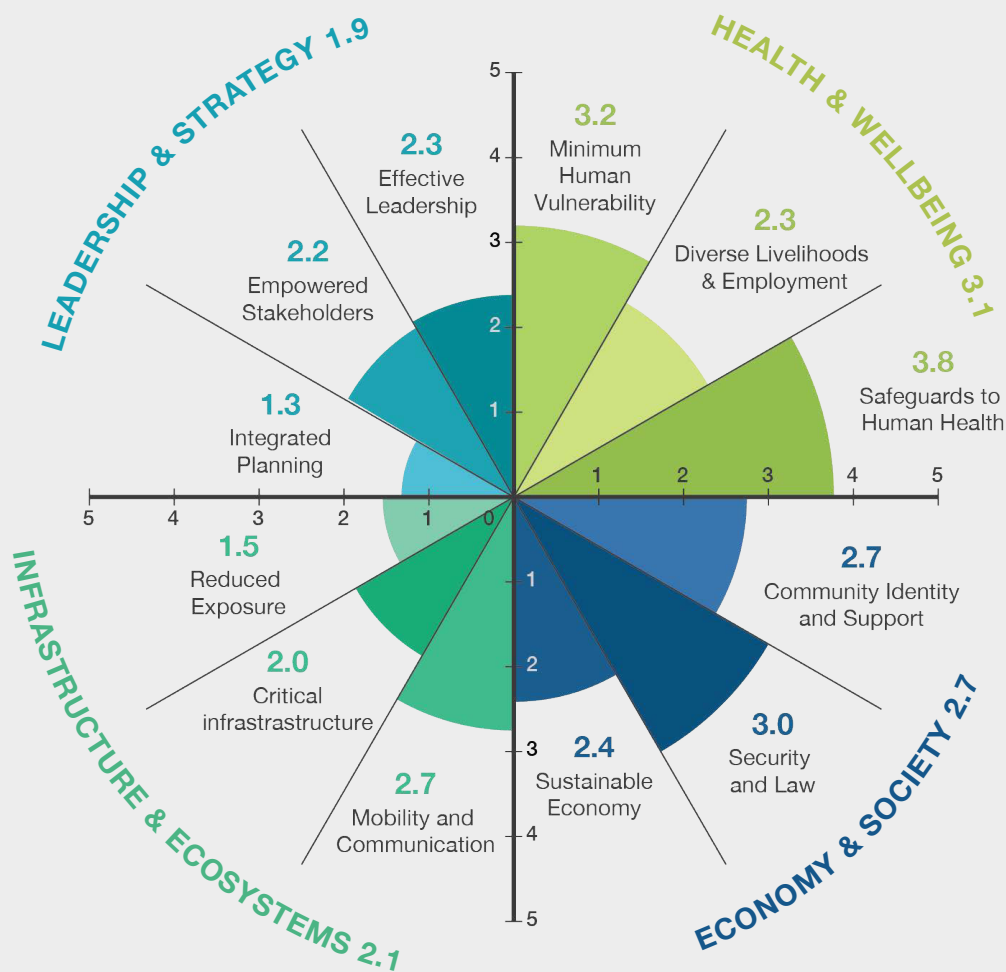
In 2018, the ADB's UCCRTF visited Peshawar city and conducted a baseline assessment of the city's resilience. The study assessed the city's resilience relating to four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe for a city. The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis showed that Peshawar has low levels of resilience suggesting that the city needs major improvements to its 'Infrastructure & Ecosystem' and 'Leadership and Strategy' dimensions to reduce the vulnerability of its residents, considering the city's existing socio-economic vulnerabilities, inadequate infrastructure, frequent flooding and exposure to climate change and its impacts. This is discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

Peshawar requires considerable improvement in its leadership and strategy dimension. It has low levels of capacity in local government for climate resilient urban planning, infrastructure identification, procurement and maintenance, and services management ("effective leadership and management": 2.27). The city has not had a development plan since 2010, resulting in unplanned development, often in climate vulnerable areas ("integrated development planning: 1.25").¹⁷ The city's lack of process for urban development and planning has also meant limited opportunities for engagement about the future of the city "empowered stakeholders (city residents)" (2.20). The city's rapidly growing population demands significant investment in public infrastructure, there is a need to empower communities and make urban development planning more integrated and inclusive.

HEALTH & WELLBEING

Peshawar requires considerable investment in basic infrastructure that protects the health and wellbeing of its citizens. Rising population has led to large and growing areas of informal settlements characterised by poor quality housing and a lack basic services. As of 2014, 18 slums were identified in the city, located across 10 union councils ("minimum human vulnerability": 3.20).¹⁸ There are 12 public hospitals in Peshawar district, and 72 private clinics, whilst government hospitals provide services free of charge, the services are oversubscribed, reducing access to medical care ("effective safeguards to human health and life" (3.80). The city scores 2.25 for "diverse livelihood and employment". 31% of the province's population is poor, and the city has high levels of gender disparity, with only 43% of women aged 10 years and above being literate.¹⁹



INFRASTRUCTURE & ECOSYSTEMS

One of the biggest challenges in Peshawar is the lack of adequate solid waste and wastewater management infrastructure with effluents from industries released in Kabul and Bara rivers. There are no formal landfill arrangements within the city itself. Water supply is also a significant issue. Whilst most of the district has a piped water supply system it is generally old and deteriorated. Normally water quality at source is safe, but due to damaged pipes, contamination has been found in the distribution network, making 80% of drinking water sources unsafe (“provision of critical infrastructure”: 2.0).²⁰ Building codes are not implemented and buildings in are often not earthquake resistant (“reduced exposure”: 1.5). The “mobility and communication” sub-dimension scores 2.7, suggesting limited capacity of residents to move and seek help when faced with hazards.

ECONOMY & SOCIETY

A score of 3.0 for the “security and rule of law” dimension indicates that the residents of Peshawar do have access to police and justice systems, however regional instability and security problems over recent decades undermines public safety. The “collective identity and community support” sub-dimension scores 2.67, indicating lack of community-based awareness and mobilisation, and residents’ inclusion and scope for participation in the city’s social and economic structures. This could be due to high levels of urban poverty and lack of access to infrastructure and resources in the city. Increased resource and environmental degradation, especially water and air pollution, due to lack of adequate infrastructure and increasing population density, along with the impacts of climate events, places livelihood activities at risk and reduces the population’s ability to cope (“sustainable economy”- 2.40).

Household perceptions of resilience

At the same time as the city-level baseline study, UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain sections of the city's population. The data collection was limited to 102 respondents. UCCRTF team and ADB staff jointly with city officials, identified households in areas that were exposed to climate impacts and were deemed socio-economically vulnerable. The results rather provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community in Peshawar, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the best against four characteristics: Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As shown in Figure 1, Peshawar scored very low (1.70) on community characteristics indicating weak community resilience. The average community score on Infrastructure and Services was 2.74, 1.35 on Connectedness, Economic Opportunities (Diverse Livelihoods) 1.35; and Community Social Cohesiveness 1.38.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Assets; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social

Safety Net. Scores against each of these dimensions were calculated as an averaged index from survey responses and secondary data.

As shown in figure 2, perceived household resilience was highest for "income and food security" with 92.2% of households perceived as having diverse sources of income and sufficient access to food. Levels of asset ownership were also relatively high, with 73% reporting that they owned assets, which may help to mitigate the effects of a possible natural hazard. About 82% of households have the capacity to adapt and recover after a disaster. 68% of households are aware of the availability of basic services in their area. However, 88% of households surveyed are still dependent on some form of government-supported social program, despite the perception of relative financial security. Dependency on government support programs suggests households are most likely limited in their internal resilience when faced with a disaster or shock. Peshawar has experienced shocks and stresses in its recent history, such as heavy rainfall, urban flooding, and epidemics such as dengue fever and congo virus, so respondents to the survey were able to draw on recent experiences about their ability to deal with and recover from shocks. An analysis of households' resilience status shows that more than two-thirds of respondents felt that their level of resilience was "low" (78%) compared with a mere 6% who felt they had relatively high levels of resilience and 16% who saw their resilience as "medium". However, the overall city level scores (see page 76) scored Peshawar as having

Figure 1

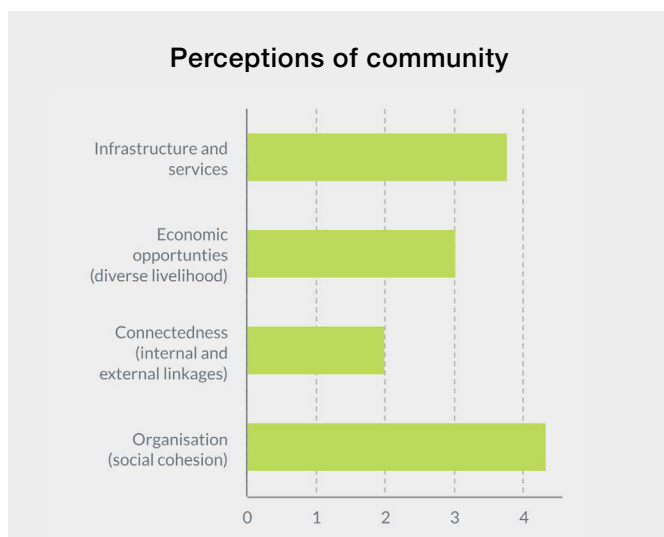
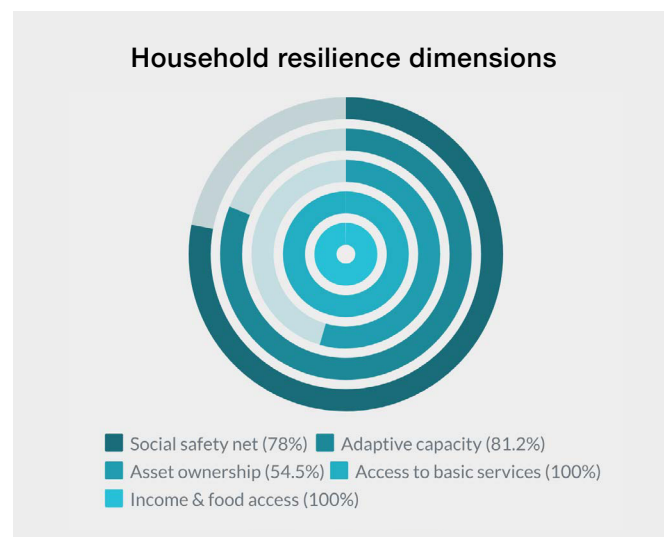


Figure 2



moderate levels of resilience across all four dimensions. This may be due to high dependence on government support programs, lack of awareness, and inclusion of residents in urban development planning processes and existing socio-economic vulnerabilities.

Perceptions of the ability to recover are context-specific and depend on the type of hazard or unexpected shock/stress experienced. 13% of households indicated they were unable to recover. The percentage of households reporting the same state of wellbeing after experiencing a shock/stress was 19% and the same percentage of respondents reported to be somewhat better after a shock/stress was experienced. 41% were not affected in any significant way.

Early warning system in Peshawar

Only 4% of households received early warnings regarding an impending natural hazard. Among those who did receive early warnings, about 75% listed television as their major source of this warning. 25% also listed a neighbour or relative as another major source of warning. About 50% of households received early warnings through a general community volunteer. None received warning from a disaster committee or volunteer, suggesting a non-existent community disaster management system in Peshawar. More than 90% of households stated that they were unaware of who their trained community volunteer was, or of anyone in the household who may have received disaster training.

Only 2% indicated they were aware of where to seek emergency shelter or help when faced with a disaster. This is most likely due to lack of awareness and lack of nearby shelters in their nearby communities. This also suggests weak city-level mechanisms to create awareness, and that these cities lack protective infrastructure.

During the occurrence of disasters, none of the householders sought shelter, while 42% said there was no shelter in the area. 4% of respondents stayed to protect their household assets and 9% said that moving to a shelter was not required. This suggests a general lack of awareness and local government support for these communities, as well as lack of disaster protection infrastructure. 50% of households said they did not have a plan to cope with the possible advent of shocks. However, 46% said they planned to evacuate vulnerable household members.

Figure 3

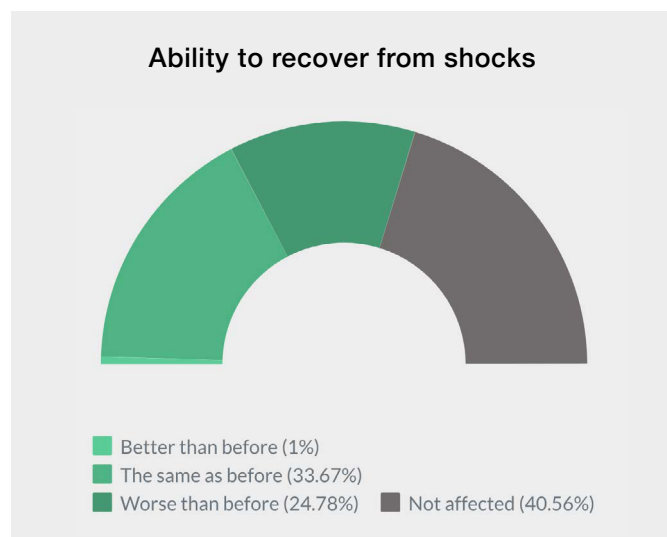


Figure 4



Resilience interventions in Peshawar

ADB and UCCRTF projects in Peshawar

CURRENT ADB PROJECTS

Khyber Pakhtunkhwa Cities Improvement Project (KPCIP)

Improving livability through investments in urban infrastructure, and institutional strengthening for urban services providers.

KPCIP Project Readiness Financing

Financing the preparation and engineering design of the KPCIP and ensuring the timely and cost-effective achievement of the project outcomes.

Supporting the Cities Development Initiative for Asia

Supporting CDIA's work conducting infrastructure pre-feasibility studies and producing knowledge products featuring innovative approaches to project design.

Strengthening Knowledge & Actions for Air Quality Improvement

Supporting the development of policy actions and technological solutions for air quality management.

UCCRTF project incorporating urban climate change resilience principles into urban development plans

Supporting:

- Assessment of socio-economic vulnerability, climate risk, and urban systems; action plans that respond to climate risks on critical systems; and identification of feasible infrastructure projects to build resilience.

UCCRTF project integrating climate-resilient technologies into designs of infrastructures under KPCIP

Supporting:

- Identification of climate resilient urban infrastructure; ensuring resilience measures and technologies are reflected in engineering designs; improving institutional climate resilience capacity.

UCCRTF support to Cities Development Initiative for Asia

Supporting:

- Prefeasibility study of urban infrastructure and services.

UCCRTF strengthening air quality improvement projects

Supporting:

- Preparation of City Level Clean Air Action Plans and accompanying investment plans.

UCCRTF Spatial Data Analysis Explorer (SPADE)

Supporting:

- Improved city-level climate and geospatial data; and project preparation, consultation and map production.

UCCRTF Platform for climate-resilient, low-carbon urban development

Supporting:

- A knowledge base on climate-informed urban development

According to the baseline assessment, Peshawar demonstrates a low level of resilience, an average of 2.44 out of 5, across the four key resilience areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. Given the existing socio-economic vulnerabilities, lack of adequate infrastructure, and frequency of urban flooding in the city, it is imperative for the city to strengthen its resilience, especially in terms of its critical infrastructure and ecosystems, integrated development planning, leadership, planning processes and stakeholder awareness and involvement. Despite the perception of relative financial security, residents are heavily dependent on government support programs, limiting their resilience when faced with shocks and hazards.

To contribute to improved resilience in Peshawar, ADB has approved the Khyber Pakhtunkhwa Cities Improvement Project (KPCIP), which will support governments in five cities in the Khyber Pakhtunkhwa Province, namely, Peshawar, Abbottabad, Kohat, Mardan and Mingora, to improve liveability through improvements in: (i) urban infrastructure, and (ii) institutional strengthening for urban services providers. Alongside, ADB has approved the KPCIP Project Readiness Financing (PRF), with the objective of financing the preparation and engineering design of KPCIP and possible future pipeline of urban projects in KPK. The PRF will ensure high project readiness of KPCIP, thereby facilitating the timely and cost-effective achievement of the project outcomes.

ADB is supporting the Cities Development Initiative for Asia, a multi donor trust fund managed by ADB, to strengthen its sustainable urban development orientation for conducting infrastructure pre-feasibility studies and disseminating knowledge products featuring innovative approaches to project design in CDIA project cities including Peshawar. This includes maintaining a core management team capable of administering the program and providing outreach to cities and national and regional urban development partners. The overall objective of the project is to strengthen the CDIA network and partnerships with national partner organizations in DMCs.

‘Strengthening Knowledge and Actions for Air Quality Improvement’ is a ADB linked loan project, aimed at enhancing the knowledge and capacity of participating

developing member countries (DMCs), including Pakistan (Sialkot and Peshawar) to develop policy actions and technological solutions for air quality management. This includes the assessment of current air quality situation, evaluation of innovative cost-effective technological and policy options and preparation of City Level Clean Air Action Plans (CAAPs) along with investment plans to implement CAAPs.

Resilience Building and the Urban Climate Change Resilience Trust Fund

Alongside ADB’s loan investment in the city, UCCRTF supported the following interventions: i) Urban resilience planning; ii) Prefeasibility study of urban infrastructure and services; iii) Climate-resilient infrastructure; iv) Capacity development for policy actions and technical solutions; v) A geo-spatial data tool the ‘Spatial Data Analysis Explorer (SPADE) to increase data access. These projects contribute to improving key areas where Peshawar’s resilience might be increased, according to the baseline study.

Urban resilience planning: UCCRTF supported three KPK cities, Peshawar, Abbottabad and Mardan, as part of the KPCIP to develop integrated urban plans and incorporate climate resilience in them. UCCRTF supported the integration of Urban Climate Change Resilience (UCCR) inputs into integrated urban development plans, which (i) include Urban Resilience Assessments (URAs) of socio-economic vulnerability, climate risk, and urban systems; (ii) provide an overview of UCCR issues and their relevance in the urban context; (iii) develop action plans that respond to climate risks on critical urban systems; and (iv) identify feasible soft and hard infrastructure projects to build UCCR. The URA for Peshawar combined regional climate data and city-level information from focus group discussions. The URA found that all districts (union councils) in the city experience some degree of vulnerability to climate impacts with most experiencing either very high or extreme vulnerability.²¹

Prefeasibility study of urban infrastructure and services: UCCRTF conducted urban climate change resilience assessments in Abbottabad, Mardan and Peshawar as part of its support to CDIA. CDIA was involved in the early part of project preparation of KPCIP by developing investment packages for the three cities,

Climate resilient infrastructure: As part of KPCIP Project Readiness Financing, UCCRTF implemented a \$2M intervention focused on integrating climate resilient (CR) technologies into detailed designs of urban infrastructures in Peshawar, Abbottabad, Kohat and Mardan. This included identifying CR urban infrastructures for KPCIP, ensure reflection of innovative CR measures and technologies in the DEDs of KPCIP and improving institutional CR capacity.

Capacity development for policy actions and technical solutions: In support of the ADB ‘Strengthening Knowledge and Actions for Air Quality Improvement’ project, UCCRTF assessed current air quality situation of Peshawar, evaluated innovative cost-effective technological and policy options, and prepared City Level Clean Air Action Plans (CAAPs). UCCRTF also produced investment plans to implement CAAPs, with the objective to develop policy actions and technological solutions for air quality management in the city and enhance capacity.

SPADE support (production of maps): SPADE (Spatial Data Analysis Explorer) is a web-based platform using open-source technology hosted on a centralized cloud-based server that contains various geospatial data that can be utilized for consultation, project preparation, production of maps, and analysis of climate change impacts. For Peshawar, SPADE can display layers/ information on vulnerability, various infrastructure (e.g., railways, roads, and highways), location of social facilities (e.g., health, and education, park and stadiums), water utilities, and certain land uses.

Potential areas for investment to strengthen Peshawar’s resilience

The baseline assessment provides a snapshot of perceived levels of resilience in Peshawar city, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment, these include:

- 1. Strengthened long-term development planning to ensure that investments are well targeted to build inclusive resilience.** The city should increase efforts to foster community engagement and collective identity through improvements to community-based awareness and mobilisation.
- 2. Investments in critical infrastructure systems, with a focus on those providing essential services to vulnerable populations, especially sanitation and drainage infrastructure to improve water quality and reduce pollution.**
- 3. Improved early warning systems and an increased awareness of citizens about them.**
- 4. Strengthened disaster management infrastructure and facilities and increased communities' awareness on disaster resilience and contingency measures.**

ENDNOTES

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Sahiwal

Sahiwal is a city that sits on the semi-arid plains of Punjab and is an important center for agriculture and agri-processing in the region, especially cotton. Whilst flooding is not a major climate risk for Sahiwal it is highly exposed to increasing temperatures and drought. This, alongside continued population growth and unplanned development, is straining the city's infrastructure systems.

This study provides a baseline assessment of Sahiwal's resilience based on a series of structured interviews

with city officials and on surveys that were conducted with 101 households in vulnerable districts of the city. It finds that the city's resilience is undermined by poor water, sanitation and transport infrastructure, which has adverse health impacts on the population. ADB is investing in Sahiwal's infrastructure, and these interventions are complemented by UCCRTF activities supporting several resilience interventions in the city.

KEY FINDINGS

- The main climate impacts faced by Sahiwal include higher temperatures and drought.
- The city's resilience is undermined by poor urban planning and rapid population growth, which has led to urban sprawl.
- The city's economy is heavily reliant on agriculture and agri-processing, which are climate-sensitive industries.
- Sahiwal's water and sanitation systems are in poor condition, with most of the water in the city not safe to drink.
- There has been little in the way of integrated urban planning in Sahiwal and planning decisions in the city are largely made without public consultation. Over one-third (39%) of households surveyed in the city rated their level of resilience as "low".
- Despite an effective early warning system in Sahiwal, most people surveyed reported that they did not move where to go to take shelter in the event of a disaster (95%).

Sahiwal in the context of climate change

Sahiwal sits in the low-lying, semi-arid, plains of Punjab. It is located approximately 150 kilometres (km) from the major city of Lahore in the densely populated region between the Sutlej and Ravi rivers. Before the development of the canal system in the early 20th century, Sahiwal was an area of barren land. However, the construction of the Lower Bari Doab Canal and later, the Deepalpur and Pakpattan canals allowed widespread irrigation of the area making it one of the most fertile areas of the province.

Agriculture is by far the main economic activity in the Sahiwal district. The city's population, estimated at around 1 million in 2014, also supports a diverse industrial sector. Sahiwal is famous for its cotton ginning and pressing, tannery, textiles, leather products, garments, pharmaceuticals, flourmills, and its food industry.

The dependency of its economic activities on agriculture and agri-processing makes it economically vulnerable to climate change, especially given the high levels of irrigation across the district. According to ADB's Climate Change Profile of Pakistan,¹ Sahiwal's primary climate-related risks stem from increased aridity and drought. Groundwater is the sole source of potable water exploited in Sahiwal. In recent years, the water table has been dropping at a rate of 0.30 meter per year due to irrigation and decreased rainfall.²

Climate projections suggest that Sahiwal and the wider Punjab state will experience declining precipitation rates and increasing temperatures. Precipitation decreases of up to 2.98 mm per decade (under a high emissions scenario) are projected until 2050, whilst temperatures are expected to rise 0.63°C per decade under the same scenario.³ For surface water, analyses of river flows from 1947–2003 show a decreasing

trend.⁴

This may have a significant impact on key agricultural industries including cotton production. Recent analysis on climate risks to cotton for the 2040s indicate that the Sahiwal district faces a high risk of a shortened growing season thanks to rising temperatures, reducing overall yields. For the 2040s, increasing global temperatures will result in more days over the optimal threshold of 30°C for cotton cultivation.⁵

Another significant climate risk for Sahiwal is the 'Loo' winds weather phenomenon whereby dust from the dry parched earth is blown through the city making out-door work difficult. Increased aridity and less rainfall may exacerbate this effect.

Sahiwal's resilience to climate change and other shocks is undermined by the generally poor quality of its infrastructure and service provision. The city's water supply and sanitation infrastructure are especially poor. The water distribution network covers 90% of the city, but the pipe network is outdated, and sewage intrusion occurs during non-supply hours, when the system is not pressurized. Chlorination facilities at the tube wells are currently out of order, so the water is not subjected to any form of disinfection before it is distributed to the consumers.⁶

Resilience context

Climate impacts



Sahiwal faces **increased aridity and drought**. In recent years, the water table has been dropping at a rate of 0.30 meters per year



Precipitation decreases of up to 2.98 mm per decade are projected until 2050



Temperatures are expected to rise 0.63°C per decade under a high emissions scenario

Additional factors



Sahiwal's economy is heavily reliant on agriculture and agri-processing which are climate sensitive industries



Poor water and sanitation systems are causing pollution and increasing health risks from water borne diseases

City Resilience Profile



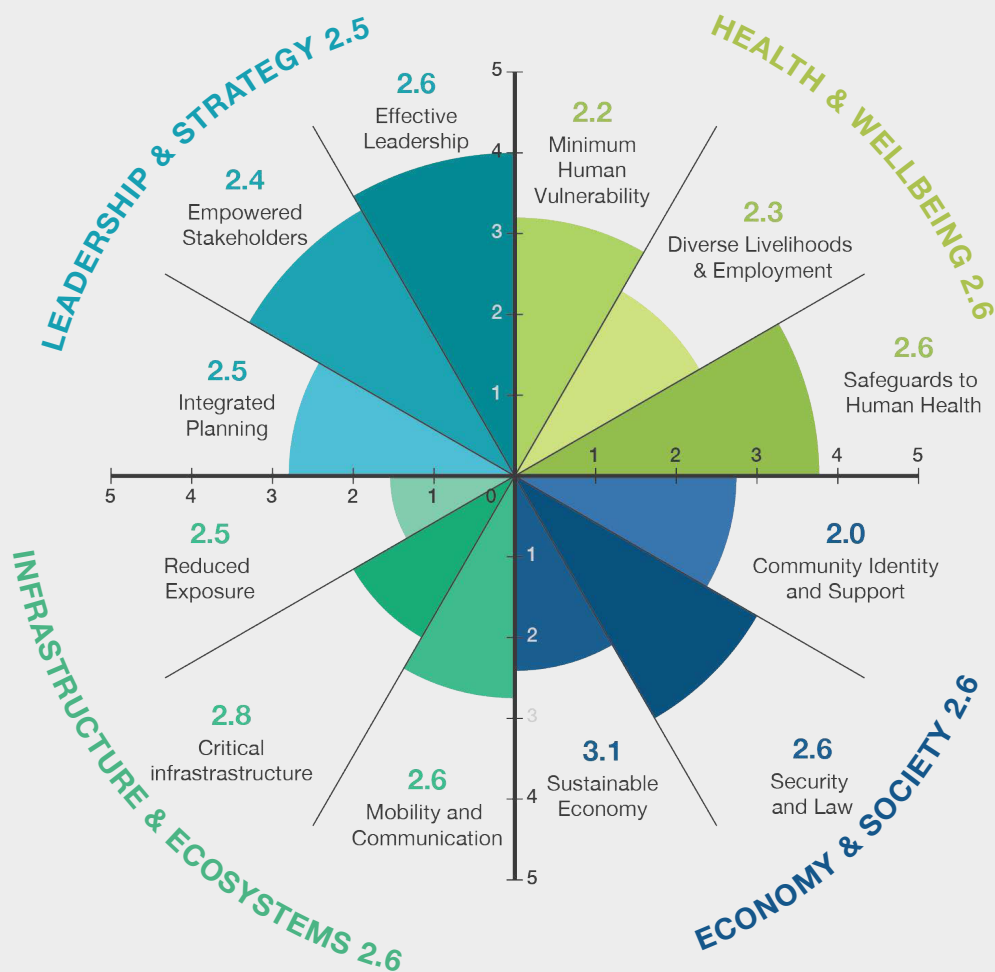
In 2018, ADB's Urban Climate Change Resilience Trust Fund (UCCRTF) visited Sahiwal to conduct baseline assessment of the city's resilience. The study assessed Sahiwal's resilience in four key areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe.⁷ The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis shows that Sahiwal requires significant investment across all four resilience dimensions to reduce the vulnerability of its residents, especially when faced with an emergency. The results of this baseline assessment are discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

Growth in Sahiwal has been largely unplanned, which has led to urban sprawl,⁸ the last recorded land-use study was completed in September 1972 and no overall urban plan exists. Overall, the concept of an integrated planning approach is not well embedded⁹ ("Integrated Development Planning": 2.5). There is a general lack of community consultation or engagement about urban planning and development, and in disaster management and response ("Empowered stakeholders": 2.4).¹⁰ Capacity and resource issues hamper effective leadership and management of urban infrastructure and services, for example rate collection for Sahiwal's water supply services only meets around 75% of the operation and management costs ("Effective Leadership and Management": 2.6).¹¹

HEALTH & WELLBEING

Sahiwal is highly dependent on agriculture and ari-processing which are climate vulnerable sectors ("Diverse Livelihood and Employment": 2.3). The city is well served by healthcare facilities with three district hospitals ten rural health centres and around 75 basic health units.¹² However, health outcomes in the city are undermined by poor quality water and sanitation infrastructure. Collected waste is dumped at designated dump sites at Ratti Tibbi, without any environmental safeguards, such as segregating hazardous waste produced by tanneries, slaughterhouses and hospitals ("Minimum Human Vulnerability" 2.2).¹³ Disaster management processes are not well established. The last Disaster Risk Management Plan covering Punjab Province was published in 2008 and it has not been well sensitised in the population ("Effective safeguards to Human Health & Life": 2.6).



INFRASTRUCTURE & ECOSYSTEMS

Sahiwal has good internet and digital communications infrastructure.¹⁴ However, its transportation systems are poor. The local road network is congested, with around 30% of roads in poor condition. The sidewalks are often blocked or missing making walking unpleasant and dangerous (“Mobility and communications”: 2.6). There is lack of green spaces in the city and the existing parks are not well maintained. Water and sewerage infrastructure is especially poor. For example, decaying water infrastructure means system losses are as high as 50%. (“Provision of critical infrastructure”: 2.8).^{15,16,17} Unplanned growth has seen a proliferation of housing in climate vulnerable areas and the lack of a database of municipal schemes and requirements; maps, master plans, infrastructure development plans and network maps has made resilience planning difficult (“Reduced exposure”: 2.5).

ECONOMY & SOCIETY

Sahiwal’s 220 factories, provide around 8,200 jobs with agri-processing an important sector. Economic development is limited by poor infrastructure systems especially transport and energy. Sahiwal’s power supply is unreliable. Interruptions are frequent, forcing businesses, and many of the residents to rely on costly and polluting diesel generators¹⁸ (“Sustainable Economy”: 3.1). Sahiwal’s low score for “Collective Identity & Community Support (2.0) suggests that the city does not have a unified, cohesive society which can undermine resilience especially at times of crisis. The district has an annual policing plan,¹⁹ however information and data for crime prevention is patchy and resources are limited (“Security & Rule of Law”: 2.6).²⁰

Household perceptions of resilience

Alongside the city-level baseline study, UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain sections of the city's population. The data collection was limited to 101 respondents from wards where ADB infrastructure investments are planned or underway. The results provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community in Sahiwal, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the best, against four characteristics: i) Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As shown in Figure 1, respondents scored Sahiwal consistently low across the four categories with the highest rating being 2.88 for Connectedness and the lowest score being 1.76 for Economic Opportunities. Overall, Sahiwal scored 2.44; suggesting weak community resilience. However, these results may be influenced by the socio-economic position of many of the households that were interviewed for the survey.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Asset Ownership; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social Safety Net. Scores against each of these

dimensions were calculated as an averaged index from survey responses and secondary data.

As shown in Figure 2, perceived household resilience was highest for "income and food access" with 81% feeling that they had sufficient access to food. Levels of asset ownership and access to basic services were also relatively high, with 65% reporting that they owned assets and 73% of households saying access to basic services in their area. Despite the perception of relative financial security in Sahiwal, over two thirds (71%) of households feel that they are still dependent on some form of government-supported social program, suggesting that these households are less resilient when faced with a disaster or shock.

To understand major shocks and stresses and their likely impacts, the residents of Sahiwal were asked about disasters and unexpected shocks and stresses that they had faced in the past five years. Half of respondents felt that their level of resilience was "medium" (50%) and 39% who saw their resilience as "low", compared with just 11% who felt they had relatively high levels of resilience. Of those surveyed 9% listed "heavy rain/hailstorm" as a major shock with strong impact. Waterlogging and flooding affected 10% of households with a strong impact. Shocks such as chronic illness (32%), and loss or reduction in income (28%) had, on average, a strong impact in the Sahiwal area. A sudden or dramatic increase in food prices affected 23% with strong impact on these households.

The residents of Sahiwal used multiple strategies to recover after unexpected shocks. 60% of households

Figure 1

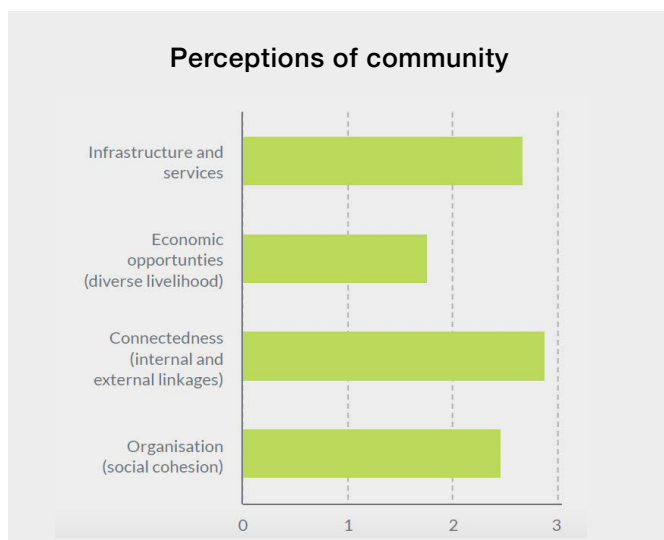
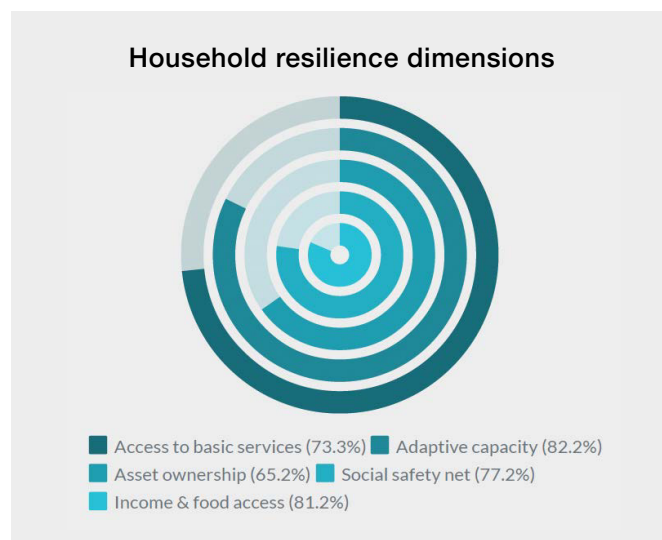


Figure 2



used their savings to recover from these unexpected shocks. The percentage of households taking loans with interest from a non-formal source was 16%. Besides requesting local government assistance, the other strategies used included reducing expenditures on health and education; reducing the number of meals and the quantity of food per day; and seeking assistance from local NGOs or family and friends and asset sales. As shown in Figure 3, one third (33%) of respondents reported that they were unable to recover from serious shocks and stresses, whilst a further 20% felt they were able to recover to the same level as before the shock occurred.

Disaster response in Sahiwal

Awareness and access to information is critical in mitigating the effect of disaster. In Sahiwal, less than one third of residents (30%) received an early warning before the last disaster. Of those that did, 90% got this information from the television, and 20% received information from a neighbour. However, no respondents received warnings from a disaster committee or a disaster volunteer, and almost all respondents (99%) said that they were unaware of any trained community volunteer, or of anyone in the household who had received disaster training. This suggests that the disaster management system in Sahiwal is non-existent or highly ineffective.

The lack of a disaster management system appears to affect the emergency response in the city. 95% of

respondents were not aware of where to seek shelter or find help in case of disaster, and no one reported that they had moved to another place to take shelter either before or after the last disaster. Additionally, over half (52.5%) of respondents said that they had no plan in place to cope with a disaster.

Early warning system in Sahiwal

Given the high-level of exposure to climate change and its impacts, Sahiwal needs significant investment to strengthen the resilience across all four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. Fundamental to these improvements is the need to establish a development control framework to prevent further unplanned expansion into high-risk areas. Similarly, integrated urban planning processes need to be updated, ratified and enforced to ensure the city can reduce its climate vulnerability and increase economic opportunities for its citizens. Addressing the very considerable infrastructure gaps will be crucial to its future development, especially with regards to water supply, sewage and waste management, energy supply and transport.

Overall, the results of the household survey appear to support the scores at the city level, with high levels of income and food access lending the populations resilience to shocks and stresses. However, the household survey also pointed to areas for improvement, especially regarding a high dependence on government-

Figure 3

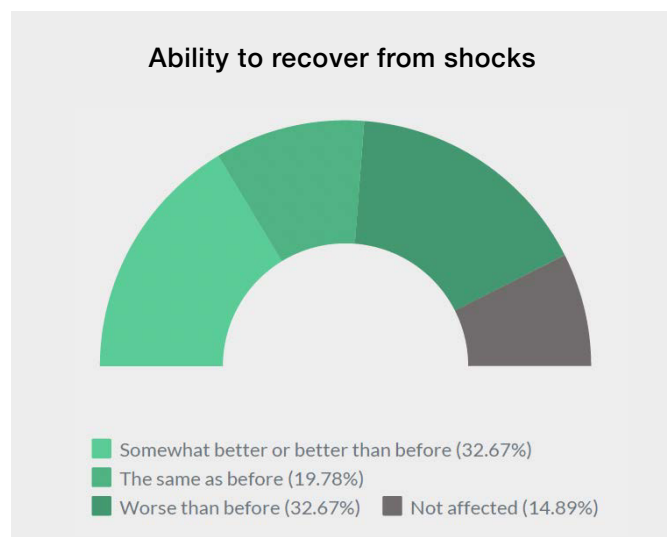
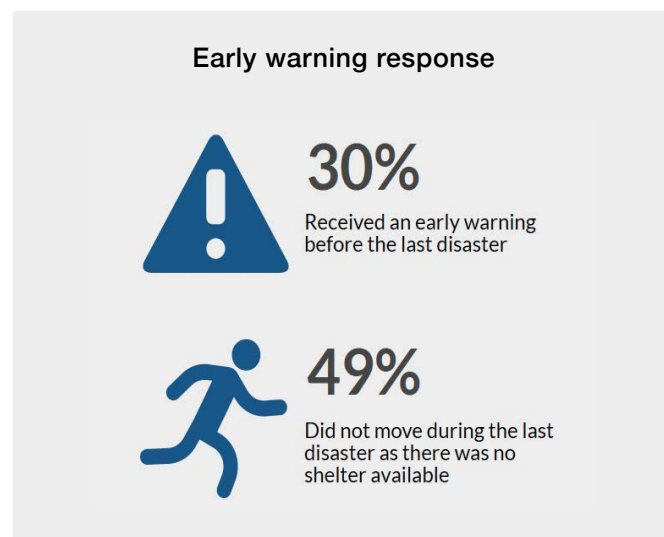


Figure 4



Resilience interventions in Sahiwal

ADB and UCCRTF projects in Sahiwal

CURRENT ADB PROJECT

Punjab Intermediate Cities Improvement Investment Project (PICIIP)

\$200 million between 2 cities in the Punjab province



Strengthen water supply systems



Sanitation system improved



Improve park and green area development



Institutional support and capacity development

UCCRTF Supported Preparation of pre-feasibility studies to support the PICCIP
\$0.67 million

Supporting:

- the Cities Development Initiative for Asia (CDIA) to strengthen Sahiwal's sustainable urban development orientation
- the maintenance of a core management team capable of administering the program well, and providing outreach to cities and national and regional urban development partners

UCCRTF Supported Preparation of Rapid Urban Assessments (RUAs)

Supporting:

- the establishment of a framework for urban planning in Sahiwal which is now a requirement for all other cities in Punjab seeking government investments

UCCRTF Supported Preparation of Integrated City Development Strategies (ICDSs)

Supporting:

- the incorporation of a climate risk and vulnerability assessment for Sahiwal

UCCRTF Spatial Data Analysis Explorer (SPADE)

Supporting:

- improved city-level climate and geospatial data
- project preparation, consultation and map production

To begin to address these issues, ADB is supporting the city through several projects including the Punjab Intermediate Cities Improvement Investment Project (PICIIP). This \$200 million project aims to improve the quality of life of the residents in cities of Sahiwal and Sialkot in Punjab Province, making these cities more livable and sustainable. The PICIIP will do this through strategic investments in urban infrastructure and services, and operations and maintenance capacity for urban service delivery. Investments will be made to strengthen: (i) water supply systems; (ii) sanitation systems (iii) urban public spaces; and (iv) institutional support and capacity.

Resilience Building and the Urban Climate Change Resilience Trust Fund

To complement the ADB loan project, UCCRTF is also supporting several interventions:

- i) Preparing prefeasibility studies to support the PICCIP;
- ii) Preparing of Rapid Urban Assessments (RUAs) and Integrated City Development Strategies (ICDSs) to support the PICCIP interventions;
- iii) Undertaking Urban Resilience Assessments supported by a geo-spatial data tool, the 'Spatial Data Analysis Explorer (SPADE), to increase data access; and

Preparing of Rapid Urban Assessments (RUAs) and Integrated City Development Strategies (ICDSs) UCCRTF supported the preparation of the RUAs and ICDSs, which incorporate a climate risk and vulnerability assessment for Sahiwal and Sialkot. It helped to establish a framework for urban planning in both cities which is now a requirement for all other cities in Punjab seeking government investments.

Preparing Prefeasibility studies to support the PICCIP. Through the Cities Development Initiative for Asia (CDIA) this \$0.64 million TA (covering Sahiwal and Sialkot) will support CDIA to strengthen Sahiwal's sustainable urban development orientation. This will include maintaining a core management team capable of administering the program well, and providing outreach to cities and national and regional urban development partners. Project outputs include: (i) Prefeasibility studies to support the PICCIP; (ii) Knowledge products

featuring innovative approaches to project design; (iii) CDIA network and partnerships with national partner organizations.

SPADE: Sahiwal was also supported through a TA in the preparation of urban resilience assessments (URA) and planning processes involving local stakeholders. The data generated through the URA are the same data made available through SPADE. SPADE is a web-based platform supported by UCCRTF that contains various geospatial data that can be used for consultation, project preparation, production of maps, and analysis of climate change impacts. Hosted on a centralized cloud-based server, the platform uses open-source technology to provide support to Regional Departments on their planning and spatial analysis needs. Sahiwal was one of five pilot cities covered by SPADE. The maps and socio-economic surveys carried out in the city have been digitized and are available on the platform.

Potential areas for investment to build Sahiwal's resilience

The baseline assessment provides a snapshot of perceived levels of resilience in Sahiwal, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment.

1. Increased investment in the quality of Sahiwal's water supply, and effective drainage and sanitation infrastructure. Poor infrastructure in this area poses health risks to the population, especially during emergencies.

2. Increased investment in waste management, and energy infrastructure. These directly influence Sahiwal's ability to improve socio-economic conditions and increase equitable access to economic opportunities.

3. Strengthened efforts to foster community engagement and support in resilience planning and urban development, and in disaster response. The city should develop integrated urban planning processes that include climate resilience assessments.

4. Economic diversification to provide livelihood opportunities that are less reliant on agriculture

infrastructure. This will also help to boost employment opportunities and reduce poverty.

5. Improved transport infrastructure and internal transport links. This will reduce congestion and improve air quality, to meet the demands of a growing population.

6. More green spaces and public realm improvements that can provide social benefit and help reduce the impact of extreme temperatures.

ENDNOTES

1. ADB (2017) Climate Change Profile of Pakistan. <https://www.adb.org/sites/default/files/publication/357876/climate-change-profile-pakistan.pdf>
2. ADB (2017) Initial Environmental Examination. PAK: Punjab Intermediate Cities Improvement Investment Project Sahiwal City. https://www.adb.org/sites/default/files/project-documents/46526/46526-007-iee-en_0.pdf
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9. Government of Pakistan (2021) The Urban Unit, Planning and Development Dept., Punjab. Sahiwal City Profile Punjab Cities Improvement Investment Program
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Sialkot

Alongside Lahore and Faisalabad, Sialkot is one of the largest economic hubs in Punjab. It has a thriving manufacturing industry which supports a relatively high per capita income for its citizens. The city is exposed to various climate impacts, including flooding and rising temperatures. These impacts, along with the rapidly rising population, are putting increasing stress on Sialkot's infrastructure systems, including transport and housing. Unplanned urban sprawl and poor solid waste management systems undermine the city's resilience.

This study provides a baseline assessment of Sialkot's resilience based on a series of structured interviews

with city officials and on surveys that were conducted with 107 households in vulnerable districts of the city. It finds that significant investment is required to improve the city's ability to respond to shocks and stresses. ADB is investing in Sialkot's infrastructure, and these interventions are complemented by UCCRTF activities supporting several resilience interventions in the city.

KEY FINDINGS

- The main climate impacts faced by Sialkot include higher temperatures, drought, and increasing monsoon seasonal rainfall along with increasing frequency and intensity of extreme weather events.
- The city's resilience is undermined by poor urban planning and rapid population growth, which has led to urban sprawl and construction in areas prone to flooding.
- Sialkot's solid waste management system is poor, with only a quarter of the city's solid waste dealt with effectively. The remaining waste is dumped or burned, leading to adverse health consequences and blocking drains exacerbating flooding.
- Access to clean drinking water is extremely limited, with most residents boiling water or visiting local filtration stations, sometimes far from their homes.
- Planning decisions in the city are largely made without public consultation. Over one-third (35%) of households surveyed in Sialkot rated their level of resilience as "low".
- Despite an effective early warning system in Sialkot, most people surveyed reported that they did not move to another place to take shelter either before or after the last disaster (84%).

Sialkot in the context of climate change

Sialkot sits in a fertile agricultural basin close to the Indian border around 125 km north of Lahore. The third largest economic hub in Punjab, Sialkot has a per capita income almost double the national average.¹ This is due to its emergence as a specialized industrial center manufacturing sporting goods, surgical equipment and leather products. At the same time, Sialkot plays an important regional role as an agricultural processing and shipping center, supporting employment in the wider Punjab district.

The main climate change impacts facing Sialkot are higher temperatures, drought, and increasing monsoon seasonal rainfall along with increasing frequency and intensity of extreme weather events.²

The projected temperature increase is expected to be between 4.4 and 4.9°C by 2080.³ For Sialkot, higher temperatures may increase discomfort and lead to increased energy consumption for cooling. The increased energy consumption will further constrain limited electricity supply. It also represents an added health risk, particularly for the elderly and other vulnerable groups. There were 13 heat waves during the 8 years from 2006 to 2014, with the most severe one happened in 2012, which lasted for 16 days. By 2050 and 2100, the number and length of heat wave are both projected to increase. Based on the mid scenario projection, the heat wave changes from average of 1.6 times per year to 2.5 times per year.⁴

Annual rainfall levels in the region are expected to be relatively stable but the variability of monsoon rains is expected to increase with the Sialkot experiencing higher frequency of heavy rainfall.⁵ This changing weather pattern may lead to increased frequency of droughts during the

dry season, and flooding during the monsoon season. Several rivers flow through the area from the northeast to southwest feeding into the Indus River. Sialkot suffers from seasonal flooding when these rivers overflow due to rainfall in the wider basin that drains the mountainous regions of Kashmir.

The effects of climate impacts in Sialkot are exacerbated by the city's poor infrastructure systems. Population growth has put increasing pressure on the city's infrastructure, and investment has not kept pace. Since 2001, overall public sector investment in urban infrastructure and service delivery has declined. Punjab's intermediate city infrastructure investment currently averages only \$4 per capita. This compares with \$10 in Lahore, and upwards of \$200 per capita in many developed nations.⁶

The city has no separate storm water system, and drains are frequently blocked with solid waste.⁷ Sialkot's solid waste management system is inadequate. Of the 125,000 tons per year of municipal solid waste generated, only 25% enters the municipal waste system, leaving 75% of the population without waste collection.

Resilience context

Climate impacts



The variability of monsoon rains is expected to increase with a **higher frequency of heavy rainfall**



Changing weather patterns may lead to **increased frequency of droughts** during the dry season



The projected **temperature increase is expected** to be between 4.4 and 4.9°C by 2080

Additional factors



Poor urban planning and rapid population growth have led to urban sprawl and **areas prone to flooding**



75% of Sialkot's waste is dumped or burned, leading to health consequences and blocked drains which exacerbates flooding

City Resilience Profile



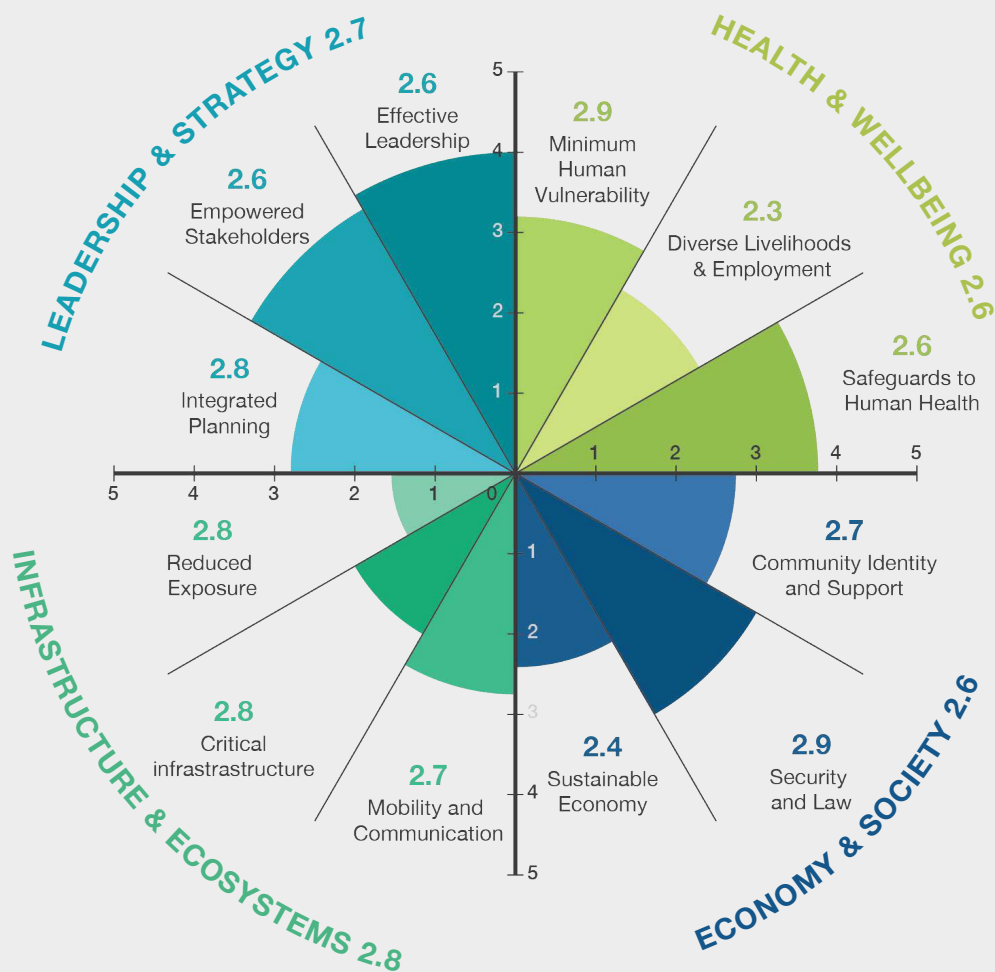
In 2018, ADB's Urban Climate Change Resilience Trust Fund (UCCRTF) visited Sialkot to conduct baseline assessment of the city's resilience. The study assessed Sialkot's resilience in four key areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe.⁸ The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis shows that Sialkot scores poorly in the dimensions of 'Health and Wellbeing', and 'Infrastructure and Ecosystems', suggesting it needs major improvements in these areas to reduce the vulnerability of its residents, especially when faced with an emergency. However, in terms of leadership and strategy, Sialkot demonstrates qualities that lend it resilience. The results of this baseline assessment are discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

Sialkot continues to experience very high rates of population growth and urban sprawl with virtually all of this expansion being unplanned.⁹ On current trends the city could triple in physical area over the next 20 years. ("Integrated Development Planning": 2.8)¹⁰ Planning decisions in the city are largely made without public consultation, reducing the city's ability to take planning decisions that have the desired impact on development and benefit the community ("Empowered stakeholders": 2.6).¹¹ Overall guidance for urban development comes from the Punjab Urban Development Sector Plan 2018. Sialkot lacks capacity to develop and deliver effective urban planning, however there has been significant improvements in the last five years thanks to urban improvement projects in the city. ("Effective Leadership and Management": 2.6).¹²

HEALTH & WELLBEING

Sialkot has a large factory workforce spread over more than 3,000 factories and nearly 69% of employment is in the informal sector which provides few social safety nets.¹³ Skilled workers in Sialkot also earn 26% less than the national average ("Diverse Livelihood and Employment": 2.3).¹⁴ Despite high levels of employment in the manufacturing sector Sialkot's residents are economically insecure. Average wages would need to increase by around 50% to meet living wage levels.¹⁵ The poor quality of water in the city also undermines human health ("Minimum Human Vulnerability" 2.9). Sialkot is served by 4 district hospitals and over 20 other hospitals or specialized care facilities. However human health is undermined by the cities poor sanitation infrastructure which leads to high incidence of water-borne diseases ("Effective safeguards to Human Health & Life": 2.6).¹⁶



INFRASTRUCTURE & ECOSYSTEMS

Sialkot has road linkages to nearby major cities and towns and is connected to the railway system. The transport situation within the city, however, is characterised by high congestion with little space for pedestrians and no facilities for non-motorized transport. Public transport is not adequately developed (“Mobility and communications”: 2.7).¹⁷ Sialkot has very few green areas or parks, with the most prominent being Gulshan-e-Iqbal Park off Narowal Road, a park in the Cantonment and the Stadium. There is need for more open spaces, more defined spaces for industrial activities.¹⁸ Sialkot’s solid waste infrastructure is especially poor. (“Provision of critical infrastructure”: 2.8).¹⁹ A lack of drainage, relatively poor quality housing, and high levels of unplanned development serve to undermine the resilience of the city to climate impacts, especially flooding (“Reduced exposure”: 2.8).²⁰

ECONOMY & SOCIETY

Industrial manufacturing is the largest employer in Sialkot, followed by trade and hospitality, construction and personal care services.²¹ The city is also dependent on agriculture being a hub for agri-processing. The per capita income of Sialkot is ranked among the highest in Pakistan and it has a relatively well-developed educational infrastructure.²² However, the illiteracy rate is high standing at over 20%. (“Sustainable Economy”: 2.4).²³ The city scores poorly for its collective identity and community support, reflecting the lack of public consultation and engagement on planning and development issues (“Collective Identity & Community Support”: 2.7). Similarly the city’s resilience is further undermined by poor levels of security and access to justice for all members of society (“Security & Rule of Law”: 2.9).

Household perceptions of resilience

Alongside the city-level baseline study, UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain sections of the city's population. The data collection was limited to 107 respondents from wards where ADB infrastructure investments are planned or underway. The results provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community in Sialkot, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the best, against four characteristics: i) Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As shown in Figure 1, respondents scored Sialkot highest for community organisation (2.14), but relatively poorly for economic opportunities (2.29), connectedness (2.28) and infrastructure and services (2.56). Overall, Sialkot scored 2.31; suggesting weak community resilience. However, these results may be influenced by the socio-economic position of many of the households that were interviewed for the survey.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Asset Ownership; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social Safety Net. Scores against each of these

dimensions were calculated as an averaged index from survey responses and secondary data.

As shown in Figure 2, perceived household resilience was highest for "income and food access" with 96% feeling that they had sufficient access to food. Levels of asset ownership stand at 51%, 80% of households said they are aware of the availability of basic services in their area. Despite the perception of relative financial security in Sialkot, over half (83%) of households feel that they are still dependent on some form of government-supported social program, suggesting that these households are less resilient when faced with a disaster or shock.

To understand major shocks and stresses and their likely impacts, the residents of Sialkot were asked about disasters and unexpected shocks and stresses that they had faced in the past five years. 8 out of 10 respondents rated their resilience as "low" (81%) with 17% saying "medium" (17%) and just 2% who felt they had relatively high levels of resilience. As shown in Figure 3, almost a third of respondents reported that their ability to recover from shocks was the same as before (35%), a further 25% felt that their ability to recover was "somewhat better" or "better" than before, and 7% felt that it was worse than before.

Figure 1

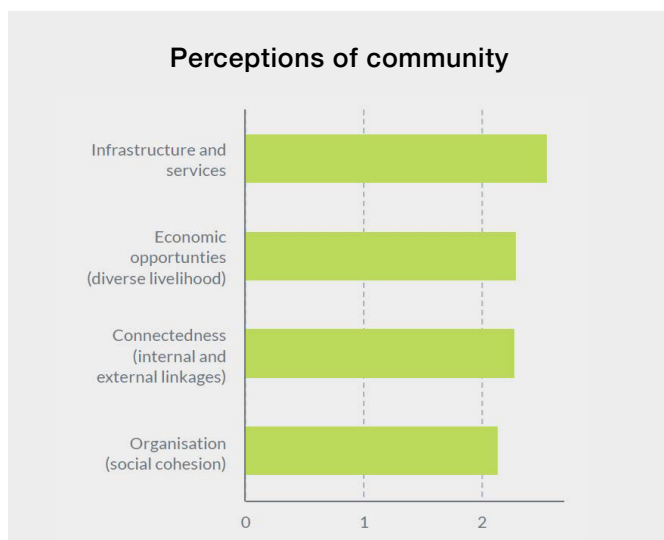
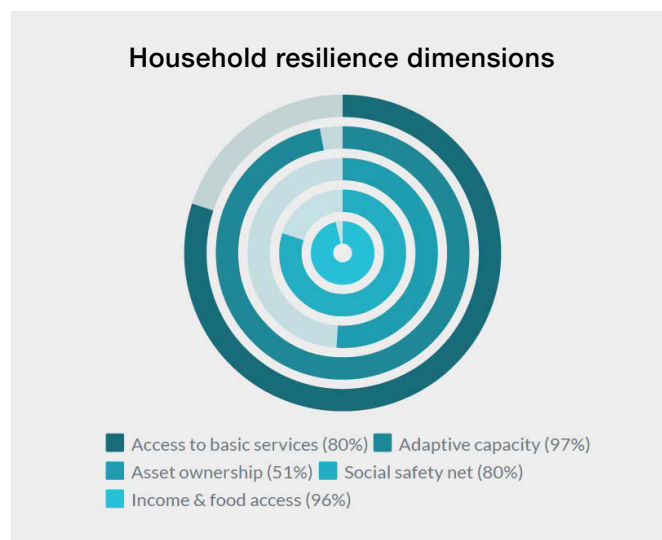


Figure 2



Disaster response in Sialkot

Almost all respondents in Sialkot reported that they had received an early warning before the last disaster (94.4%). These warnings were communicated effectively via multiple channels, the most popular of which were: radio (100%), television (100%), and a relatively small proportion from neighbours, relatives, NGOs or mosques (17%). However, 94% of households were not aware of where to seek shelter or help in case of a natural disaster, suggesting ineffective city-level mechanisms to create awareness and provide protective infrastructure.

Despite the effective early warning system in Sialkot, almost no one moved to another place to take shelter either before or after the last disaster (99%). This is likely due to several factors. Firstly, the most popular communications channels for receiving the early warnings were largely passive. Far fewer respondents reported receiving warnings via direct instruction from people who have received training such as community volunteers or disaster management committees.

Secondly, responses indicate that early warning information was not entirely accessible. 90% of respondents were not aware of any members of the community who are trained to help during a disaster and very few people reported having received disaster preparedness training. Additionally, over half (73.8%) of respondents said that they do not know what they would do if a disaster were to happen.



Figure 3

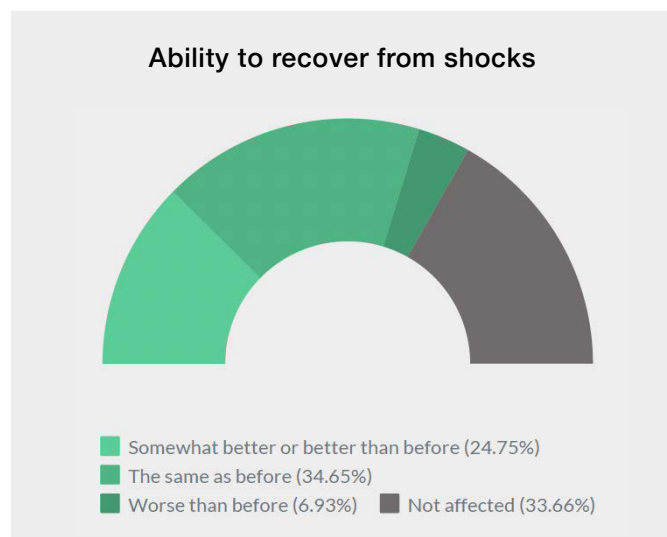


Figure 4



Resilience interventions in Sialkot

ADB and UCCRTF projects in Sialkot

CURRENT ADB PROJECT

Punjab Intermediate Cities Improvement Investment Project (PICIIP)

\$200 million between 2 cities in the Punjab province



Strengthen water supply systems



Sanitation system improved



Improve park and green area development



Institutional support and capacity development

UCCRTF Support to the PICIIP \$0.67 million

Supporting:

- preparation of pre-feasibility studies to support the PICIIP
- preparation of Rapid Urban Assessments (RUAs)
- preparation of Integrated City Development Strategies (ICDSs) to support the PICIIP interventions

UCCRTF TA Supporting Sustainable Transport for All \$5.5 million (for 19 countries)

Supporting:

- road asset management
- road safety
- e-mobility support
- knowledge and capacity of DMCs in sustainable transport improved

UCCRTF TA Supporting Strengthening Knowledge and Actions for Air Quality Improvement \$2.5 million

Supporting:

- technical assistance to enhance the knowledge and capacity to develop policy actions and technological solutions for air quality management
- preparation of City Level Clean Air Action Plans and accompanying investment plans

UCCRTF Spatial Data Analysis Explorer (SPADE)

Supporting:

- improved city-level climate and geospatial data
- project preparation, consultation and map production

According to the baseline assessment Sialkot requires investment across all four resilience dimensions. This was reinforced by the results of the household survey that showed that the city's weak infrastructure undermines the perceived resilience of its citizens. Given the city's high-level of exposure to climate change and its impacts, Sialkot should prioritise investments that deal with its most pressing infrastructure challenges and make improvements across all four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy.

Fundamental to these improvements is the need to establish planning processes and procedures, ensuring that future development is well planned and preventing urban sprawl. Addressing the considerable infrastructure gaps will be crucial to its future development, especially with regards to flood protection, water supply, and solid waste management.

The results of the household survey appear to support the scores at the city level, with high levels of income and food access lending the populations resilience to shocks and stresses. However, the household survey also pointed to areas for improvement, especially regarding a high dependence on government-supported social programmes that leave households highly susceptible to climate change impacts.

To begin to address these issues, ADB is supporting the city through several projects including the Punjab Intermediate Cities Improvement Investment Project (PICIIP). This \$200 million project aims to improve the quality of life of the residents in cities of Sialkot and Sahiwal in Punjab Province, making these cities more livable and sustainable. The PICIIP will do this through strategic investments in urban infrastructure and services, and operations and maintenance capacity for urban service delivery. Investments will be made to strengthen: (i) water supply systems; (ii) sanitation systems (iii) urban public spaces; and (iv) institutional support and capacity.

ADB is also supporting Sialkot through the Strengthening Knowledge and Actions for Air Quality Improvement project that is helping to develop policy actions and technological solutions for air quality management.

ADB's Implementation of Sustainable Transport for All project is also active in Sialkot, helping to support sustainable transport operations through project

preparation, implementation, and capacity development to operations departments. Project outputs include: (1) Road asset management, road safety, and e-mobility support provided; (2) Knowledge and capacity of DMCs in sustainable transport improved.

Resilience Building and the Urban Climate Change Resilience Trust Fund

To complement the ADB loan project, UCCRTF is also supporting several interventions:

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- i) Preparing prefeasibility studies to support the PICCIP;
- ii) Preparing of Rapid Urban Assessments (RUAs) and Integrated City Development Strategies (ICDSs) to support the PICCIP interventions;
- iii) Developing City Level Clean Air Action Plans (CAAPs);
- iv) E-mobility support to improve transport infrastructure;
- v) Undertaking Urban Resilience Assessments supported by a geo-spatial data tool, the 'Spatial Data Analysis Explorer (SPADE), to increase data access; and

Preparing of Rapid Urban Assessments (RUAs) and Integrated City Development Strategies (ICDSs) UCCRTF supported the preparation of the RUAs and ICDSs, which incorporate a climate risk and vulnerability assessment for Sialkot and Sahiwal. It helped to establish a framework for urban planning in both cities which is now a requirement for all other cities in Punjab seeking government investments.

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CDIA network and partnerships with national partner organizations.

Developing CAAPs: In support of the ADB Strengthening Knowledge and Actions for Air Quality Improvement project, this UCCRTF TA will help to build the business case for investment through the preparation of City Level Clean Air Action Plans (CAAPs) along with investment plans to implement CAAPs.

E-mobility support: UCCRTF is identifying potential e-mobility solutions for Sialkot in connection with ADB's Implementation of Sustainable Transport for All project. The TA will support capacity development through policy actions and technical solutions.

SPADE: Sialkot was also supported through a TA in the preparation of urban resilience assessments (URA) and planning processes involving local stakeholders. The data generated through the URA are the same data made available through SPADE. SPADE is a web-based platform supported by UCCRTF that contains various geospatial data that can be used for consultation, project preparation, production of maps, and analysis of climate change impacts. Hosted on a centralized cloud-based server, the platform uses open-source technology to provide support to Regional Departments on their planning and spatial analysis needs. Sahiwal was one of five pilot cities covered by SPADE. The maps and socio-economic surveys carried out in the city have been digitized and are available on the platform.

Potential areas for investment to strengthen Sialkot's resilience

The baseline assessment provides a snapshot of perceived levels of resilience in Sialkot, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment, these include:

1.Increased investment in water supply, transport, waste management and flood protection infrastructure. These directly influence Sialkot's ability to improve socio-economic conditions and increase equitable access to economic opportunities.

2.Strengthened efforts to foster community engagement and support in resilience planning and urban development.

3.Increased investment in the quality of Sialkot's water supply, and effective drainage and sanitation infrastructure. Poor infrastructure in this area poses health risks to the population, especially during emergencies.

4.Improved transport infrastructure and internal transport links. This will reduce congestion and improve air quality, to handle a growing population.

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City Resilience Profiles

Philippines



URBAN CLIMATE
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Janiuay

Janiuay, in the Iloilo province of Panay Island, is vulnerable to a wide range of climate-related impacts, including heavy rain, river flooding, and landslides. The city's growing population and poor infrastructure systems for water supply and waste management undermine its resilience.

The results of the baseline study indicate that considerable investment is needed for Janiuay to build

resilience to key shocks and stresses against each of the resilience dimensions in the study. UCCRTF is working with Janiuay as an active partner to strengthen the city's critical infrastructure, including its water supply system through a rainwater harvesting facility.

KEY FINDINGS

- Janiuay is prone to climate change shocks and stresses, particularly earthquakes, flooding, landslides, storm surges and tsunamis, which could exacerbate the current socioeconomic conditions, such as migration and traffic issues, in the heavily urbanized city center.
- An average score of 3.6 out of 5 across all 4 dimensions of city resilience in health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy indicates that Janiuay displays adequate resilience.
- The city will be able to strengthen its resilience by investing in critical infrastructure and reducing the vulnerability of its residents, particularly in relation to Health and Wellbeing.
- Janiuay scored the lowest on the Health & Wellbeing indicator, suggesting that the city needs to take action to safeguard its residents in case of an emergency.
- The city can strengthen its resilience by investing in infrastructure that can handle the increased population in urban centers and protect citizens from flooding.

Janiuay in the context of climate change

The city of Janiuay is located in the Iloilo province of Panay Island in the Western Visayas region of the Philippines. Mountains rise to the west of the city, whilst flat plains extend to the coast some 35 kilometers (km) to the east. Janiuay sits on the floodplain of Suague River, which provides the fertile soils that sustain a thriving agricultural economy. With a current population of 63,905 that is expected to rise dramatically by 2050, rapid urbanization and unplanned development pose potential threats that will be exacerbated by the impacts of climate change, such as lack of housing for the lower- and middle-income class, lack of adequate power and water supply and rising unemployment.

The Philippines is one of the most vulnerable countries to climate change in the world¹ and is regularly impacted by severe climate-related events, such as tropical storms. The country lies in the most cyclone-prone region in the world² and, in 2018, experienced one of the most powerful typhoons to make landfall in the Philippines since Haiyan in 2013 – Typhoon Mangkhut – devastated the north of the Philippines, affecting over 250,000 people.³ Cyclone activity in the region may become more intense due to climate change.⁴

Janiuay, is subject to frequent climate-related shocks including, landslides, heavy rain and flooding. In 2008, Typhoon Frank caused widespread flooding in Janiuay and in the wider Iloilo province. The average losses to households in the city amounted to around \$280 (PhP 13,500) per household, roughly 17% of household annual income.⁵ There is some evidence that frequency of flooding in the city has meant that its population is more prepared for such events, with high levels of awareness of climate change and preparedness for flooding.⁶

The population of the wider municipality was estimated at 63,000 people in 2014, including a significant indigenous population of Panay Bukidnon, who make up around 15% of the population. The population is growing quickly and is expected to reach 91,000 by 2023,⁷ with much of the growth expected in urban centres. This is

putting increased pressure on infrastructure and essential services such as solid waste disposal, access to water and electricity, and transport systems. Only 70% of Janiuay's population has access to an improved source of water and whilst 85% of the households have access to electricity.

The town's water supply company cannot adequately meet the needs of the growing population. Groundwater sources have been overused and are now insufficient to supply the residents. The lack of reliable water supply hinders development and causes sanitation problems and health risks for Janiuay's residents. Climate change will aggravate the water scarcity problem. The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)⁸ projects that by mid-century, rainfall will become more variable, increasing during the rainy months of December to May, and decreasing from September to November. This shift in rainfall pattern will likely impact water availability for irrigation, water supplies and water table replenishment in the municipality.

Outside of the city centre, barangays (the smallest administrative units) are also experiencing challenges that hinder further economic development and threaten their resilience to climate-related disasters. For example, three barangays are not connected via roads or transport networks to other areas of the province.

Resilience context

Climate impacts



Janiuay is at high risk of landslides, heavy rain and flooding



Cyclone activity in the region may become more intense due to climate change



Shifts in rainfall patterns will likely impact water availability

Additional factors



Rapid urbanization and unplanned development pose threats to the power and water supply



Flooding events, combined with poor solid waste management, has a negative impact on health



Undeveloped transport networks reduce economic opportunities

[illegible]

LEADERSHIP & STRATEGY

HEALTH & WELLBEING

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INFRASTRUCTURE & ECOSYSTEMS

Janiuy's infrastructure and ecosystems resilience is weakened by relatively poor access to quality critical infrastructure. For example, only 65% of the population have access to a sanitary toilet and only 85% of households have access to electricity, with reduced access outside of the city centre ("Provision of Critical Infrastructure": 2.6).¹² Three barangays in Janiuy have no road access and local government faces increasing pressure to source water and power alternatives to match the rapid population growth ("Reduced Exposure": 3.7).^{13,14} However, the city does have good quality paved roads, connecting it to other parts of the province to the north, south and east. Janiuy's small size means it remains reasonably accessible, with affordable transport options for most residents. Within the city, "trysikads", bicycles fitted with a cab for two people, are commonly available ("Mobility and communications": 3.6).

ECONOMY & SOCIETY

Janiuy's resilience for the economy and society dimension could be improved to enable residents to adequately sustain themselves in a crisis. Janiuy scored 3.0 under the "Security and Rule of Law" subdimension which suggests that residents may have less access to the police and the justice systems.¹⁵ However, Janiuy resilience is bolstered by strong scores for the "Collective Identity and Community Support" (4.7) and "Sustainable Economy" (3.9) subdimensions. The latter perhaps being attributed to the rapidly-evolving and newly industrialised country transitioning from being agriculture-based to services and manufacturing-based.

Resilience interventions in Janiuary

The baseline assessment showed that Janiuary demonstrates moderate levels of resilience across the four key resilience areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The city scored the lowest in the 'Health and Wellbeing' dimension, including minimum human vulnerability, and in the 'Infrastructure and Ecosystem' dimension for provision of critical infrastructure, indicating that the city needs serious efforts to safeguard its residents in case of an emergency and build resilience against shocks or stresses. Existing socio-economic challenges such as rapid urbanisation and unplanned development, solid waste disposal, and lack of access to basic social services make it necessary for the city to build its critical infrastructure and strengthen minimum human vulnerability to enhance resilience and tackle the impacts of climate change.

The Urban Climate Change Resilience Trust Fund

Janiuary is one of nine cities where the \$5.5 million, community-led, UCCRTF Community Level III Water Supply System and Rain Water Harvesting Facility project is being implemented to support flood drainage improvements and community water supply. The investment is being designed and implemented by the city and considers the beneficiaries as active partners to integrate nature-based solutions (NbS).

The project identifies priority interventions that are community-led in key areas and actively partners with beneficiaries to design and implement the city-specific projects. As part of its technical assistance, UCCRTF is supporting the project with feasibility studies with the overall goal to empower communities to participate effectively in project design and implementation through the conduct of capacity development activities.

The objective of UCCRTF support is to promote urban climate change resilience for the cities and ensure that climate change concerns are integrated into the city's decision-making process.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Janiuary, suggesting that while the city has strong community capacity and leadership, this has not yet adequately translated to improvements in local infrastructure and the health and well-being of residents, compromising the capacity to respond to major shocks and stresses.

The baseline assessment does not represent a full assessment of the investment needed to build urban resilience; however, the results of the study suggest possible areas of focus for resilience investment:

- 1. Flooding remains the most significant challenge to Janiuary.** Measures to reduce the impact of flooding include improvements to natural ecosystems and flood defences, improved drainage and attenuation of flood waters, and better building, zoning and planning codes and enforcement.
- 2. Solid waste management improvements will help to reduce flood impact and improve water quality improving health and wellbeing.**
- 3. Improved socio-economic structures such as adequate access to police and justice systems to help residents protect themselves in a crisis.**
- 4. The city's disaster and emergency response systems can be improved to ensure people are able to respond in an emergency and recover effectively.**
- 5. Rainfall variability will mean that water management measures will be important to increase access to clean drinking water especially when demand is high for other areas such as agriculture and industry.**
- 6. Participatory urban planning processes, that integrate climate change vulnerability assessments, can help to reduce unplanned developments in the city and protect vulnerable populations from highly exposed areas.**



Market in Janiway - UCCRTF

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La Trinidad

Located in the Benguet province of the Philippines, La Trinidad is a mountainous municipality bisected by the Balili river. The economy is driven by wholesale trade, retail, and agriculture which are the sources of significant employment in the city.

The results of the baseline study, which collected primary data at the city level, showed that La Trinidad requires significant investment to increase the resilience of its population to climate change shocks and stresses. In particular, the city's flood management systems and

infrastructure require improvement. Integrating climate change into La Trinidad's urban planning will also help to increase its resilience, given its vulnerability to flooding and cyclones.

UCCRTF is working with La Trinidad as an active partner to strengthen the city's critical infrastructure that supports improved air quality in the city and improves flood management in the most vulnerable barangays (districts).

KEY FINDINGS

- La Trinidad is prone to climate change shocks and stresses, particularly earthquakes, flooding, and landslides. Five barangays in the local area are considered especially vulnerable to climate change impacts.
- Climate shocks and stresses exacerbate existing infrastructure weaknesses which undermine the population's resilience. For example, only 35% of La Trinidad's population has access to an improved water source, and flood drainage and sewer systems are outdated.
- There is a high dependence on agriculture to support livelihoods; however, climate change threatens crop productivity threatening food security.
- There is significant heavy road traffic in the city, and cars remain the dominant form of transportation.
- An average score of 3.3 out of 5 across 4 dimensions of city resilience: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy, indicates that La Trinidad requires significant investment to increase the resilience of its population to climate change and other shocks.
- The city could strengthen its resilience by investing in its flooding, transport and air quality infrastructure.

La Trinidad in the context of climate change

The capital town of Benguet Province, the Municipality of La Trinidad is around 250 kilometers (km) north of Metro Manila.¹ With a population standing at 137,404 in 2020,² the city is nestled amidst mountain peaks, and is characterized by steep terrain. The Balili river flows through the municipality, running from Baguio towards the eastern edge of the valley flowing to the north.³ The city is located on an active fault line making it susceptible to earthquakes. It is also exposed to typhoons and heavy rainfall which can trigger floods and landslides.

The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) projections under the medium range emission scenario (RCP 4.5) show that temperature and rainfall will likely increase by mid-century.⁴ By 2050, average temperatures could increase by around 2°C, whilst rainfall is likely to fall in heavier and more intense bursts, decreasing by around 26% between March and May but increasing by over 63% from June-August (compared to 1970-2000 baseline).⁵ Extreme rainfall events and a projected increase in the strength of typhoons make La Trinidad more exposed to climate impacts.

Such shocks threaten the city's critical infrastructure systems and existing weaknesses in key areas restrict the municipality's ability to absorb shocks. The impacts of flooding are intensified because the city has no sewerage system, with many homes releasing wastewater into canals, or septic waste into waterways, thereby spreading contaminated water during flooding events when the canals overflow.⁶ The drainage facilities that are in place largely consist of manhole drop inlets with interceptors that cross the roads, an outdated and inefficient method for diverting surface run-off. This results in commercial and residential wastewater flowing regularly into the Balili River.⁷

Flooding affects some barangays more than others. Five barangays are ranked as vulnerable

from the flooding of Bolo Creek and rainfall-induced landslides.⁸ When flooding occurs in these areas, farmers (who represent a major part of the economy) are left suffering with endless cycles of debt for inputs on the farm, major losses during typhoons and other climate-related events, and poor irrigation which all in all means they receive a lower income.⁹ Therefore, five barangays ranked vulnerable and low income of farmers due to decreased crop productivity will make it hard for the citizens of La Trinidad to face climate-related disaster. These issues limit economic opportunities in the city, increasing its vulnerability to shocks and stresses.

The city's transport network is not well-developed and has poor connectivity with other regions in the area which reduces economic opportunities. The internal network remains heavily reliant on motorized private vehicles which results in high traffic and pollution. Air quality in the municipality is poor with Total Suspended Particulate (TSP) measured at 230 µg/Ncm in 2015,¹⁰ nearly twice the WHO recommended limit of 120 µg/Ncm.¹¹ Sand, dust and exhaust emissions are the primary pollutants.¹² The air quality is worse during hot, dry conditions consistent as dust particulates in the air increase and particulates remain lower to the ground. This causes health risks for La Trinidad's population especially for those with respiratory conditions such as asthma or COVID-19.

Resilience context

Climate impacts



Rainfall in La Trinidad is likely to fall in **heavier and more intense bursts**, resulting in flooding and landslides



Maximum temperatures could rise by **2°C**



Rainfall is likely to **decrease by 26% from March-May and increase by over 63% from June-August**

Additional factors



Climate change threatens crop productivity, impacting food security

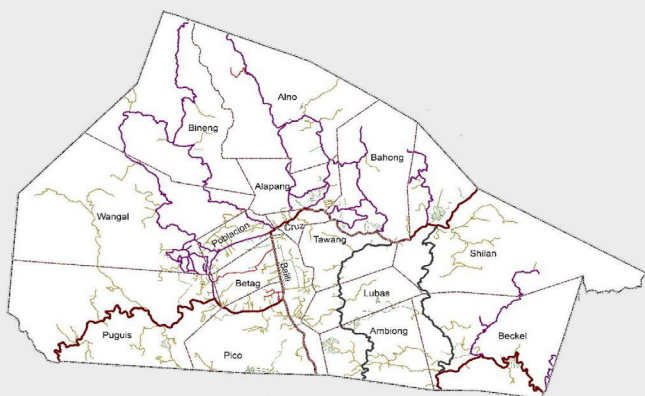


Air quality will become worse as temperatures rise, resulting in health risks for the population



The impacts of flooding are intensified by the city's **lack of a sewage system**

City Resilience Profile



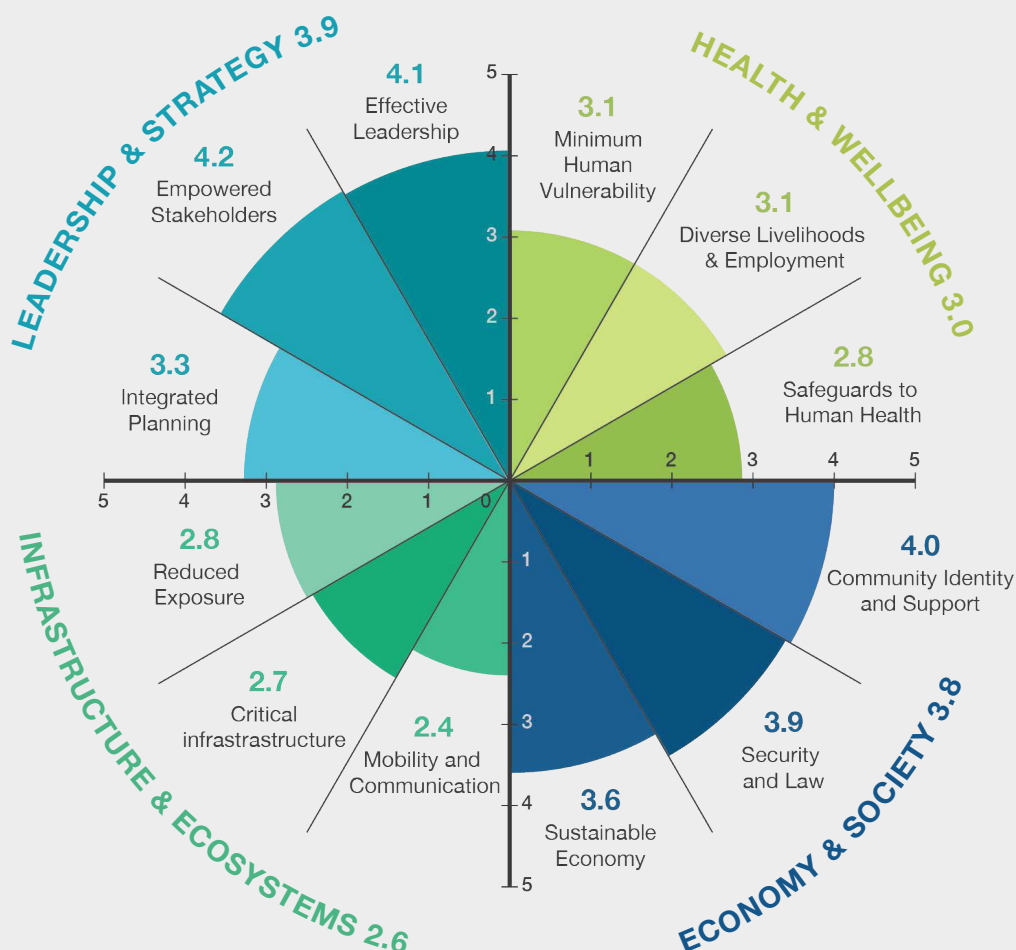
In 2018, ADB's UCCRTF visited the city of La Trinidad and conducted a baseline assessment of the city's resilience. The study assessed La Trinidad's resilience relating to four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe for a city. The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis showed that La Trinidad is perceived to demonstrate resilience in areas such as Leadership and Strategy. The city could strengthen its resilience by investing in its Infrastructure and Ecosystems and the Health and Wellbeing. This is discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

La Trinidad's highest-ranking baseline score of 3.9 for the Leadership & Strategy resilience dimension relates to evidence-based decision-making, knowledge, awareness, governance, and the civil society space to interact and exchange information. La Trinidad's resilience in this area is strengthened by effective municipal leadership ("Effective Leadership and Management": 4.1), and that citizens are engaged and informed when faced with a climate-related shock or emergency ("Empowered Stakeholders": 4.2). However, the city requires investment to improve Integrated Development Planning ("Integrated Development Planning": 3.3)

HEALTH & WELLBEING

La Trinidad scored 3.0 for the Health and Wellbeing subdimension, suggesting that the city needs major improvements so that citizens' basic needs, such as access to water, shelter and sanitation, can be met. Solid waste management is a serious problem for the municipality. With no sewerage system and most households releasing wastewater into canals or septic waste into waterways, 65% of the population that does not have access to an improved source of water and relies on water springs for domestic and irrigation use are prone to major health hazards and a polluted environment.¹³ Drainage facilities are also found to be inefficient in diverting surface run-off water from residential and commercial areas away from the Balili river.¹⁴ The city could increase its resilience in this area through targeted investment ("Effective Safeguards to Human Health & Life": 2.8).



INFRASTRUCTURE & ECOSYSTEMS

La Trinidad's resilience score for Infrastructure and Ecosystems (2.6) indicates significant investment is required to improve its critical infrastructure systems. For example, only 35% of the population have access to improved water sources ("Provision of Critical Infrastructure": 2.7). Transportation systems are inadequately accessible with narrow roads in barangays ("Mobility and Communications": 2.4) and solid waste management infrastructure, such as sewerage systems, drainage facilities and household water systems, are in poor condition which exacerbates flooding. Lastly, La Trinidad is located on an active fault line and is highly vulnerable to earthquakes which, when paired with extreme rainfall, makes citizens vulnerable to landslides ("Reduced Exposure": 2.8).

ECONOMY & SOCIETY

La Trinidad's score of 3.8 for "Economy and Society" reflects the strong community engagement in the city and relatively high levels of community involvement in decision making ("Collective Identity and Community Support": 4.0). The cohesive society has led to a stable and safe environment with good security and legal protection ("Security and Rule of Law": 3.9). This provides the foundations for economic development and improves resilience in times of crisis. However, La Trinidad's overreliance on climate-sensitive agricultural industries including vegetable and strawberry production means that the city could do more to ensure its economy is sufficiently diverse to deal with climate shocks ("Sustainable Economy": 3.6).

Resilience interventions in La Trinidad

ADB and UCCRTF projects in La Trinidad

CURRENT ADB PROJECT

Strengthening Knowledge and Actions for Air Quality Improvement

This TA will build the business case through the preparation of City Level Clean Air Action Plans (CAAPs) along with investment plans to implement them.

Project outputs:

- i) An assessment of current air quality situation and management practices;
- ii) An evaluation of cost-effective technological and policy options for addressing air quality; and
- iii) The Development of City Level Clean Air Action Plans along with investment estimates for air pollution control.

UCCRTF project supporting the implementation of the City Level Clean Air Action Plans

Supporting:

- Enhanced knowledge and capacity of La Trinidad to develop policy actions and technological solutions for air quality management

UCCRTF community-led project on flood drainage improvement

Supporting:

- Flood drainage and community water supply improvements
- Integrating nature-based solutions (NbS) to the planning and design
- Implementation and capacity building of community
- Improved flood control systems along Balili River by expanding culverts.

Trinidad demonstrates qualities that lend its resilience across the four key resilience areas of health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy, the city requires investment to be able to adequately respond to climate-influenced disasters or shocks. The city scored the lowest in the 'Infrastructure and Ecosystem' dimension for provision of critical infrastructure, indicating that the city needs serious efforts to safeguard its residents from any emergency and build resilience against shocks or stresses. In particular, La Trinidad needs to improve its water drainage facilities to avoid flooding roads and polluting the nearby Balili river from residential and commercial wastewater in the likely case of typhoons. Existing socio-economic challenges such as solid waste disposal and major traffic on roads make

it necessary to invest more in its critical infrastructure to strengthen resilience and mitigate the impacts of climate change.

The ADB and UCCRTF are working with La Trinidad to address some of the infrastructure investment gaps through projects that focus on air quality improvements and flood resilience. La Trinidad is one of seven Asian cities supported by a \$2.5 million ADB technical assistance (TA) on Strengthening Knowledge and Actions for Air Quality Improvement. This will enhance the knowledge and capacity of participating developing member countries to develop policy actions and technological solutions for air quality management. The TA will also prepare a City Level Clean Air Action Plan (CAAP) which will develop the business case as well as

investment plans to implement CAAPs. The project is community-designed, and the specific outputs include:

1. An assessment of current air quality situation and management practice;
2. An evaluation of cost-effective technological and policy options for addressing air quality; and
3. The development of City Level Clean Air Action Plans (CAAPs) along with investment estimates for air pollution control.

The Urban Climate Change Resilience Trust Fund

The objective of UCCRTF support is to identify the risks of vulnerable population and ensure that climate change concerns are integrated across all stages of infrastructure development and inform decision making.

In addition to supporting the Strengthening Knowledge and Actions for Air Quality Improvement project, the UCCRTF helps build resilience in La Trinidad through a \$5.5-million TA which also covers the cities of Del Carmen, Janiway and Malay. The TA identifies priority community-led interventions in key areas which will help integrate urban climate change resilience into projects that are at-risk from climate change and that seek to build more resilient urban systems.

In La Trinidad the community-led grant focuses on flood drainage and community water supply improvements. The investment is designed and implemented by the city and considers the beneficiaries as active partners in integrating nature-based solutions (NbS) to the community-led project. As part of its technical assistance, UCCRTF supported the project with feasibility studies with the overall goal to empower communities on project design and implementation, including the conduct of capacity development activities. For example, the project is working with the community to improve the flood control system along Balili River by expanding the volume capacity of the flood culvert. This is to improve flood flow and reduce perennial flooding in the adjacent strawberry fields.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in La Trinidad, suggesting that while the city has strong community capacity and leadership, this has not yet adequately translated to improvements in local infrastructure and the health and well-being of residents, thus compromising the capability to respond to major shocks and stresses. The baseline assessment does not represent a full assessment of the investment needed to build urban resilience; however, the results of the study suggest possible areas of focus for resilience investment:

1. **Improvements to the city's critical infrastructure systems should focus on water infrastructure.** This includes water supply and sanitation investments to ensure that wastewater no longer flows into local waterways and the population has access to clean, safe, piped water sources.
2. **Waste management and drainage infrastructure should be improved to ensure that the city can cope with increasingly severe flood events.** Evacuation and early warning procedures should also be strengthened.
3. **The recommendations of the City Level Clean Air Action Plans (CAAPs) should be implemented to improve air quality in the city and realise the associated health benefits.**
4. **Climate change resilience should be integrated into inclusive urban planning to ensure that the long-term resilient urban development.** Improved capacity in urban planning, procurement and design is needed at the municipal level.



Street in La Trinidad - UCCRTF

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City Resilience Profiles

Viet Nam



URBAN CLIMATE
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Dong Hoi

Dong Hoi is one of the most important tourism centers in Vietnam. The region's long beaches and precious natural ecosystems, including the nearby Site Phong Nha-Ke Bang National Park, a UNESCO-listed World Heritage Site, attract millions of visitors each year. However, the city's coastal location makes it particularly exposed to typhoons and flooding.¹ Flooding is made worse by Dong Hoi's lack of adequate drainage and sewerage infrastructure both within the city and from the urban centers to the coast.²

This study provides a baseline assessment of Dong Hoi's resilience based on a series of structured interviews with city officials and on surveys that were conducted with 103 households in Dong Hoi. The results of the baseline

study showed that Dong Hoi needs to invest in critical infrastructure to increase its resilience to shocks and stresses.

ADB is actively working with Dong Hoi to strengthen the city's urban planning and critical infrastructure. UCCRTF activities complement ADB's projects and are strengthening the city's resilience through investments to improve Dong Hoi's infrastructure, including rehabilitating and protecting the coastal dune system.³ UCCRTF intends to undertake another assessment at the end of the programme to assess changes in resilience.

KEY FINDINGS

- Dong Hoi is sensitive to climate change shocks and stresses, especially tropical storms/typhoons, sea-level rise, and coastal erosion.
- Rapid urbanisation and tourist development are putting increased strain on the city's drainage and sewerage systems, impacting the health and safety of citizens and damaging the ecologically significant natural coastal dune system.
- An average score of 3.39 out of 5 across all 4 dimensions of city resilience indicates that Dong Hoi requires significant investment to improve its resilience, especially by investing in improved sanitation infrastructure and effective governance mechanisms.
- Dong Hoi's lowest score was for "Health & Wellbeing" (2.8), indicating the city can improve the resilience of its population by investing in measures to safeguard minimum human vulnerability and increase diverse livelihood and employment opportunities.
- Further investment is needed to protect the coastline, and improved drainage and sewerage infrastructure will be needed as the city deals with more frequent typhoons and sea level rise.

Dong Hoi in the context of climate change

Dong Hoi is a coastal city, situated along the Nhat Le estuary, a river draining a catchment area of 2,650 km². Recognised as an important tourism centre, the region boasts of long beaches and is home to precious natural ecosystems, including the UNESCO-listed World Heritage Site Phong Nha-Ke Bang National Park.⁴ It has historically been one of the most disaster-prone areas in Viet Nam and is affected by severe weather conditions such as typhoons which occur yearly, floods which occur on average three times per year, as well as coastal erosion.⁵

Dong Hoi is located in the tropical monsoon zone, which experiences high temperatures from April to September with an average temperature of about 35°C. Each year there are about around 48 hot-dry days with temperatures rising above 35°C. Whilst the total average rainfall has slightly decreased over time, by an average of about 8 mm/year,⁶ rainfall events are becoming increasingly concentrated. Quang Binh Province receives 80-90% of its total annual rainfall in the rainy season which lasts from May to early November.⁷

Coastal erosion is exacerbated by illegal sand mining and uncontrolled development of the natural dune system which protects the coastline and is also important to the tourism industry.⁸ The coastal dune system is especially important to protect the coastal zone from storm surge events in typhoon season (September and November). From 2006 to 2012, the Quang Binh Province was hit by 13 typhoons, or an average of 2 typhoons per year.

The city's population is 169,000⁹ and is served by a well-developed transportation system which connects Quang Binh province with the rest of the country, and to Laos and Thailand.¹⁰ 97% of the province is connected to electricity, and practically the entire urban population has access to health facilities and educational institutions. However, other critical infrastructure systems are not well-developed. For example, just 38.5% of people have access to sanitary toilets, largely due to an inadequate drainage and sewerage system overburdened by a growing urban

population.¹¹ This puts Dong Hoi citizens at risk from health issues such as diarrhoea and dengue fever when flooding occurs.¹²

Climate projections indicate that Dong Hoi is likely to experience a more variable climate, with less rainfall and higher maximum and average temperatures in the dry season. This may affect water quality and availability in the city, and could have health consequences from increased heat stress, and higher prevalence of water and vector-borne diseases. During the rainy season, rainfall will increase and is likely to be concentrated in shorter, more intense downpours. Increased rainfall may be accompanied by more frequent and intense storms. This will mean that Dong Hoi will face greater incidence of riverine, surface and coastal flooding unless adaptation measures are put in place.¹³

Sea level rise will increase the vulnerability of Dong Hoi's coastal zone to storm surge inundation and saltwater intrusion. Under the high-emissions scenario (RCP 8.5), sea level may rise by between 17 and 36 cm by 2050 and by between 51 and 106 cm by the end of the century. Dong Hoi itself is at relatively low risk of inundation from sea level rise however, a 100 cm rise would result in widespread disruption to coastal rail and transport infrastructure. Sea level rise will also increase saltwater intrusion which may reduce water quality and supply, and reduce soil quality affecting agriculture.

Resilience context

Climate impacts



Flooding from **sea level rise, rivers, and more intense rainfall** are projected to increase



Rainfall is decreasing, and becoming more concentrated



Temperatures are likely to increase, and already average 35°C in April - September

Additional factors



Coastal erosion is exacerbated by illegal **sand mining** and uncontrolled development of the natural dune system that provides protection

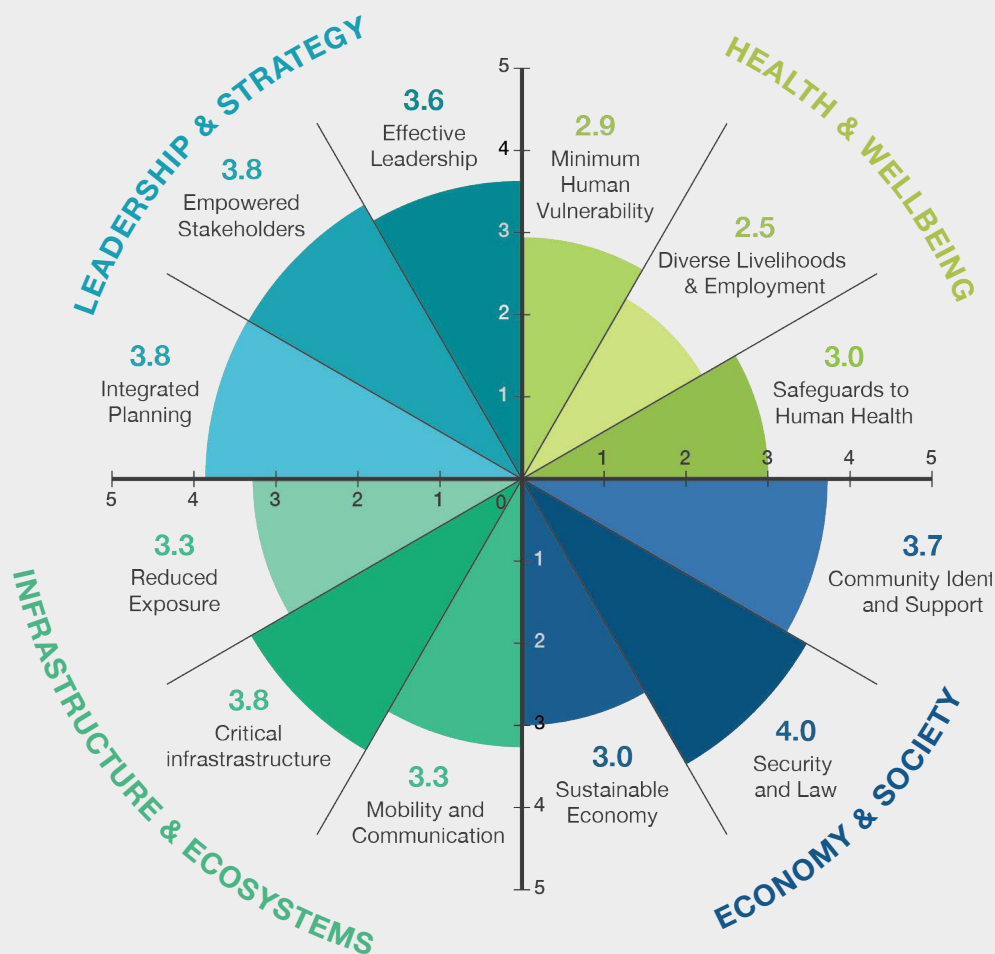


Inadequate infrastructure means that only **38.5%** of the population has access to a sanitary toilet

LEADERSHIP & STRATEGY

Dong Hoi's resilience in this area could be strengthened by giving enabling local city governments to take decisions about infrastructure investment needs ("Effective leadership and Management" - 3.55).¹⁴ The lack of local control over investment decisions in implementation and maintenance has resulted in obsolete water supply systems, uncontrolled disposal of untreated waste, and a reduced livelihood for the urban population.¹⁵ There is generally good participation in decision making in the city, with development processes including consultations with a wide range of local stakeholders (Empowered stakeholders - 3.80). Currently, there are no links between the city's socioeconomic development plans, spatial plans and urban subsector master plans (Integrated development planning - 3.75).¹⁶

Dong Hoi's lowest-ranking baseline score of 2.8 relates to the extent the city enables its residents to meet their basic needs. During floods, Dong Hoi is susceptible to major public health issues, such as diarrhoea or dengue fever, due to the overflow of septic tanks and an inadequate sewerage network ("Effective safeguards to human health and life" – 3.00).¹⁷ This is compounded by the city's growing urbanisation rate, especially amongst the 23% of the population that is considered "urban poor" ("Minimum human vulnerability" - 2.9).¹⁸ Dong Hoi's resilience is further undermined as it lacks diverse livelihood and employment opportunities, since 40% of the population works within the tourism sector which heavily depends on a coastal ecosystem that is under pressure from climate impacts (Diverse livelihood and employment" 2.5).¹⁹



INFRASTRUCTURE & ECOSYSTEMS

Dong Hoi has good transport links to other cities in Vietnam. However, the quality of the transportation systems within the city itself could be improved. Dong Hoi's road network is congested and there is limited provision of public transportation. Telecommunications networks are modern and widely accessible in Dong Hoi (Mobility and communications – 3.30). However, there is still insufficient infrastructure investment directed at improving water supply systems, preventing flooding of blocked drains, and ensuring the controlled disposal of untreated waste (“Provision of critical infrastructure” – 3.8).²⁰ Without drainage infrastructure to address flooding, pollutants will persist running into local waterways, placing environmental pressure on the coastal water resources and increasing health concerns to recreational coastal activities, particularly in tourist areas (“Reduced exposure” – 3.33).^{21,22}

ECONOMY & SOCIETY

Dong Hoi's resilience in this dimension relates to the levels of collective identity, economic sustainability, and security. The city's resilience is boosted by a strong score for “Security and the rule of law” (4.00) thanks to effective law enforcement and good levels of crime prevention and safety. The city invests in socio-cultural issues and has good quality education and health care facilities (Collective identity and community support - 3.67). Whilst the city funds vocational training to ensure it creates sufficient jobs for its citizens, the economy remains dominated by tourism, suggesting that more work is needed to encourage diversity of livelihood opportunities (Sustainable economy - 3.00).

Household perceptions of resilience

Alongside the city-level baseline study, UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain segments of the city's population. The data collection was limited to 103 respondents from wards where the ADB infrastructure investments are planned or underway. The results provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community in Dong Hoi, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the highest against four characteristics: i) Infrastructure and Services; ii) Economic Opportunities (diverse livelihood); iii) Connected (internal and external linkages); and iv) Organized (socially cohesive).

As shown in Figure 1 at the bottom of the page, respondents scored Dong Hoi low (overall 2.21) across all the general community characteristics. The residents perceived the city as having poor economic opportunities (1.98) and social cohesiveness ("Organized" – 2.99). The households also felt that they lacked good access to infrastructure and services (2.21) and that the internal and external linkages in the city were weak (1.21) undermining connectedness and limiting the city's ability to adequately provide support when faced with a disaster.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Income and Food Access;

iii) Adaptive Capacity; iv) Social Safety Net; and v) Assets. Scores against each of these dimensions were calculated as an averaged index from survey responses and secondary data.

As shown in Figure 2 at the bottom of the page, perceived household resilience was highest for "Income & Food Access" with all households perceiving they would have sufficient access to food, as well as access to diverse sources of income. With 46% of households perceiving they have access to basic services in the area, such as being connected to the Dong Hoi Wastewater System or relying on grid-supplied electricity for cooking, and 93% still dependent on some form of government-supported social programs, this suggests that households are less resilient when faced with a disaster.

When asked about the disasters and unexpected shocks and stresses they had faced in the past, those considered as a major shock with strong impact included "cyclones/hurricanes" (96% of respondents) and "damaging winds and storms" (83% of respondents). "Heavy rains/hailstorms" were also considered to be major shocks by 66% of respondents but with an average impact. Waterlogging and flooding affected 35% of households with strong impact, and shocks such as loss or reduction in income (32%) and chronic illness (20%) had a strong to moderate impact in the city, on average.

Among the unexpected shocks, survey respondents consider the death of a household member, especially if income-earning, to be a major shock, costing households around \$3,341. The loss of reduction in income after an unexpected shock cost \$2,805, a major

Figure 1

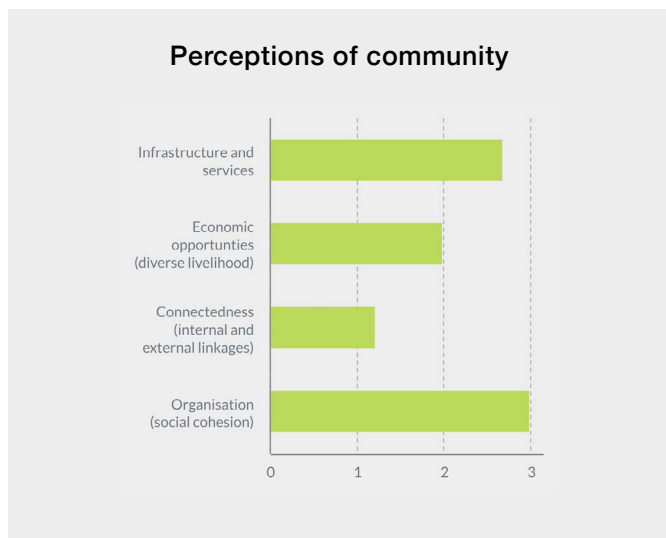
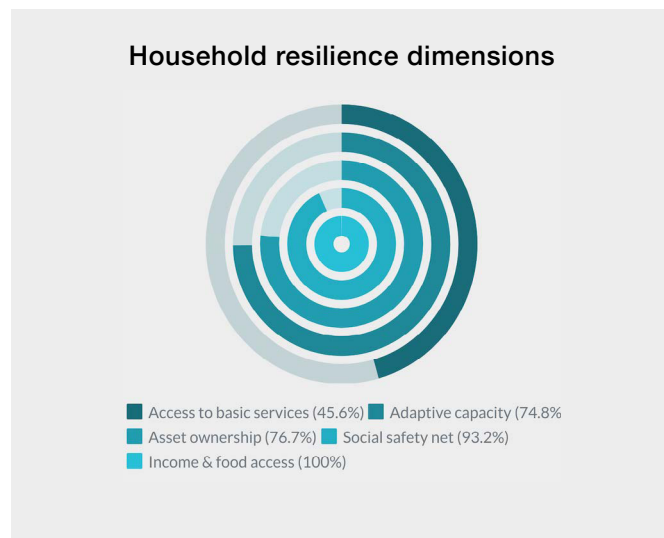


Figure 2



illness/injury of a household member cost households \$814 and loss or damage to a house cost an average of \$501. As a result, Dong Hoi households use an array of strategies to recover from these unexpected shocks and deal with their financial consequences. With 53% of residents receiving cash from relatives and friend, and 21% obtaining loans with interest from non-formal sources, the citizens of Dong Hoi request assistance from others. Rather than relying on their own savings, almost 1 in 10 households (9%) resort to reducing the number of meals per day, while almost two-thirds (63%) reported reducing expenditure on health care and education.

Responding to shocks and stresses

Dong Hoi experiences several extreme climate-driven shocks on an annual basis. Respondents drew on recent experience about their ability to deal with and recover from shocks in answering the survey. Over half (60%) of the respondents to the household survey felt that their level of resilience was “relatively high” compared with 6% who felt they had relatively low levels of resilience and 34% who saw their resilience as “medium”. As shown in Figure 3 below, perceptions about the ability to recover from shocks show that 65% of Dong Hoi households felt they were unable to recover effectively.

Almost all respondents (97%) in Dong Hoi reported that they had received an early warning before the last disaster. These warnings were communicated effectively via multiple channels, the most popular by far being

television (95%), followed by disaster volunteers (44%) and NGOs (37%). Although 23% listed a neighbour or relative as another important source of warning, none of the households received early warning through a community volunteer and over 90% were unaware of who their trained community volunteer was, suggesting a lack of community disaster risk management system in Dong Hoi.

Additionally, 40% of respondents indicated they knew where to seek shelter or help, suggesting some awareness of knowledge of nearby shelters in their immediate communities but also that there are weak city-level mechanisms in place for awareness raising. This is reflected in the low “Connectedness” score in the overall resilience dimensions, with low internal and external linkages throughout the community.

Around half of the survey respondents (52%) moved to another place to take shelter before or after the last disaster they experienced. Of those who did not move to shelter, it was because they remained to protect their home and assets (43%), had lived in a protected house (40%) or there was no shelter available (19%). When asked households’ plan in case of a disaster, majority of residents planned to protect their household valuables/assets (83%) and plan for dry food (74%) – 11% of households did not have a plan or know what to do in an emergency.

The baseline assessment showed that Dong Hoi demonstrates limited resilience across the four key resilience areas: health and wellbeing, economy and

Figure 3

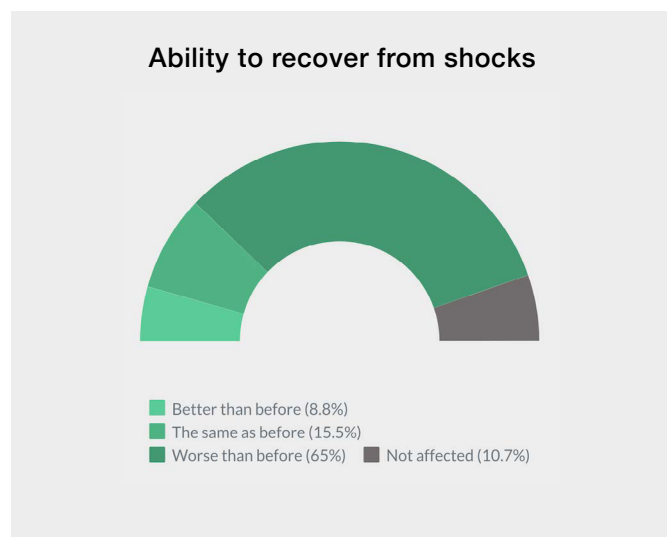


Figure 4



Resilience interventions in Dong Hoi

ADB and UCCRTF projects in Dong Hoi

CURRENT ADB PROJECT

Urban Environment and Climate Change Adaptation Project

\$144.16 million between 2 cities in Vietnam



development of wastewater system including 13.1 km of gravity sewer, 3.5 km of pumping main and 3 pumping stations



construction of new road systems including 2 roads of 5.7 km length and 3 roads of 2.2 km length



remediation of previous drainage system and connecting sewerage and final outfalls (7.0 km) to the Nhat Le River

UCCRTF Dong Hoi Coastal Management \$1 million

The project will provide two assignments:

Hydrodynamic study:

- evaluate the stability and historical evolution of the Nhat Le river mouth
- identify the causes of beach erosion and the mechanisms of beach erosion
- carry out surveys at the study area
- implement mathematical modeling
- study the evolution of the river mouth and analyse impacts of various options to defend against erosion

Dune restoration and protection study:

- prepare a topographical map for the whole sand dune system
- assess the current status of the sand dune system and its surface vegetation
- sample and analyse the sediment on the sand dune at representative locations
- develop a flood and coastal management plan
- rehabilitate the dune system
- physical restoration of the coastal dune conservation
- improve understanding of the dune system ecosystem

society, infrastructure and ecosystems, and leadership and strategy. The city's lowest score was for the 'Health and Well Being' dimension, such as in terms of access to food, water, livelihood, shelter and sanitation, indicating that the city needs improvements in the delivery and infrastructure of said basic services to adequately strengthen resilience against shocks or stresses.

To address some of the infrastructure investment gaps, Dong Hoi is one of the two cities in Viet Nam where the \$144.16 million ADB project "Urban Environment and Climate Change Adaptation Project" is being implemented. This will facilitate the construction and upgrading of infrastructure facilities to improve urban environmental conditions, water supply systems and sewerages, waste and water treatment facilities, and flood control in order to reduce environmental pollution, improve the urban environment and climate change adaption for Dong Hoi . Specifically, the project intends to:

- i) Climate-proof urban development in Dong Hoi's Bao Ninh peninsula by constructing basic infrastructure, such as a wastewater collection system, to protect the coastal dune complex from erosion; and
- ii) Improve wastewater management in Dong Hoi by constructing household-connected sewerage networks, and a wastewater treatment plan to reduce environmental pollution.

Alongside the ADB loan project, UCCRTF supports resilience in Dong Hoi through a \$1-million grant to develop an integrated flood and coastal management plan and rehabilitate the dune system. This component includes the physical restoration of the coastal dune conservation, and a study to improve understanding of the natural dune system ecosystem.

Exploratory studies that seek to determine the way that the Kien Giang river behaves and moves sediment, and the development and migration of the dune system in Nhat Le estuary are crucial to the design of sand dune restoration. Since 2018, UCCRTF, through an expert consortium of international and national specialists led by Dutch consulting engineers Witteveen+Bos, Hanoi University's Center for Environmental Fluid Dynamics (Hanoi University), and Van Phu JSC, have been conducting studies, capacity building activities, and raising public awareness on coastal zone management.

These studies will eventually provide a detailed picture

of how the process of sedimentation in the river mouth contributes to severe flooding upstream and causes problems for river and marine transport navigation. They will also show the impact of annual dredging, which negatively affects the condition of the beach. The preliminary results of these studies and ongoing monitoring and observations have helped to identify actions that can help to sustainably adapt and maintain the river mouth and the coastline.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Hue city, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment, these include:

- 1. Improved integrated development planning is foundational for resilience in Dong Hoi.** Such plans should be informed by recent climate vulnerability assessments that provide information at the ward level.
- 2. Urban development planning processes should ensure wide community engagement.**
- 3. Investment in critical infrastructure systems, in particular water supply and waste management processes** are especially important considering the city's ongoing population growth and anticipated increase in tourism. Additionally, investments in water supply and waste management will bring co-benefits on health.
- 4. Investment should be made to protect and enhance the natural ecosystems around Dong Hoi's coastline** to provide improved protection from coastal flooding and saltwater intrusion.
- 5. Further investment is needed in infrastructure** such as river embankment strengthening to protect the city from disasters.
- 6. Investment is needed to improve internal transport links to reduce congestion.**

ENDNOTES

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*Coastal erosion along Dong Hoi coastline. This could be exacerbated by sea level rise.
Image by: ADB*

Hà Giang

Hà Giang City sits on the fertile floodplains of the Lô River, on a relatively flat part of a mostly mountainous province. Home to 53,000 people, Hà Giang regularly faces climate-related shocks and stresses, such as flooding and landslides caused by extreme weather events and the increasing intensity of rainfall and discharges from upstream hydroelectric facilities in Viet Nam and China.¹ Shocks and stresses like these are likely to become more frequent and severe in the future due to climate change. Economic and spatial isolation, underdeveloped infrastructure and inadequate waste disposal and drainage systems leave the city

vulnerable to shocks and stresses.² Improvements to Hà Giang's infrastructure, urban planning, and community preparedness are essential to strengthen its resilience.

ADB is currently working with Hà Giang municipality to strengthen its urban planning and critical infrastructure. These projects are complemented by UCCRTF activities to build climate resilience by supporting disaster risk financing activities and community-led resilience projects to strengthen the city's urban planning and critical infrastructure.

KEY FINDINGS

- Hà Giang faces climate-related shocks and stresses, including flooding and landslides caused by extreme weather events and the increasing intensity of rainfall and discharges from upstream hydroelectric facilities in Viet Nam and China.
- The baseline study found relatively strong levels of resilience in the city across several dimensions of resilience. The city's resilience was boosted by effective leadership within the government and community, a strong tourism industry and a range of other employment opportunities.
- Investment in the quality of the city's water supply and sanitation would increase the population's resilience, protecting them against flooding and improving water quality.
- Inadequate waste disposal and drainage systems make Hà Giang vulnerable to flooding.
- The city's resilience could be strengthened further by investing strategically in improvements to infrastructure for connectivity and disaster prevention and the health and well-being of the city's residents.

Hà Giang in the context of climate change

Hà Giang City is located along the banks of the Lô River in the northeast of Viet Nam. Much of the wider city region is too mountainous for agriculture, save for some tea plantations, and is covered by dense forests. However, Hà Giang's fertile central plateau is perfect for growing stone fruits like plums and peaches, which the province exports. The region is highly ethnically diverse, with 22 ethnic minorities living there speaking 13 separate languages. Hà Giang City itself has an urban population of 54,000³ and is situated in the floodplain of the Lô and Mien rivers at an elevation averaging from 50 to 100 metres.⁴ Rapid urbanisation along the Lô River and its main tributary has made the city more exposed to extreme weather events including flash flooding and landslides.

Flooding in Hà Giang City is primarily caused by river overflows resulting from heavy rainfall and water releases from upstream dams. Rainfall is typically abrupt and strong in the province, which leads to local flash flooding events amongst the already low-lying urban areas of Hà Giang City.⁵ In recent years, the construction of dams in the upper Lô River basin both in Viet Nam and the People's Republic of China has led to a decrease in the number of severe floods in the city.⁶ However, suspected releases from upstream dams, combined with blocked drains caused by rapid urbanisation, continue to result in localised, chronic flooding in many areas of the city.⁷

Flood damages in Hà Giang City, stood at \$215,000 in 2013 and \$1 million in 2014. The 2013 floods impacted fishery production, led to major soil erosion, and damaged numerous buildings. The floods of 2014 damaged several hundred houses, reduced output in farming and poultry, and destroyed several sections of the city's river embankment.⁸ Along with exposure to shocks and stresses related to flooding, Hà Giang City faces temperature increases that will likely impact vulnerable populations such as the elderly, the sick and those who are required to work outdoors.

In June 2020, the region experienced its longest

heatwave in 49 years with a recorded 21 days of hot spells where temperatures averaged 1.5 to 2.4°C higher than past years.⁹

Hà Giang is one of the poorest provinces in Viet Nam.¹⁰ However, Hà Giang city itself has lower poverty rates than the surrounding areas, with just only 0.8% of poor households being located there.¹¹ Many households remain at or just over the poverty line and remain susceptible to weather-related shocks and stresses that can push them back below it.

In the city, septic tanks are the most common form of household sewage disposal, while wastewater collection systems are non-existent leading to untreated wastewater to discharge directly into the two main rivers and their tributary streams.¹² Access to basic services, particularly sanitation facilities could be improved. Although infrastructure in the city has seen some improvement in recent years, roads and schools are significantly less developed than other parts of Viet Nam.

Resilience context

Climate impacts



Flooding from sea level rise, rivers, and more intense rainfall are projected to increase



Temperatures are likely to increase, and already average 1.5°C - 2.4°C higher in recent years

Additional factors



Household poverty rates are some of the highest in the country, and exacerbates the population's vulnerability



Lack of wastewater collection systems leads to untreated wastewater being discharged into waterways

City Resilience Profile



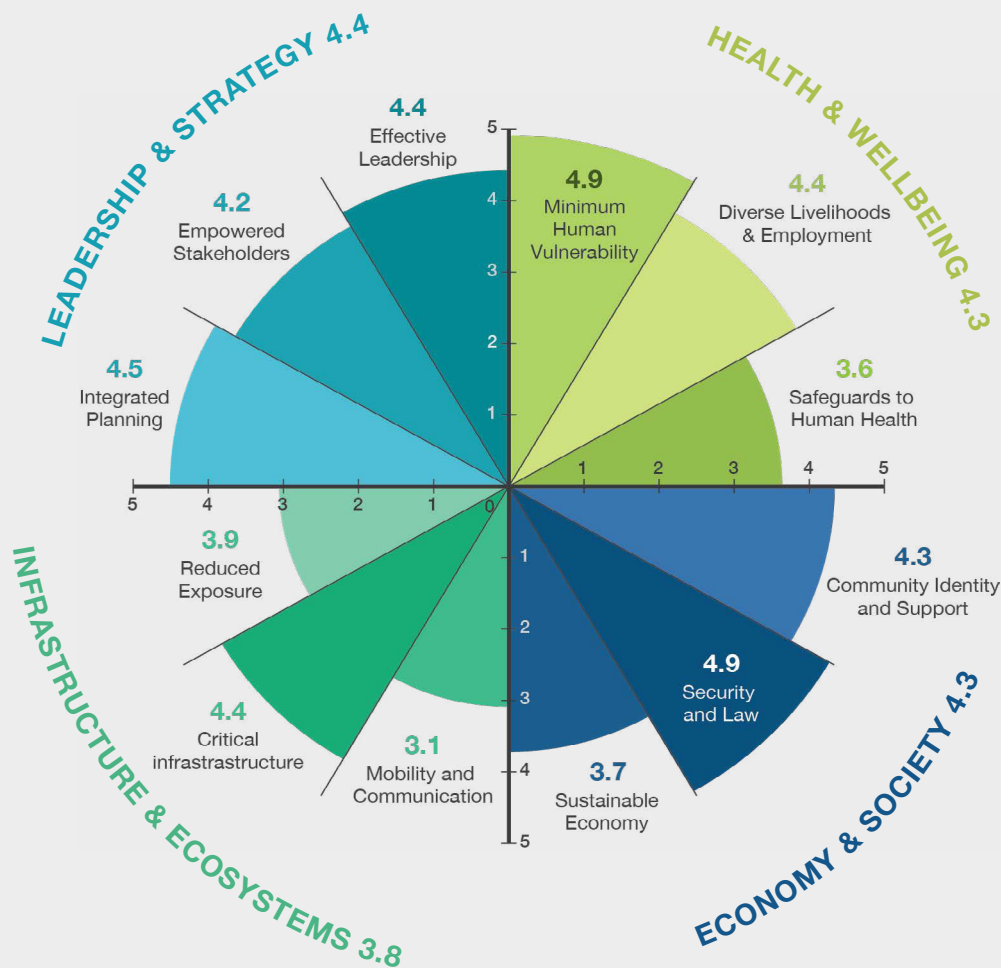
In 2018, ADB's UCCRTF visited Hà Giang to conduct a baseline assessment of the city's resilience. The study assessed Hà Giang's resilience in four key areas: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe for a city. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis shows that Hà Giang has many attributes that lend it resilience; however, it could benefit from investment in sanitation, disaster protection and transport infrastructure. The results of this baseline assessment are discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

Hà Giang scored 4.4 for the 'Leadership and Strategy' dimension suggesting that it has relatively informed, inclusive, integrated and iterative decision-making process in place. Hà Giang has a city Master Plan in place which is currently being extended to cover the period to 2035. This will be informed by a GrEEEn City Action Plan which is designed to recommend measures to build resilience and increase livability in the city ("Integrated development planning" - 4.5). The city's score is boosted further by strong scores in relation to development planning and effective management ("Effective Leadership & Management" - 4.4). Resilience in this area could be increased by increasing engagement with city residents in urban planning and resilience building ("Empowered Stakeholders" - 4.2).

HEALTH & WELLBEING

Hà Giang scored an average (4.3) on the 'Health and Wellbeing' dimension. The city has relatively low household poverty levels compared to the surrounding areas, and is endowed with very rich ecosystems and green spaces throughout the city ("Minimum Human Vulnerability" - 4.9). The city could build its resilience further by improving its score in 'Effective Safeguards to Human Health and Life' (3.6). There are four hospitals in Hà Giang city, however, not all health care centres are fully equipped. The city offers relatively good levels of employment opportunities, benefitting from a thriving tourism industry, as well as small-scale manufacturing, which focuses on rattan and wooden furniture, weaving and embroidery of ethnic clothing, and aluminium manufacturing ("Diverse Livelihood and Employment" - 4.4).



INFRASTRUCTURE & ECOSYSTEMS

While the city benefits from its rich natural environment, its resilience is undermined by weaknesses in transport, disaster protection and wastewater infrastructure. Almost all households in the city have access to reliable, electricity and water supply, and to flushable toilets (“Provision of critical infrastructure”- 4.4). However, the city has a combined wastewater and stormwater drainage system which flows into tributaries and the Lo River and Mien River., with raw sewage flowing directly into rivers. Water losses through leaks currently stand at 40%.¹³ The city has no public bus transport system. Taxis and motor-taxis are the only mode of non-private transportation within the city. The steep roads within the city also prevent the widespread use of bicycles. Therefore, the city’s resilience could be improved through investment in “Mobility and Communications” infrastructure (3.1).

ECONOMY & SOCIETY

Hà Giang’s resilience in the area is boosted by a relatively strong, service-based economy which contributed close to 71 % of the city’s production value in 2014. A strong tourism sector and small-scale manufacturing provides divers employment opportunities. The city also hosts over half of the regions’ 15 state enterprises, half of the 1,082 non-state enterprises, and both foreign investment enterprises (“Sustainable economy” – 3.7).¹⁴ As the gateway to the UNESCO Dong Van Karst Plateau Global Geopark, the city is provided with plenty of opportunities to develop its tourism industry. The city also received a high score for ‘security and rule of law’ (4.9), reflecting good access to justice and effective law enforcement. The city has a strong sense of collective identity, helping it to respond effectively to disasters (Collective identity and community support - 4.3).

Resilience interventions in Hà Giang

ADB and UCCRTF projects in Hà Giang

CURRENT ADB PROJECT

Secondary Cities Development Project

\$224 million between 3 cities in Vietnam



9,000 linear meters of embankment to be strengthened



rehabilitate 7 km of storm drain-streams



over 31 km of road improvements and new projects



17 hectares of green spaces and landscaping for public amenities



undertake construction of a new wastewater collection network and wastewater treatment plant

UCCRTF program preparatory technical assistance \$1 million

Supporting:

- the preparation of the Green City Action Plan (GCAP) for the city of Hà Giang
- feasibility studies for climate-resilient urban infrastructure investment
- preparation of preliminary engineering designs for each urban infrastructure subproject
- capacity building programs on planning and management for green city development
- consultations

UCCRTF Spatial Data Analysis Explorer (SPADE)

Supporting:

- improved city-level climate and geospatial data
- project preparation, consultation and map production
- Hà Giang was among the 5 pilot cities covered by SPADE.

According to the baseline assessment, Hà Giang City has many qualities that contribute to its resilience. These include effective leadership within the government and community, ethnic diversity and tourism, and a strong healthcare system. However, given the high level of exposure to climate change and its impacts, there are several areas where the city can invest to strengthen its resilience across all four resilience dimensions.

In particular, improving infrastructure provision in key areas, such as flood protection, is a priority for Hà Giang. Additionally, investments in infrastructure that improve mobility and communications could also contribute to improved resilience in other areas, such as providing job security whilst boosting the local economy.

To contribute to improved resilience in Hà Giang City, ADB has approved the Secondary GrEEEn Cities Development Project, which supports environmentally sustainable and socially inclusive development in the cities of Hà Giang, Hue, and Vinh Yen. The total loan amount for the project stands at just over \$224 million covering all three cities, and will finance sub projects to (i) control urban stormwater runoff and reduce flood risks, (ii) improve sanitation for public health, (iii) enhance green landscaping and public amenities, (iv) upgrade urban road networks and their connectivity, and (v) promote public participation in planning.

In Hà Giang City, the project will rehabilitate 7 kilometres (km) of storm drain-streams, upgrade and provide protection to river embankments along the Lô and Mien Rivers and undertake the construction of a new wastewater collection network and wastewater treatment plant. The project will benefit approximately 14,600 households in Hà Giang, including about 6,000 poor and near-poor households. The overall project social impacts will be positive and contribute to improving the quality of life of the people in Hà Giang. Additionally, the project will improve the resilience of vulnerable groups and alleviate poverty through improvements in access to climate resilient urban environmental services.

Resilience and the Urban Climate Change Resilience Trust Fund

Alongside ADB's loan investment in the city, UCCRTF supports resilience building in the city through the preparation of the GCAP. A \$1-million investment grant

funded the GCAP alongside feasibility studies for climate resilient urban infrastructure investment, preparation of preliminary engineering designs for each urban infrastructure subproject, and further consultations.

In addition, Hà Giang was one of five pilot cities for UCCRTF's geo-spatial platform, the Spatial Data Analysis Explorer (SPADE), which is designed to increase access to geospatial data for users. SPADE is a web-based platform that contains various geospatial data that can be used for consultation, project preparation, production of maps, and analysis of climate change impacts. Hosted on a centralized cloud-based server, the platform uses open-source technology to provide support to Regional Departments on their planning and spatial analysis needs. The maps and socio-economic surveys carried out in the city have been digitized and are available on the platform.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Hà Giang City. It does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment, these include:

- 1. Increased investment in flood resilience from river flooding, with an emphasis on green infrastructure and ecosystem-based solutions to complement planned grey infrastructure investment and potentially reduce cost.**
- 2. Improved sanitation and drainage infrastructure to improve water quality and reduce pollution.**
- 3. Investment in public transport systems and improved street infrastructure that encourages walking and cycling.**
- 4. Improved piped-water systems to reduce leaks and increase overall capacity to deal with the city's growing population.**

ENDNOTES

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*A photo of a street Hà Giang City, Vietnam.
Image by: trungydang, Wikimedia Commons*

Hoi An

Hoi An, a coastal city situated in the Quang Nam province, is highly vulnerable to climate change-induced events and disasters such as sea level rise and storms. Climate change projections indicate increased temperature, higher intensity storms and sea level rise in the region. The city already experiences high levels of coastal and riverbank erosion, inundation, salinity and flooding, which will be further exacerbated by climate change. Improvements to Hoi An's infrastructure, urban planning, and community preparedness are essential to improve the city's resilience to shocks and stresses caused by climate change.

This study provides a baseline assessment of Hoi An's resilience based on a series of structured interviews with city officials and on surveys that were conducted with 100 households in Hoi An. According to the baseline

assessment, Hoi An demonstrates several qualities that make it resilient to shocks and stresses. Increasing its resilience further will require investment in its critical infrastructure and improved stakeholder engagement.

ADB is actively working with Hoi An to strengthen the city's urban planning and critical infrastructure. UCCRTF activities complement ADB's projects to strengthen the city's resilience through investments that help improve Hoi An's critical infrastructure and planning processes. UCCRTF intends to undertake another assessment at the end of the programme to assess changes in resilience.

KEY FINDINGS

- Hoi An is sensitive to climate change-related shocks and stresses, including sea level rise, increased intensity of storms, temperature rise and increase in rainfall.
- Climate impacts aggravate other existing challenges in the city, such as coastal and riverbank erosion, inundation, saline water intrusion and flooding.
- Interviews with city officials suggest that Hoi An has many qualities that lend it resilience to shocks and stresses, including a climate change-informed development plan, a strong local economy, and good law and order.
- Hoi An could increase its resilience by improving its governance processes and empowering civil society. It also requires targeted investment to improve key critical infrastructure systems, particularly water supply and transport.
- Community awareness about disaster shelters, post-disaster facilities and local disaster management systems was found to be low, indicating a lack of critical infrastructure and effective communication mechanisms. This corroborates a low city resilience score for critical infrastructure as part of the baseline assessment.
- While 78% of households surveyed consider that they have the capacity to recover after a disaster, 40% of the surveyed households were unaware of the availability of essential services in the city, which could undermine their resilience to repeated shocks or chronic stresses.

Hoi An in the context of climate change

Situated in the South-Central Coast region of Viet Nam, Hoi An is a city in Quang Nam province. The city has a population of 92,000 and is declared a UNESCO World Heritage site in 1992, as the ancient town is an exceptionally well-preserved example of a South-East Asian trading port.¹ Being a coastal city and characterized by low elevation levels, Hoi An is highly vulnerable to climate change induced events and disasters such as sea level rise, storms and flooding.

The province of Quang Nam already experiences high levels of coastal and riverbank erosion, inundation, salinity and flooding, which will be further exacerbated by climate change. According to the 2011 National Target Program to Respond to Climate Change (NTP-RCC) of the Ministry of Natural Resources and Environment, the medium emissions scenario indicates that Quang Nam's temperature might increase by 1.4oC by 2050 and by 2.7oC by 2100, and precipitation levels might increase by 1.9 % by 2050 and 3.6 % by 2100.²

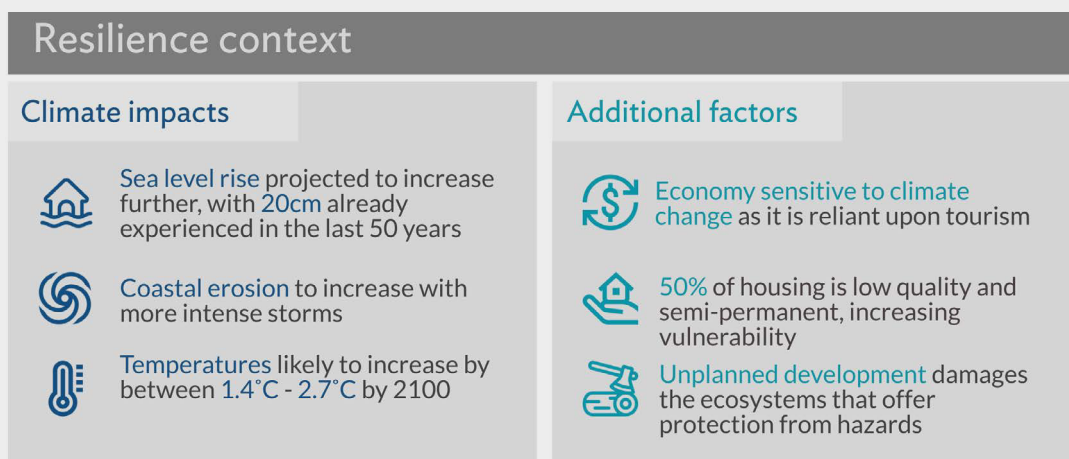
Almost one in four tropical storms that make landfall in Viet Nam affect Hoi An. During these events, the city experiences wind speeds of up to 110 km per hour and wave heights of three meters above average sea-level.³ Coastal erosion near Hoi An city can reach an annual rate of 10-20 m or higher as frequent storms have led to significant loss of pine forests which acted as a buffer against storms for the city.⁴ Over 50 hectares (ha) of the city's land area is at risk of permanent inundation by 2020.⁵ These climate-related risks will continue to adversely impact urban infrastructure, damaging housing and reducing the availability of and access to freshwater resources.

The city's economy is especially exposed to climate

impacts as it is heavily reliant on tourism, a highly climate-sensitive economic sector. Hurricanes and floods in 2006 and 2009 alone caused an estimated damage of between \$1.4 - 1.7 billion to the city, around 20% of the city's GDP.⁶

The climate vulnerability of Hoi An's population is made worse due to low quality housing with 50% of houses in the city are classified as 'semi-permanent' or lower.⁷ Urban development in the city has been characterised by unplanned growth which has damaged natural ecosystems that offer protection from climate-related hazards. This expansion has led to indiscriminate deforestation and mining of river sand, which has resulted in destabilization of riverbanks.⁸

To respond to the significant risks posed by climate change, Hoi An is currently in the process of developing a city-wide resilience programme to incorporate climate change adaptation considerations into the city's urban plans.⁹



City Resilience Profile



In 2018, ADB's Urban Climate Change Resilience Trust Fund conducted a baseline assessment of Hoi An's resilience. The study assessed Hoi An's resilience based on four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe for a city. The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram below. The city scored relatively high, that is above 4 out of 5, in the dimensions of health and wellbeing, economy and society and infrastructure and ecosystem. Out of the 4 dimensions, Hoi An scored the lowest (3.86) in leadership and strategy, indicating the need to focus on improving the city's local leadership and management, empowering city stakeholders, especially city residents, and enhance development planning approaches.

LEADERSHIP & STRATEGY

Whilst there is generally good co-ordination between departments at the municipal level, infrastructure investment and maintenance decisions are often made at the regional level, which can make them less responsive to local needs (Effective leadership and management – 3.7). Urban development and planning processes engage a range of stakeholders. However, the city could improve its resilience by ensuring participation of the wider community (Empowered stakeholders – 3.6). Hoi An's current master plan is being adapted to ensure that environmental protection and climate change are integrated. However, for the plan to be effective it will be important to increase the capacity of city officials and municipal departments to implement them (Integrated Development planning – 4.3).

HEALTH & WELLBEING

Hoi An's score of 4.3 for 'Diversity of livelihoods and employment opportunities' reflects the city's efforts to create employment opportunities for its citizens, especially in jobs related to tourism, the service sector and agriculture. Tourism and agriculture are also highly sensitive to climate change so Hoi An could increase its resilience further by creating opportunities outside these sectors. The city has a good range of health care facilities including hospitals, and clinics (Minimum Human Vulnerability – 4.2). However, its residents are susceptible to climate-related hazards such as flooding and erosion, with housing and infrastructure located in high-risk zones along coastal areas and near the Thu Bon and De Vong rivers (Effective safeguards to human health and life – 4.2).



INFRASTRUCTURE & ECOSYSTEMS

Hoi An has a well-developed road network (Mobility and communications - 4.5). However, transportation infrastructure is often located near the Thu Bon and De Vong rivers making it susceptible to flooding. Hoi An also has limited public transport infrastructure, so private vehicles and road transport are essential in the city. In general, the city's population is well served by critical infrastructure including piped water, electricity and sanitation. However, the water supply infrastructure is coming under increased pressure from salinisation due to sea level rise, and over extraction due to the growing population and increased tourism activity (Provision of critical infrastructure - 3.7). Coastal flood protection infrastructure is in place in the city, however, improved flood risk management practices are key to improve the city's resilience to climate change (Reduced exposure - 4.5).

ECONOMY & SOCIETY

Hoi An has experienced years of strong economic growth driven by a booming tourism industry, which has helped to provide good job opportunities and relative stability for its citizens (Sustainable economy - 4.3). However, COVID-19 has negatively impacted the tourism in the city, emphasising the importance of diversifying the city's economic base. This economic growth has been founded on the city's effective law enforcement, creating a safe environment for citizens and tourists (Security and rule of law - 4.1). Hoi An scored 4 for its 'Collective identity and community support' which indicates that the local community is generally cohesive, lending it resilient especially in the wake of disasters.

Household perceptions of resilience

Along with conducting the city level baseline study, UCCRTF also conducted a household level survey to understand the perception of resilience in certain segments of the local population. The data collection was limited to 100 households in two climate vulnerable wards: Cam Thanh and Cam Pho. The UCCRTF team and ADB staff worked jointly with city officials to identify households in areas that were exposed to climate impacts and were deemed socio-economically vulnerable. The results provide more of an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

During the household survey, residents were asked to rate their community on a scale of 1 to 5, with 1 being the lowest rating and 5 being the best against four general community characteristics: i) Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As seen in figure 1, overall, Hoi An scored low across these community characteristics (2.6) indicating that residents interviewed perceive community resilience to be weak. Results show the city scored 3.2 on infrastructure and services; 1.6 on connectedness, indicating weak linkages which may impact recovery initiatives; 2.6 on economic opportunities; and 3 on community social cohesiveness. A low score in these dimensions indicates the presence of specific

weaknesses in connectivity and availability of economic opportunities, which limit the community's resilience.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Assets; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social Safety Net. Scores against each of these dimensions were calculated as an averaged index from survey responses and secondary data.

As seen in figure 2, based on the residents' perceptions, 78% of households interviewed consider that they have the capacity to adapt to and recover after a disaster. Perceived household resilience is highest for income and food security (93%) which implies that most households interviewed have diverse sources of income and sufficient access to food. Only 40% of households are aware of the availability of basic services in the area, suggests that residents may not access services which play an important role in enhancing their resilience. 77% of the households were dependent on some form of government-supported social program.

Dependency on government support programs which indicates that these households may be less resilient to a disaster or shock. The level of asset ownership amongst respondents is also relatively low, with only 52% of households reporting that they own assets. This is an indicator of low levels of resilience as an asset base is a key socio-economic factor for recovery from shocks. The majority of households were found to have low or medium resilience (89%), suggesting overall

Figure 1

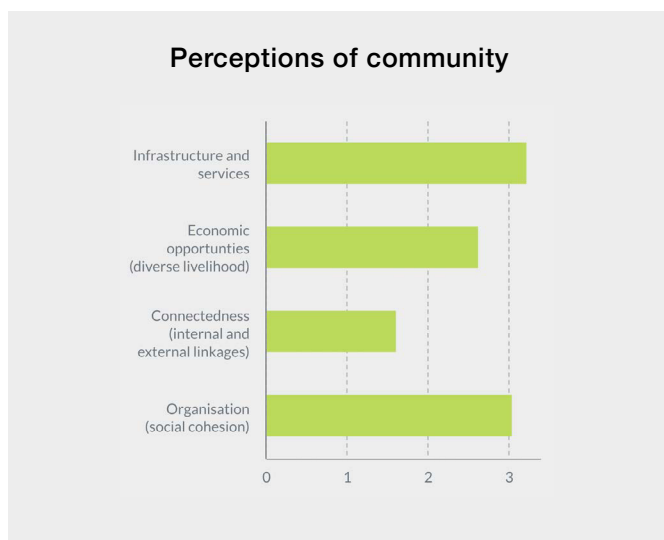
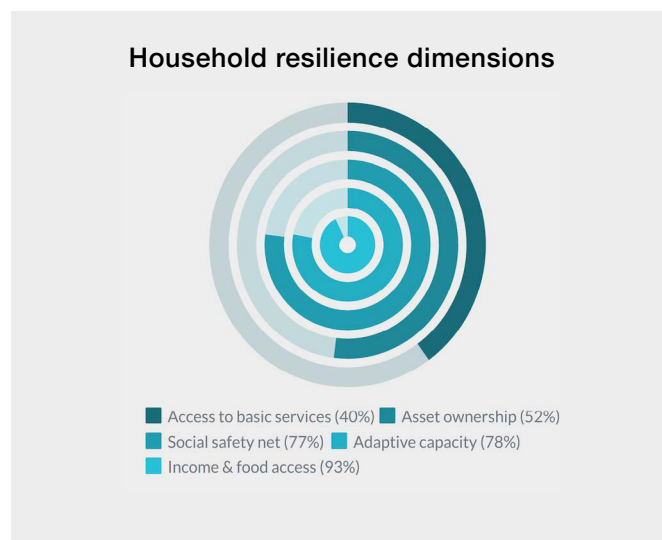


Figure 2



lower levels of resilience at the household level.

Responding to shocks and stresses

The residents of Hoi An were asked to recollect significant shocks and stresses and disasters that they had faced in the past and their coping mechanisms for each. 64-73% of households interviewed listed heavy rain or hailstorm, cyclone and strong damaging winds with storms as major shocks with moderately average impacts. 99% of households expressed that they have been strongly impacted by waterlogging and flooding.

Survey respondents consider social and health-related shocks such as chronic illnesses (19%) and loss or reduction in income (23%) to have had a strong to moderate impact on them. Major illness or injury of a household member was listed by residents as a major impact, costing residents \$117 on average. The loss or reduction in income was listed as a major shock, costing households \$259 on average. Loss of assets came at an average cost of \$188, while loss or damage to housing cost \$2659 on average.

Households interviewed used multiple strategies to recover from unexpected shocks. 5% households took loans from non-formal sources, 46% received food/cash from relatives and friends, and 24% requested assistance from local government bodies. To cope with shocks, 8% pledged labour, crops or livestock in advance, 60% reduced expenditure on healthcare and

education and 11% reduced the amount of food they ate. Reducing expenditure on health, education and basic services and reducing meals or food consumption are considered severe recovery strategies and adversely affect the wellbeing of households. As shown in figure 3, 31% of households surveyed state that they were unable to recover from disasters or shocks, while 41% expressed that their wellbeing remained the same after experiencing a shock or stress.

Early Warning System in Hoi An

According to the survey respondents, 88% of households received early warnings or forecasts on impending natural hazards. Out of those who received warnings, 90% listed television as their major source of information, 49% listed a neighbour or relative as a source of warning, while only 6% received early warnings from the disaster risk management committee. This indicates lack of a robust community disaster risk management system in Hoi An. This was further validated by 85% stating that they are unaware of who their trained community volunteer is and that none in the household received a disaster preparedness training.

Almost half (49%) of respondents indicated that they were unaware of where to seek shelter or help during a disaster. One reason for this could be due to lack of nearby disaster shelters or due to limited awareness of the location of the shelters. This suggests that city level mechanisms need to be strengthened to create

Figure 3

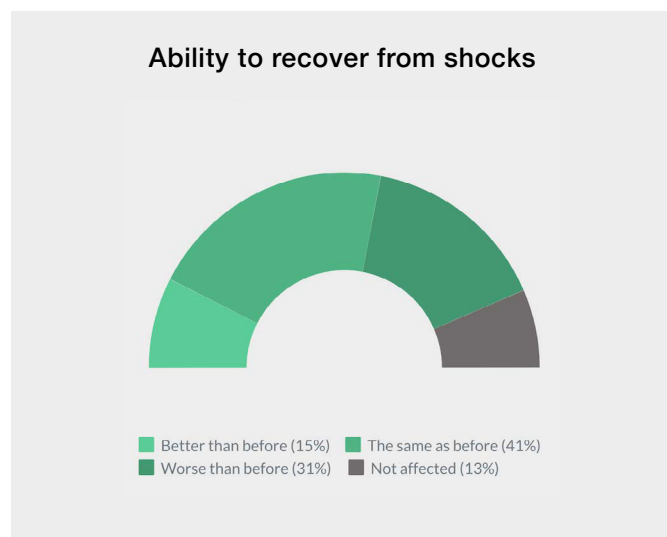
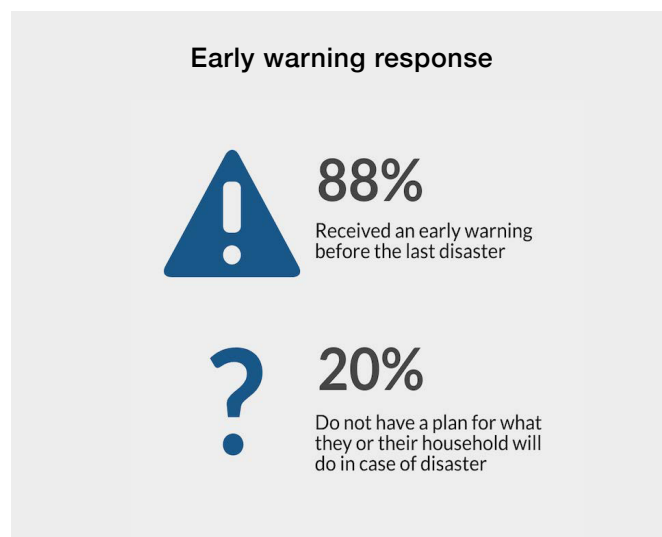


Figure 4



Resilience interventions in Hoi An

ADB and UCCRTF projects in Hoi An

CURRENT ADB PROJECT

Urban Environment and Climate Change Adaptation Project (43237-013)

\$144.16 million between 2 cities in Vietnam



Co Co River works to improve water flow through the city reducing flood risk.



improving connectivity through the construction of a new access road and flood-resilience improvements to another.



improvement of Lai Nghi Reservoir and Phap Bao Lake to improve water supply and reduce flood risk

UCCRTF Flood Forecasting and Warning System for Hoi An and Vu Gia–Thu Bon River Basin

\$3 million grant

Flood Forecasting and Warning System (FFWS)

The UCCRTF grant will improve the meteorological and hydrological forecasting system which will improve flood, flash flood and tidal and storm surge forecasts. The system will also improve the accuracy of landslide risk forecasting.

The project will support the development of new FFWS operating software as well as training and capacity building in its use. The project tasks include:

- reviewing current monitoring, forecasting, warning and response systems and organization,
- enhancing hydro-meteorological monitoring networks,
- improving meteorological and hydrological forecasting systems,
- improving flood warning and crisis communication systems,
- strengthening flood management and response capability within government and society; and
- providing ongoing support and maintenance.

capital' to mitigate disasters for the poor and vulnerable, thereby contributing to their vulnerability rather than reducing it. When asked whether households have a plan in place to cope with a disaster, 75% households planned to stay home to protect household assets, 60 % households stated that they plan to store dry food, 23% expressed that they will evacuate vulnerable household members, and 20% households said that they have no plan in place.

According to the baseline assessment, Hoi An scored strongly in all dimensions of resilience. However targeted investment in critical infrastructure, leadership, stakeholder engagement and ownership, and awareness levels of the city's residents could increase resilience further. Critical infrastructure provision is particularly necessary in disaster risk management. Lack of awareness among residents about post disaster services and support further add to the challenge. While the city scored well on integrated development planning, there remain key gaps in leadership and empowerment of city residents. This indicates that while the city does have characteristics which make it resilient, existing vulnerabilities and gaps will be further exacerbated by climate change, posing threats to life, livelihoods and development.

The household level survey confirms the baseline assessment's findings in terms of lack of awareness among residents about post disaster facilities and services. Perceived resilience of households on general community characteristics such as infrastructure and services, connectedness, economic opportunities and community social cohesiveness was found to be low. This indicates that community-based mobilisation, availability of economic opportunities and critical infrastructure are weak, which reduces the community's overall resilience to the impacts of climate change.

To improve Hoi An's resilience, ADB has approved the \$144.16-million Urban Environment and Climate Change Adaptation Project which aims to improve infrastructure resilience of three coastal cities in Viet Nam that are vulnerable to flooding and typhoons. Hoi An is one of the three cities, the others being Dong Hoi and Sam Son. The project will upgrade exiting and building new sewerage systems, water supply facilities and flood protection systems to improve the cities' physical infrastructure and environment and strengthen the city's resilience to climate change.

By improving the city's urban environment, ADB hopes to strengthen the municipality's economic base and increase the capacity to expand the tourism industry. In Hoi An, the following physical construction works have been undertaken under the project:

i. Improvement of Lai Nghi Reservoir and Phap Bao Lake:

The project will reduce flood risk and improve water quality by: dredging Lai Nghi Reservoir increasing its capacity and reducing siltation; reinforcing existing embankments; building a raw water pumping station along with a pipeline connecting the reservoir to the new water treatment plant; and installing a wastewater collection system around Lai Nghi Reservoir.

ii. Co Co River Dredging Improvements: The drainage capacity of the Co Co River will be increased by dredging a 5 km section in key parts of Hoi An to reduce flood risk.

iii. Upgrading Provincial Road 608: Flood resilience will be increased by raising the height of Provincial Road 608. This will reduce the incidence of flooding of this road, which will serve as a flood evacuation route on the southwest side of the city.

iv. Access Roads to Cua Dai Bridge: New access roads linking neighbourhoods to the Cua Dai Bridge will improve connectivity and reduce congestion.

Resilience and the Urban Climate Change Resilience Trust Fund

Alongside ADB's loan investment in the city, UCCRTF is supporting the city in developing a Flood Forecasting and Warning System for Hoi An and Vu Gia-Thu Bon River Basin. This \$3-million project aims to strengthen the city's early warning systems and disaster response. UCCRTF is reviewing the current monitoring, forecasting, warning, and response systems and working to enhance the hydro-methodological monitoring networks. This will provide the basis for an effective flood forecasting and warning system.

To make sure that citizens respond to early warnings appropriately, UCCRTF is also working to improve crisis communication systems, crisis management procedures, and evacuation planning.

Training and capacity building of relevant stakeholders at the city-level is also planned, as well as maintenance support, for two years. These measures will ensure that the systems are sustainable in the long term.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Hoi An. It does not represent a full assessment of the investment needed to increase urban resilience. However, the results of the study suggest possible areas of focus for resilience investment, which include:

- 1. Strengthened efforts to foster community engagement and support in resilience planning and urban development.**
- 2. Increased investment in flood resilience to protect transport networks and housing.**
- 3. Improvements to green infrastructure should be strategically implemented to complement planned grey infrastructure investment and potentially reduce cost.**
- 4. Improved water and sanitation systems that have the capacity to serve Hoi An's growing population and can deal with an influx of tourists in the coming years.**
- 5. Improved internal transport links to reduce congestion and improve air quality to encourage more sustainable transport modes such as walking and cycling.**

ENDNOTES

1. ADB Vietnam City Profiles

2. UN Habitat: <https://unhabitat.org/sites/default/files/download-manager-files/vietnam.pdf>

3. ADB Vietnam City Profiles

4. ADB Vietnam City Profiles

5. ADB Vietnam City Profiles

6. UN Habitat: <https://unhabitat.org/sites/default/files/download-manager-files/vietnam.pdf>

7. ADB Vietnam City Profiles.

8. UN Habitat <https://unhabitat.org/sites/default/files/download-manager-files/vietnam.pdf>

9. Hoi An Eco-city Development Programme towards the year 2030



A UCCRTF photo taken while baselining Hoi An in 2018.

Image by: ADB

Hue

Hue is highly exposed to climate-related shocks and stresses, such as river flooding, sea-level rise and extreme temperatures. Climate projections suggest that these issues will become more severe in the future. Improvements to Hue's infrastructure, urban planning, and community preparedness are essential to ensure its resilience.

This study provides a baseline assessment of Hue's resilience based on a series of structured interviews with city officials and on surveys that were conducted with 113 households in Hue. The results showed that Hue demonstrated many positive qualities that lend the city resilience to shocks and stresses. However,

they also indicated that there are several areas where improvements could be made to increase resilience, including in urban development planning, the quality of infrastructure for connectivity, and disaster prevention and mitigation.

ADB is actively working with Hue to strengthen the city's urban planning and critical infrastructure. These projects in the city are complemented by UCCRTF activities to build climate resilience in Hue by supporting disaster risk financing activities and community-led resilience projects. UCCRTF intends to undertake another assessment once ADB infrastructure projects are complete to assess changes in resilience.

KEY FINDINGS

- Hue is sensitive to climate change shocks and stresses, including sea level rise, surface water flooding, and extreme heat. The city displays many qualities that contribute to its resilience; however it can strengthen its resilience by investing in improved infrastructure and urban planning.
- Hue's good emergency management plans, coordinated governance and multi-stakeholder engagement provide a strong foundation for its leadership and strategy resilience. The city could improve in this area by investing in improved integrated development planning.
- Hue's health and well-being resilience was strengthened by high levels of access to quality, robust public healthcare system. Areas for improvement in this area were found to strengthen safe housing, energy supply, and access to safe drinking water.
- Critical infrastructure systems in Hue were perceived to be relatively well able to cope with shocks and stresses. However, resilience could be strengthened by investing in ecosystem protection, infrastructure to support disaster risk reduction, and better codes and standards for infrastructure design and planning.
- Hue's economic and social resilience is supported by effective law enforcement, crime prevention and access to criminal justice systems. To further increase resilience in this area, the city could improve its engagement with its citizens and diversify its economic base.
- Household-level surveys found that most vulnerable households in Hue reported that they had diverse sources of income and owned assets (87.6% and 67.3%, respectively). This lends them resilience. However, there was a relatively high dependency on government support services (62.8%), and less than half of households (45.1%) were aware of the availability of basic services in their area, which could undermine their resilience to repeated shocks or chronic stresses.

Hue in the context of climate change

Hue is one of the most vulnerable cities to climate change in Viet Nam. Situated in the delta region of the Perfume River, it sits just 3 meters above sea level. Hue is exposed to shocks and stresses related to sea-level rise and flooding. Temperatures in the city can reach 41°C in the dry season which will likely impact vulnerable populations such as the elderly, the sick and those who are required to work outdoors. By the end of the century, climate change could lead to 48 more days per year where temperatures go above 40°C.¹

Home to over 350,000 people, the city's population has grown at a modest rate of 1.1% over the last five years.² Nonetheless around a fifth of the population is classified as being urban poor and is therefore especially vulnerable to climate impacts. The expanding population and increasing tourism have put additional strain on the city's infrastructure systems, especially transport and wastewater treatment facilities. The city also faces a range of significant infrastructure challenges, for instance, less than 15% of urban wastewater is collected and treated by centralized treatment systems.³ Nonetheless, infrastructure for water and energy has undergone significant improvements in recent years, with almost all households connected to the utilities.

Hue is annually subjected to flooding from tropical storms during the rainy season. Urban flooding has increased as a result of the city's poor drainage systems, deforestation upstream and rapid urbanisation across the floodplain. Extreme rainfall events, which are expected to increase in intensity in the region, are likely to continue affecting Hue, thanks in part to its extensive canal network. ADB flood hazard simulations suggest that while the

land area exposed to flooding will not change significantly, the flood depth could increase by around 1 meter in the lower reaches of the Bo and Perfume rivers, by the end of the century.⁴

Sea level rise will increase the pressure on Hue's coastal zone. Climate projections indicate that sea levels may rise by up to 94 cm by 2100, and could lead to further coastal erosion, especially around the area at the mouth of the Perfume River. Elevated sea levels will make coastal areas more exposed to storm events, increasing the city's sensitivity to such events thanks to the significant loss of pine forests that used to protect the city from the worst effects of storms.

Tourism has also become an important contributor to the economy. Climate change will pose risks to tourism, public health, and infrastructure in the form of flooding, siltation, erosion, destruction of homes, damage to power supply and impacts to ecosystems. To respond to the significant risks posed by climate change, Hue is currently developing a city-wide resilience programme to incorporate climate change adaptation considerations into the city's urban plans.

Resilience context

Climate impacts



Sea-level rise projected to be 94cm by 2100, causing flooding and coastal erosion



Extreme rainfall events to increase in intensity



Increased temperatures to result in 48 more days per year above 40°C by 2100

Additional factors



Population growth of 2.5% puts strain on current infrastructure



Poor drainage systems exacerbate flooding



Deforestation reduces protection from storms and increases flooding

City Resilience Profile



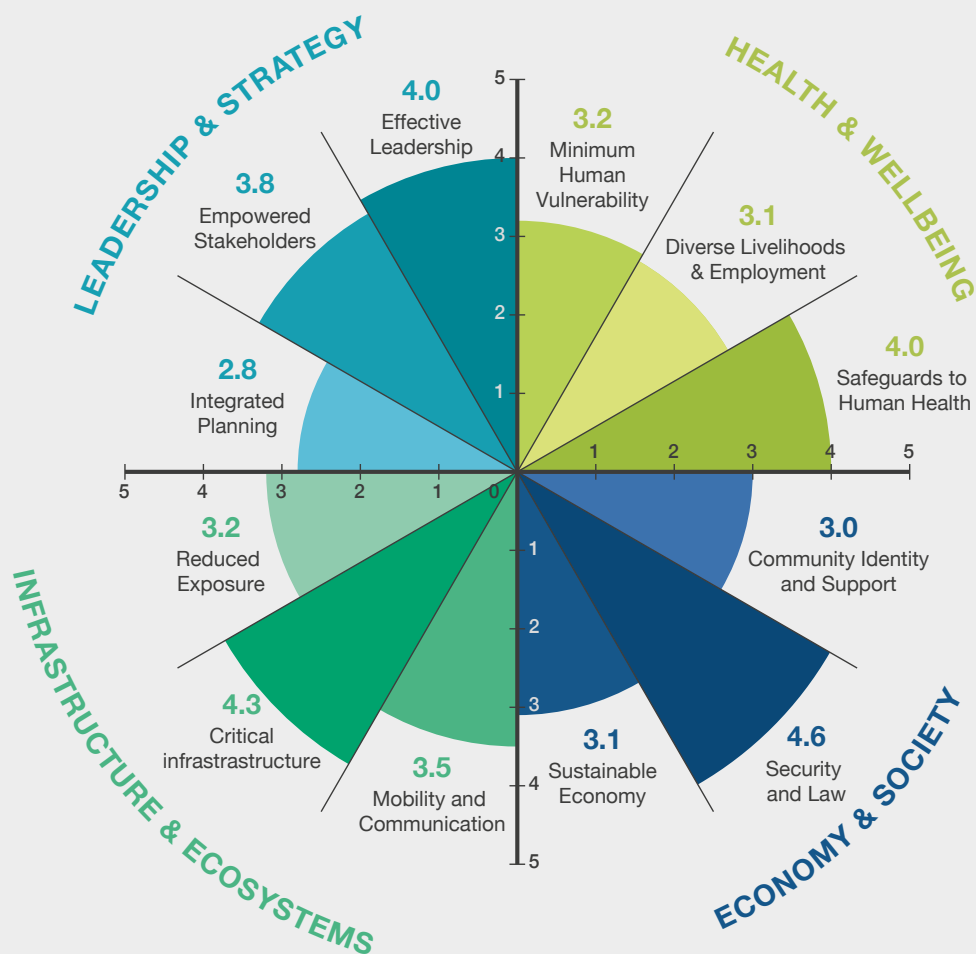
In 2018, the Asian Development Bank's Urban Climate Change Resilience Trust Fund visited Hue city and conducted a baseline assessment of the city's resilience. The study assessed Hue's resilience relating to four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The assessment scored these categories relating to twelve relevant goals of resilience, which are crucial in addressing a wide range of chronic problems or a sudden catastrophe for a city.⁵ The scoring was based on structured interviews with key city officials. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis showed that Hue is perceived to demonstrate resilience in several areas, and in others where it could invest to strengthen its resilience, considering the city's high level of exposure to climate change and its impacts. This is discussed according to each dimension in the coloured boxes below.

LEADERSHIP & STRATEGY

Hue has effective leadership which helps it to cope with hazards, shocks and stresses contributing to its resilience. Qualities that were perceived to lend the city resilience in this area included proactive multi-stakeholder co-operation, effective coordination between government bodies, and good emergency management plans ('Effective Leadership' – 4.0) and ('Empowered Stakeholders' – 3.8). However, Hue's most recent urban development plan was its GrEEEn City Action Plan, produced with support from ADB in 2014.⁶ To boost the city's resilience further investment is needed to update and build on this plan, to ensure that it is fully integrated into the city's urban development planning processes ('Integrated Planning' – 2.8).

HEALTH & WELLBEING

Ensuring that residents of Hue are healthy and have a good quality of life, is important to cope with shocks and stresses. Hue was perceived to have higher levels of access to good quality, robust public healthcare system including specialist healthcare facilities ('Safeguards to Human Health' – 4.0). The city could boost its resilience levels further by strengthening safe housing, sanitation, and access to safe drinking water, ('Minimum Human Vulnerability' – 3.2).⁷ While many neighborhoods are well served by these utilities, poorer neighborhoods around the Citadel are often not connected to sanitation infrastructure.⁸ Hue could also support greater variety and diversity of employment opportunities by boosting its tourism sector ('Diverse Livelihoods and Employment' – 3.1).⁹



INFRASTRUCTURE & ECOSYSTEMS

Hue's infrastructure and ecosystems resilience is boosted by its effective provision of critical infrastructure ('Critical Infrastructure' – 4.3). Infrastructure systems were perceived to be able to cope with shocks and stresses relatively well. Hue's infrastructure is improved by being one of the greenest cities in Viet Nam, benefitting from the protection offered by the Ru Cha mangrove forest and coastal lagoons.¹⁰ However, these assets must be preserved in order to continue to allow natural ecosystems to protect the city from hazards ('Reduced Exposure' – 3.2). To do this the city would benefit from better codes and standards for infrastructure design and planning. Hue's resilience would be further strengthened by improving the road and pavement infrastructure in and around the Citadel area which would also help to boost tourism in the city ('Mobility and Communications' – 3.5).¹¹

ECONOMY & SOCIETY

Hue's overall resilience for the economy and society dimension is positively influenced by the city's 'Security and the Rule of Law' (4.6) with effective law enforcement, crime prevention and access to criminal justice systems for its citizens. Hue remains a relatively safe and stable city in which to live and work.¹² The city's resilience could be improved by increasing its engagement with its citizens ('Collective Identity & Community Support' – 3.0), especially with regards to urban planning which remains largely a top-down process¹³ and diversifying its economic base ('Sustainable Economy' – 3.1).¹⁴

Household perceptions of resilience

At the same time as the city-level baseline study, UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain sections of the city's population. The data collection was limited to 113 respondents from the Citadel area of the city. UCCRTF team and ADB staff jointly with city officials to identified households in areas that were exposed to climate impacts and were deemed socio-economically vulnerable. The results rather provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community in Hue, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the best against four characteristics: i) Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As shown in figure 1 at the bottom of the page, respondents scored Hue highest for provision of infrastructure and services (3.03), but relatively poorly for economic opportunities (1.67), connectedness (1.51) and organisation (2.02). This may be due to the socio-economic position of many of the households that were interviewed for the survey. Most surveys were conducted in the Citadel area of the city, in poorer neighbourhoods where people rely on farming activities, and there are few opportunities for business or tourists.

The household survey also assessed perceptions of

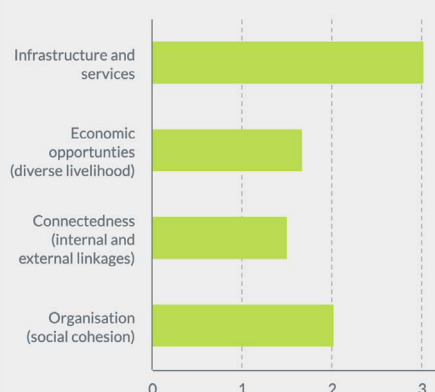
resilience against five commonly-used dimensions: i) Access to Basic Services; ii) Assets; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social Safety Net. Scores against each of these dimensions were calculated as an averaged-index from survey responses and secondary data.

As shown in figure 2 at the bottom of the page, perceived household resilience was highest for "income and food security" with 87.6% of households having diverse sources of income and sufficient access to food. Levels of asset ownership were also relatively high, with 67.3% reporting that they owned assets and 62.8% of households have the capacity to adapt and recover after a natural disaster. The results suggest that households' financial resources and asset ownership are important factors that could help the people of Hue recover from disasters.

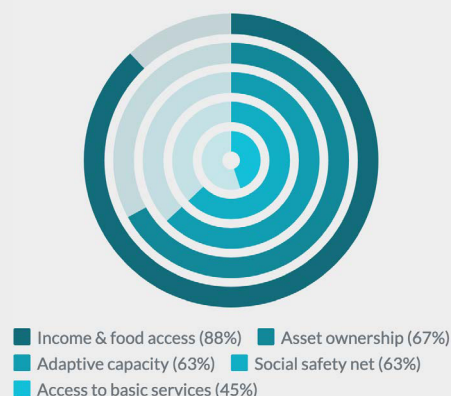
Despite the perception of relative financial security in Hue, almost two thirds (62.8%) of households are dependent on some form of government-supported social programme. This may indicate that household financial security is less sustainable than it first appears, which could be undermined by significant losses due to external shocks. Less than half of households (45.1%) were aware of the availability of basic services in their area which further restricts their adaptive capacity and overall resilience to shock.

Hue has experienced several shocks and stresses in its recent history, so respondents to the survey were able to draw on recent experience about their ability to deal with and recover from shocks. Overall almost two thirds of respondents to the household survey felt that their

Perceptions of community



Household resilience dimensions



level of resilience was “medium” (63.7%) compared with 22.1% who felt they had relatively high levels of resilience and 14.2% who saw their resilience as “low”. This is in line with the overall city level scores (see page 150) which scored Hue as having moderate levels of resilience across all four dimensions.

As shown in figure 3 below, over half of respondents also reported that their ability to recover from shocks was worse than it used to be (50.4%), a further 37.2% felt that their ability to recover had not changed, and very few felt that it was better than before (3.6%).

Early warning system in Hue

Almost all respondents in Hue reported that they had received an early warning before the last natural disaster (94.7%). These warnings were communicated effectively via multiple channels, the most popular of which were: radio (51.4%), television (86.9%), and from neighbours or relatives (56.1%).

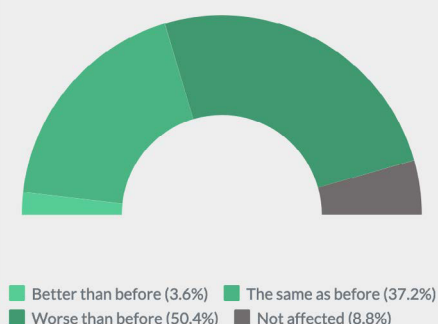
Despite the very effective early warning system in Hue, most people did not move to another place to take shelter either before or after the last natural disaster (75.2%). This is likely due to several factors. Firstly, the most popular communications channels for receiving the early warnings were largely passive. Far fewer respondents reported receiving warnings via direct instruction from people who have received training such as community volunteers or disaster management committees (12.1% for each).



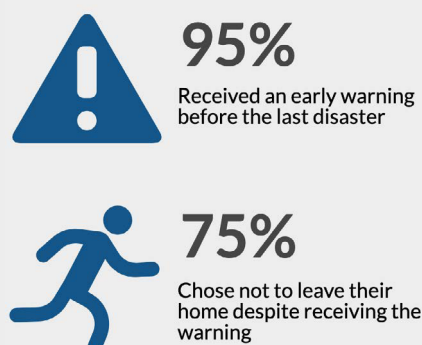
Image: The UCCRTF and SPADE team visit Hue for the baseline study

There was an overall lack of awareness of where to seek shelter or help in case of disaster. Over half (55.8%) of respondents said they were not aware of a local safe shelter, and 73% were not aware of members of the community who are trained to help during a disaster. Very few people reported having received disaster preparedness training (5.3%). Many people also reported that they wanted to stay at their own home instead of seeking shelter elsewhere. Almost half of households believed that their home was already protected (49.4%) and a further quarter (25.9%) wanted to stay behind to protect their home or assets.

Ability to recover from shocks



Early warning response



Resilience interventions in Hue

ADB and UCCRTF projects in Hue

CURRENT ADB PROJECT

Secondary Cities Development Project

\$224 million between 3 cities in Vietnam



9,000 linear meters of embankment to be strengthened



22 km of drainage pipelines upgrades and dredging 6.2 ha of water-retention ponds



over 31 km of road improvements and new projects



17 hectares of green spaces and landscaping for public amenities



water supply system for a solid waste treatment in Phu Son

UCCRTF program preparatory technical assistance \$1 million

Supporting:

- feasibility studies for climate-resilient urban infrastructure investment
- preliminary engineering designs
- capacity building programs on planning and management for green city development
- integrating green infrastructure

UCCRTF climate risk financing technical assistance \$1 million

Supporting:

- strengthening regulatory frameworks
- market building
- stimulating premium payment mechanisms
- capacity development

UCCRTF community-led initiatives grant \$2 million

Supporting:

- community-defined projects
- preparation of community resilience plans
- the implementation of chosen projects
- sustaining the plans in the long term

UCCRTF e-mobility project

Supporting:

- knowledge and capacity to develop policy actions and technical solutions for e-mobility

UCCRTF Spatial Data Analysis Explorer (SPADE)

Supporting:

- improved city-level climate and geospatial data
- project preparation, consultation and map production

According to the city level baseline assessment, Hue has many qualities that contribute to its resilience. The city's infrastructure provision serves the basic needs of the population, there is a robust healthcare system, and the population benefits from good levels of law and order. However, given the high level of exposure to climate change and its impacts, there remains several areas where the city can invest to strengthen the resilience across all four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy.

In particular, the city's capacities around integrated development planning could be enhanced. While the city's critical infrastructure systems were found to contribute to its resilience, improving infrastructure provision in key areas such as flood protection, to reduce exposure to hazards was found to be a priority for Hue. Investments in infrastructure that improves mobility and communications could also contribute to improved resilience in other areas, such as increasing employment opportunities and boosting the local economy.

The results of the household survey appear to support the scores at the city level, with reasonably good levels of financial security and asset ownership lending the populations resilience to shocks and stresses. However, the household survey also pointed to areas for improvement especially around access to and awareness of infrastructure provision, and improved disaster risk management planning and communications.

To contribute to improved resilience in Hue ADB has approved the Secondary Green Cities Development Project, which supports environmentally sustainable and socially inclusive development in the cities of Hue, Vinh Yen, and Ha Giang. The total loan amount for the project stands at just over \$224 million¹⁵ covering all three cities, and will finance sub projects to (i) control urban stormwater runoff and reduce flood risks, (ii) improve sanitation for public health, (iii) enhance green landscaping and public amenities, (iv) upgrade urban road networks and their connectivity, and (v) promote public participation in planning.

In Hue, the project will upgrade 21.9 km of drainage pipelines, rehabilitate 15.9 km of road surface and drainage, develop 17.2 ha of green spaces, strengthen and improve river embankments, and extend access to a clean water supply.

Resilience building and the Urban Climate Change Resilience Trust Fund

Alongside ADB's loan investment in the city, UCCRTF supported the following interventions: i) Technical assistance to support the planning and preparatory stages of projects, and prepare Green City Action Plans and integration of nature-based solutions; ii) Climate risk financing support; iii) Grant-funded community-led initiatives to increase the resilience of vulnerable communities; iv) A geo-spatial data tool the 'Spatial Data Analysis Explorer (SPADE) to increase data access; and v) Technical assistance on e-mobility. These projects contribute to improving key areas where Hue's resilience might be increased, according to the baseline study.

Green City Action Plans and integration of nature-based solutions: In Hue, the UCCRTF supports the preparation of green city action plans, feasibility studies for climate resilient urban infrastructure investments, preparation of preliminary engineering designs for each urban infrastructure subproject, capacity building programs on planning and management for green city development, and other workshops and consultations associated with these activities. This is particularly important in Hue, which showed a gap in integrated development planning according to the baseline study.

Climate risk financing: The UCCRTF provided \$1 million in technical assistance towards climate risk financing which will allow the city to better manage the cost of disasters by strengthening sources of finance aimed at recovering from climate related shocks. UCCRTF activities include strengthening regulatory frameworks, market building, stimulating premium payment mechanisms and capacity development. Through technical assistance support for climate risk financing, the UCCRTF supports Hue to develop diverse livelihoods and employment opportunities, and a sustainable economy.

Community-led initiatives: Funded through an investment grant of \$2 million for Hue, a series of community-led initiatives will support a range of activities to improve the resilience of the most vulnerable communities. While the specific interventions supported by the investment grant will be defined by the communities themselves, the project will support the preparation of community resilience plans; the implementation of the projects; and sustaining the plans in the long term. community-led initiatives to support vulnerable communities in the city, strengthen participation, good governance, and build collective identity and community support.

SPADE: The UCCRTF SPADE is a web-based tool and data repository that contains various geospatial data that can be used for consultation, project preparation, production of maps, and analysis of climate change impacts. Hue city was one of the five pilot cities for the tool. The maps and socio-economic surveys carried out in the city have been digitized and available on SPADE. For Hue, SPADE can display thematic layers including utilities, various infrastructure, natural water system, cultural heritage locations, and land use.

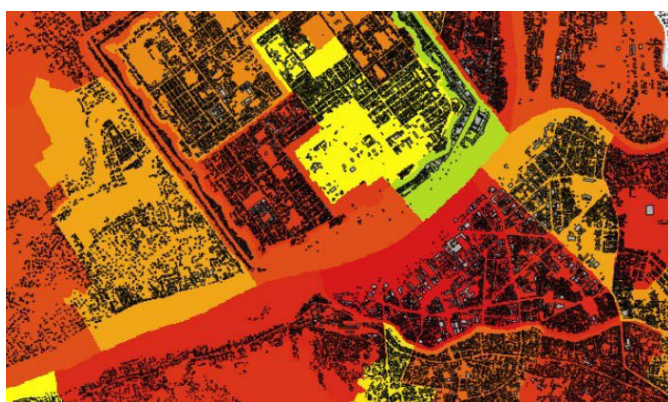


Figure: SPADE map of central Hue with hazard exposure

E-mobility project: UCCRTF promotes e-mobility by enhancing knowledge and capacity of Hue, amongst other cities, to develop policy actions and technical solutions. This is part of a regional technical assistance that aims to promote sustainable transport operations in ADB and partner countries. In Hue, traffic is dominated by motorcycles. However, the city intends to increase the share of journeys taken on public transport share from currently less than 1% to 10% by 2030. The city also intends to increase the use of electric vehicles to transport tourists in the city centre. Currently 59 vehicles are in operation and by the end of 2020 they expect to increase this to 300.¹⁶

Potential areas for investment to build Hue's resilience

The baseline assessment provides a snapshot of perceived levels of resilience in Hue city, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment, these include:

- 1. Strengthened efforts to foster community engagement and support in resilience planning and urban development.**
- 2. Increased investment in flood resilience from coastal and river flooding, with an emphasis on green infrastructure and ecosystem-based solutions to complement planned grey infrastructure investment and potentially reduce cost.**
- 3. A catchment-wide flood management plan that includes efforts to increase tree cover.**
- 4. Improved wastewater treatment facilities increasing coverage as Hue expands.**
- 5. Improved internal transport links to reduce congestion and improve air quality, to handle increased numbers of tourists and a growing population.**

ENDNOTES

1. World Bank Climate Knowledge Portal: <https://climateknowledgeportal.worldbank.org/country/Viet Nam/climate-data-projections>
2. Asian Development Bank (2018) SC 109094 REG: Climate Change and Flood Hazard Simulations Tools for ADB Spatial Application Facility Final Report.
3. Asian Development Bank (2018) SC 109094 REG: Climate Change and Flood Hazard Simulations Tools for ADB Spatial Application Facility Final Report.
4. Asian Development Bank (2018) SC 109094 REG: Climate Change and Flood Hazard Simulations Tools for ADB Spatial Application Facility Final Report.
5. The resilience dimensions and goals are based on the City Resilience Index (CRI). The CRI is a tool developed by the Rockefeller Foundation to help cities assess their resilience progress.
6. ADB (2014) Hue GrEEEn City Action Plan. <https://www.adb.org/sites/default/files/publication/179170/hue-green-city-ap.pdf>
7. ADB (2014) Hue GrEEEn City Action Plan. <https://www.adb.org/sites/default/files/publication/179170/hue-green-city-ap.pdf>
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11. ADB (2014) Hue GrEEEn City Action Plan. <https://www.adb.org/sites/default/files/publication/179170/hue-green-city-ap.pdf>
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14. Hue GrEEEn City Action Plan. <https://www.adb.org/sites/default/files/publication/179170/hue-green-city-ap.pdf>.
15. DB (2014) Hue GrEEEn City Action Plan: <http://www.adb.org/sites/default/files/publication/179170/hue-greeeen-city-ap.pdf>
16. ADB E-Mobility for Hue: A report on the potential of Electric Vehicles in Hue and strategies to foster electric mobility.

Vinh Yen

Whilst Vinh Yen has not suffered severe problems with flooding in the past. However, climate change is likely to lead to changes in rainfall patterns in northern regions of Viet Nam and cyclones that affect the city may also become more severe, bringing heavy rainfall with them.¹ It is, therefore, important for Vinh Yen to build resilience to future climate shocks and stresses. Improvements to Vinh Yen's infrastructure, urban planning, residents' economic security and community preparedness are essential to achieve this. The results of the baseline study showed that Vinh Yen demonstrated moderate resilience levels to shocks and stresses against every indicator. The city could further increase its resilience through infrastructure development and improved urban development.

ADB is actively working with Vinh Yen to strengthen the city's urban planning and critical infrastructure. UCCRTF-supported activities on the preparation of the Vinh Yen GrEEEn City Action Plan, including investments in community-led initiatives, subsidies to poor households for sanitation services, and air quality improvement, help to complement ADB's projects on green and resilient urban space improvement, the landscape restoration of Dam Vac Lake, drainage and wastewater management, green park development, and the creation of a new business center.² UCCRTF intends to undertake another assessment at the end of the programme to assess changes in resilience.

KEY FINDINGS

- Vinh Yen has not experienced severe climate shocks in the past, however, this may change in the future due to climate change. Stronger cyclones, extreme heat events and flooding may increase in the coming decades.
- The city's strong economy, excellent international and regional transport links, and effective governance systems support its resilience. However, the city could strengthen its resilience by investing in improved critical infrastructure systems and urban planning to deal with the pressures of a growing population.
- Vinh Yen's wastewater and sanitation infrastructure capacity does not meet the needs of a growing population even at the relatively modest current rate of around 1%. The combined sewers frequently discharge water into waterways during flooding events, while 30% of the city's residents are not connected to the sewer network at all.
- 72.3% of households received early warnings regarding an impending natural hazard; however, none of these households chose to seek shelter. This is partly due to their perception that they must stay home to protect their livestock and other assets.
- 76% of households said they had no plan in place to prepare for a natural disaster. The city could improve in this area, ensuring these communities have the capacity and resources for disaster preparedness and response.

Vinh Yen in the context of climate change

Lying on a tributary of the Red River, Vinh Yen is a successful industrial suburb of Ha Noi located in one of Viet Nam's most economically prosperous regions. The city is located between the Tam Đảo mountains and the river delta and has a varied topography that includes low hills and flat plains, dotted with ponds and lakes. Whilst Vinh Yen has not experienced severe flooding in the recent past, climate change will increase the likelihood of its exposure to climate-related events including flooding, extreme heat and tropical cyclones.³

At the heart of Vinh Yen sits the 160-hectare Dam Vac lake, a valuable natural asset and a focal point for the city's tourism industry. Although Vinh Yen does not currently experience very heavy rains during the monsoon season, low-lying areas around the lake such as Thanh Tru, Nga Ba Tam Duong, and Lien Bao already experience seasonal flooding.⁴ Climate change projections show a high level of uncertainty around future changes to rainfall in the region, which could see a 10% increase or a similar decrease in rainfall by mid-century.⁵ Should rainfall increase, then existing flooding could become more severe. Improved flood protection infrastructure will be important to cope with other climate driven extreme events. Northern Viet Nam is expected to suffer more intense cyclones, which could bring extreme rainfall over short periods of time leading to flash flooding. This would be problematic for Vinh Yen's road infrastructure, much of which does not have proper side and cross-drain structures, causing them to become waterlogged.⁶

A decrease in overall average annual rainfall for Vinh Yen would bring its own challenges for water resource management in the city. While the city is not in a region that is expected to suffer severe water stress, the seasonal variation in rainfall is expected to become more pronounced by mid-century.⁷ Rainfall is expected to fall in more intense spells, with more falling in the warmer, summer months than in winter, supply of water resources

will therefore have to be managed carefully to meet growing demand.

The city has maintained an impressive average annual economic growth rate of 20% between 2009 and 2012.⁸ However, Vinh Yen's rapidly growing industrial and commercial sectors pose significant environmental challenges. Vinh Yen already struggles in managing its domestic wastewater and solid waste, and now it is straining to cope with the growing amount of industrial waste. Infrastructure development has also failed to keep up with industrial expansion such that effluents are often discharged into the surrounding waterways. While air quality is not a major problem for Vinh Yen, it is important that the city's air quality is continually monitored, especially in light of the many industrial projects in the city's development plans.

Climate projections indicate that Vinh Yen will experience rising temperatures and more extreme heat events in the coming decades. Annual mean surface temperatures are projected to increase by 1.9°C by mid-century and 3.8°C by the end of the century.⁹ This is likely to increase the demand for electricity for cooling, especially in the summer months, adding pressure on the city's electricity grid. Heat stress will also affect Vinh Yen's citizens, especially outdoor workers, the elderly, and those living in low quality housing.

Resilience context

Climate impacts



Flash flooding projected to increase, due to increased rainfall intensity



Total Rainfall predicted to increase or decrease by around 10%



Temperatures likely to increase by between 1.9°C - 3.8°C by 2100

Additional factors



Rapid economic growth of 20% annually puts strain on current infrastructure

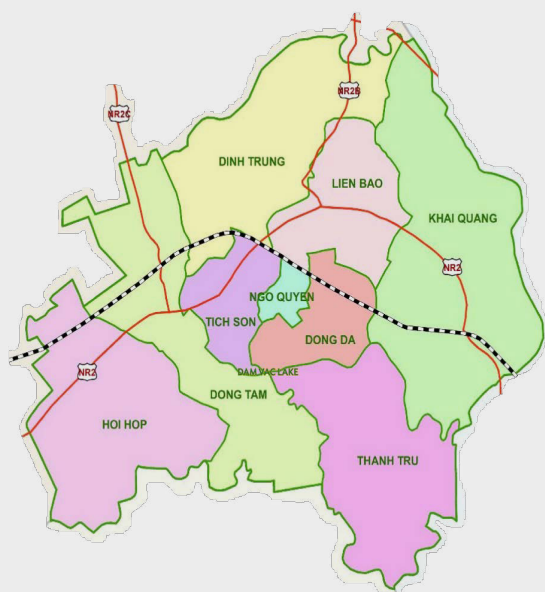


Poor drainage systems exacerbate flooding



Pollution from overflowing effluent discharged into waterways

City Resilience Profile



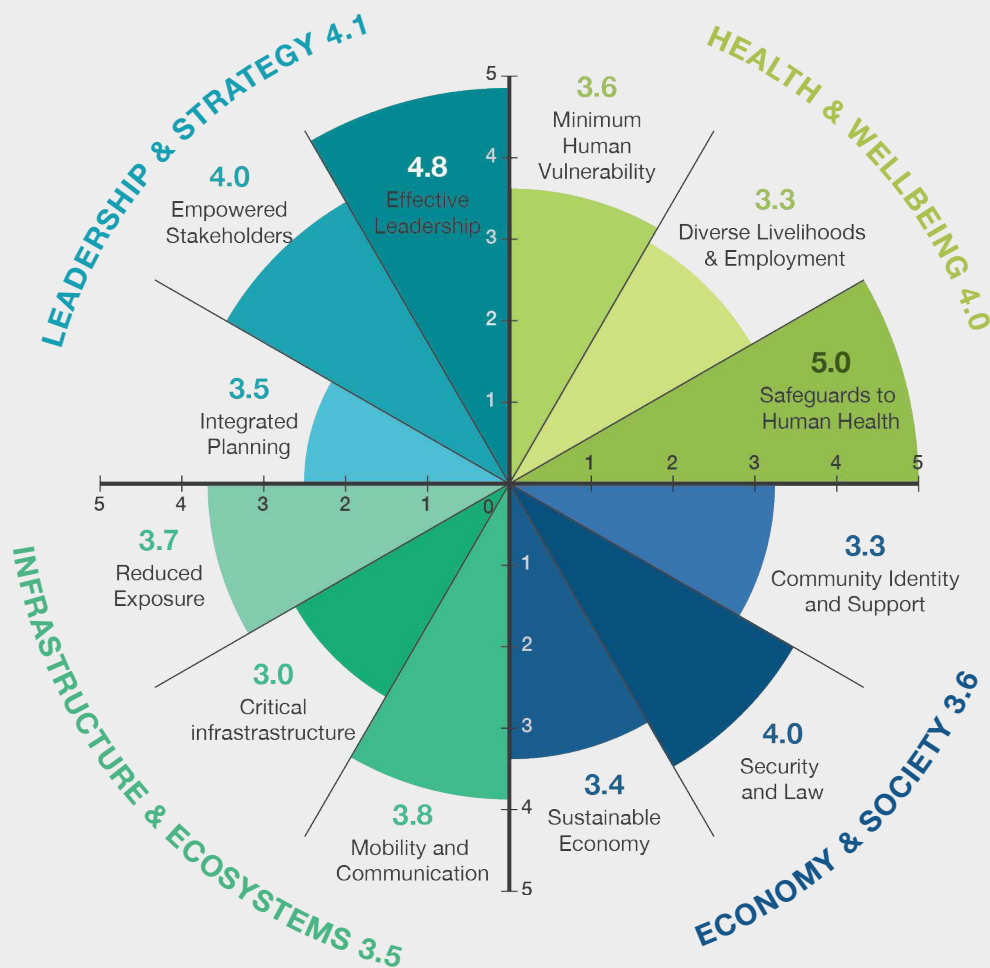
In 2018, the ADB's Urban Climate Change Resilience Trust Fund (UCCRTF) visited Vinh Yen and conducted a baseline assessment of the city's resilience. The aim of the baseline assessment is to establish what impacts UCCRTF urban resilience projects will have in the city. The study, which was conducted based on interviews with key city officials, assessed Vinh Yen's resilience across four key dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The overall scores for each resilience dimension and goal are shown in the diagram to the right. The analysis shows that Vinh Yen has many characteristics that support its resilience including effective leadership and a strong economy. However, it also shows areas for improvement. Vinh Yen's lowest score was for the provision of critical infrastructure, suggesting further investment is required. The results are presented in the coloured boxes below.

LEADERSHIP & STRATEGY

Vinh Yen's effective governance systems and the capacity of its municipal agencies contribute to its overall resilience to shocks and stresses ("Effective Leadership and Management" – 4.8). However, the city's development planning has not kept pace with the growth of its industries and population. This has led to infrastructure gaps in transport, sanitation and waste management "Integrated Development Planning" – 3.5).¹⁰ The poor planning has meant that Vinh Yen has not yet been able to capitalise on its natural assets, and has more opportunities to expand the amount of accessible green space. Furthermore, the effectiveness of urban services could be improved by more proactive efforts to get input from users ("Empowered Stakeholders" – 4.0).

HEALTH & WELLBEING

Vinh Yen has good quality health facilities that meet the basic demands of the current population. The city plans to add hospital capacity to meet the needs of a growing population by relocating its main hospital to a larger site and constructing a new hospital for women and children ("Effective Safeguards to Human Health and Life" – 5.0). Whilst virtually the entire population has reliable water and electricity access, resilience in this dimension could be improved by investing in waste management and sanitation services ("Minimum Human Vulnerability" – 3.6). Vinh Yen's successful economic growth could be complemented by an increase in service sector opportunities to create more livelihood diversity for the residents. ("Diverse Livelihood and Employment" – 3.3).



INFRASTRUCTURE & ECOSYSTEMS

Vinh Yen's critical infrastructure systems require investment in order to meet the needs of a growing population. Almost all households have access to improved water sources and electricity, however 30% have no access to the sewerage network. Piped water systems serve 85% of the population with the rest having access to wells. Current infrastructure is at capacity and will not cope with the significant levels of growth forecasted ("Provision of Critical Infrastructure" – 3.0). The city's transport system lacks any significant public transport infrastructure limiting the mobility of the local population ("Mobility and Communications" – 3.80). Vinh Yen's roads are also susceptible to flooding as most do not have proper drains. The combined wastewater and stormwater system in the city also discharges untreated sewage into the Dam Vac Lake at times of heavy rainfall ("Reduced Exposure" – 3.7).

ECONOMY & SOCIETY

Vinh Yen's successful growth in manufacturing has created many jobs, reducing poverty in the city and contributing to the resilience of its population. As the center of one of Hanoi's most productive industrial provinces, the manufacturing sector employs nearly three-quarters of the workers in Vinh Yen. The city could increase its economic resilience further by expanding its services sector, particularly tourism, education, insurance, and finance and banking ("Sustainable Economy" 3.4). The city has strong foundations to expand these industries thanks to its good capacity in municipal departments and stable governance and legal structures ("Security and Rule of Law" – 4.0). There is also opportunity for greater community participation in the future direction of the city ("Collective Identity and Community Support" – 3.3).

Household perceptions of resilience

Alongside the city-level baseline study, UCCRTF also collected household level data to provide an indication of the perceptions of resilience in certain sections of the city's population. The data collection was limited to 101 respondents from wards where ADB infrastructure investments are planned or underway. The results provide an initial indication of household resilience perceptions, rather than a comprehensive assessment. For more information on the methodology please see the box on the back cover of this document.

As a general indication of householders' impression of the local community in Vinh Yen, residents were asked to rate their community, on a scale of 1 to 5; with 1 being the lowest rating and 5 being the best against four characteristics: i) Infrastructure and Services ii) Economic Opportunities (Diverse Livelihood); iii) Connected (internal and external linkages); iv) Organized (socially cohesive).

As shown in figure 1 at the bottom of the page, respondents gave Vinh Yen middling scores across most general community characteristics with the highest for being Organized (4.3), and the lowest for internal and external linkages (1.9), suggesting a fairly resilient community that is limited by a lack of transport infrastructure. This is also evidenced in the baseline studies that found internal transport links to be lacking.

The household survey also assessed perceptions of resilience against five commonly used dimensions: i) Access to Basic Services; ii) Assets; iii) Adaptive Capacity; iv) Income and Food Access; and v) Social Safety Net. Scores against each of these dimensions were calculated as an averaged index from survey

responses and secondary data.

As shown in figure 2 at the bottom of the page, perceived household resilience was highest for both access to basic services and income and food access, each scoring 100%. However, a high dependency on government support programs (78%) suggests that it is most likely that households are less resilient when faced with a disaster or similar shocks. Whilst still relatively high, perceptions around adaptive capacity and a household's social safety net were rated lower, which in turn influences the status of a household's overall resilience. As a result, 12% of households had a low resilience status and 44% had a medium resilience status. This suggests a need for better support to further improve the resilience of households. This also reflects the city-level scores (see page 160) which indicated that Vinh Yen has moderate levels of resilience across all four dimensions.

When asked about the disasters, unexpected shocks and stresses they had faced in the past 5 years, 'heavy rains/hailstorms' were considered by 29% of respondents as being a major shock/stress that has a moderate impact. Water logging and flooding affected most households (79%) and was considered to have a moderate impact. Other moderate impact shocks included cyclones/hurricanes (32%), chronic illness (16%) and epidemic disease in crops, livestock, and the human population (15%).

A sudden or dramatic increase in food prices only had a strong impact on 5% of respondents. However, other unexpected shocks, such as major illness or injury of a household member, death of a household member and

Figure 1

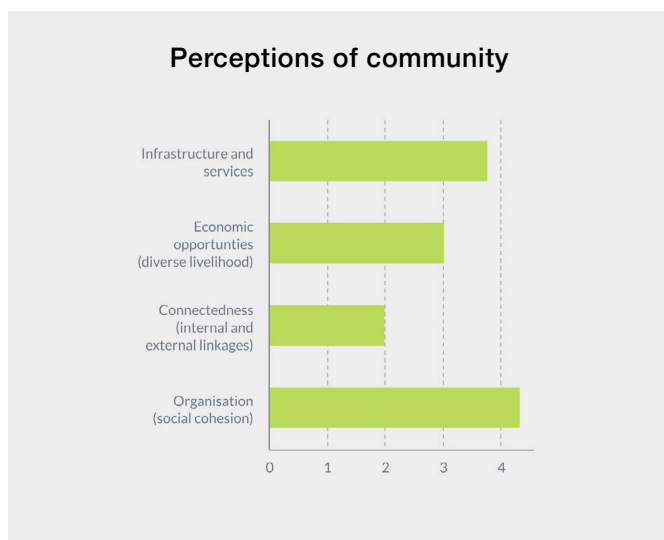
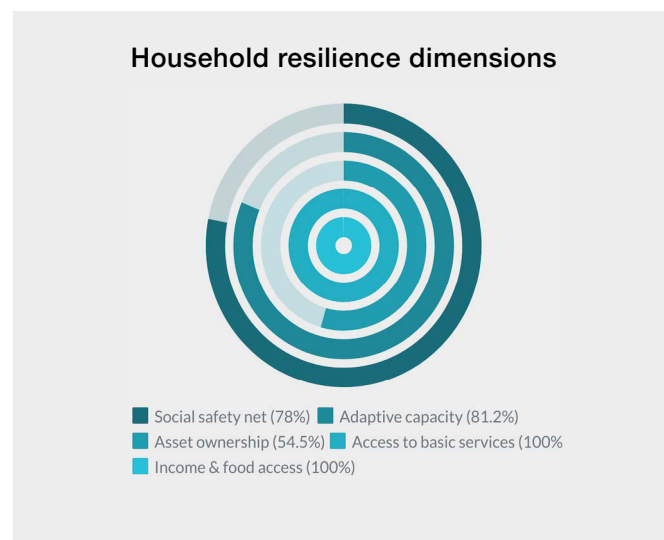


Figure 2



resulting loss of income, along with loss or damage to a house, were cited by respondents as having a major impact. As a result, 40% received food or cash from relatives in order to cope, and 40% of households requested assistance from local government to help them recover from the shock. Most of the respondents (63%) sought to reduce their expenses by reducing expenditure on health care, education, agricultural inputs, and livestock. Only 12% said that they relied upon their own savings in the aftermath of a shock.

Responding to shocks and stresses

As Vinh Yen has experienced several shocks and stresses in its recent history, respondents were able to draw on thist experience about their ability to deal with and recover from shocks in answering the survey. Figure 3, shown below, shows the perceptions households had about their responses to recent shocks, with 25% saying that they were unable to recover. Around one third (34%) were able to recover and said that they are now the same as before, and 41% said that they were not affected by the shocks. Only 1% said that their wellbeing was somewhat better, which indicates that even those who were not affected by the shocks have not seen an improvement in their wellbeing in the time that has since past.

Most respondents in Vinh Yen reported that they had received an early warning before the last natural disaster (72%). Among those who received an early warning, the vast majority (92%) listed the television

as the sources that they received the warning from. Other sources included the radio (55%) and neighbours or relatives (30%). Under 7% of respondents said that they received early warning information from disaster risk management committees and volunteers. There was also low awareness amongst respondents about community members trained to help them during a disaster, with 72% not knowing of anyone. The vast majority (85%) of respondents also said that neither they nor anyone in their household had ever received any training on disaster preparedness.

Access to information on where to seek shelter is critical when facing a natural disaster. All respondents said that they did not move to another place to take shelter before or in the aftermath of the last disaster. Half said that this was because it was not required, whilst others said they did not move because there was not any shelter available (13%), or that they did not want to (17%) and wanted to stay to protect their home and assets (18%). When asked how they would plan a course of action in case of a natural disaster, 76% said they had no plan. Protecting household values and assets were part of a planned response 15% of respondents, alongside identifying safe shelter for livestock (10%), planning for dry food (9% and evacuating vulnerable household members (7%). These household assets are also a form of productive capital used to provide immediate funds and mitigate the effects of a disaster for the poor and the vulnerable. This may therefore suggest a lack of local government support for these communities in providing them with an alternative disaster response.

Figure 3

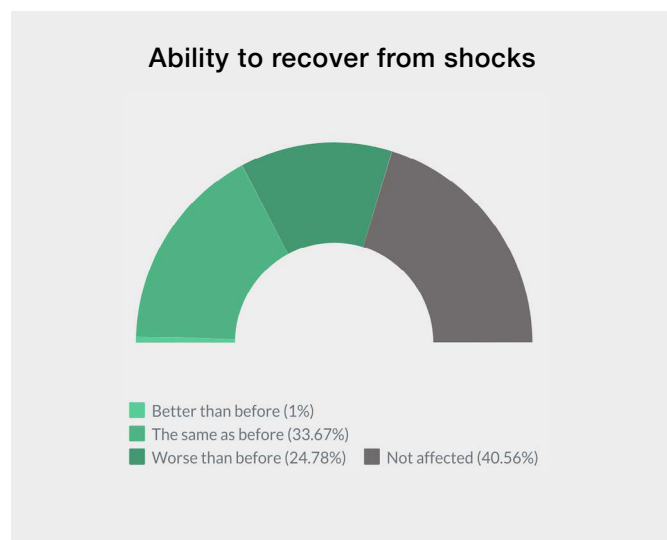
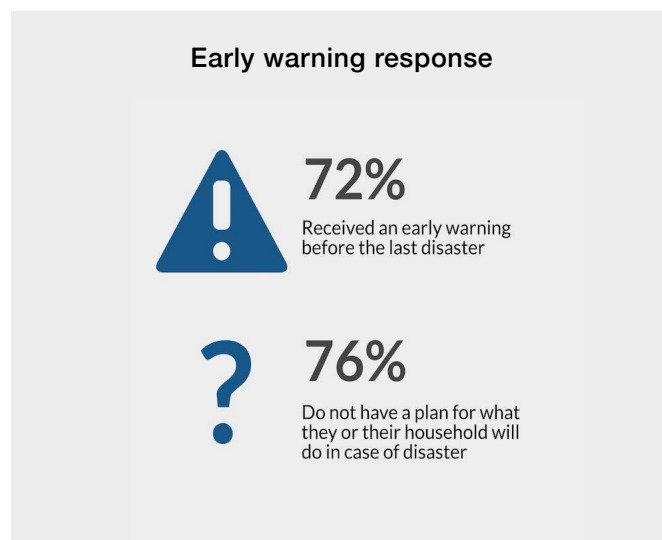


Figure 4



Resilience interventions in Vinh Yen

ADB and UCCRTF projects in Vinh Yen

CURRENT ADB PROJECT

Secondary Cities Development Project

\$224 million between 3 cities in Viet Nam



Dredging and Landscape Protection of Dam Vac Lake



Drainage, collection and Wastewater Treatment improvements



Green Park Development South of Dam Vac Lake



Exhibition and Business Support Center



Infrastructure for University Area

UCCRTF program preparatory technical assistance for Green City Action Plans \$1 million

Supporting:

- feasibility studies for climate-resilient urban infrastructure investment
- preliminary engineering designs
- capacity building programs on planning and management for green city development
- integrating green infrastructure

UCCRTF community-led initiatives grant \$2 million

Supporting:

- community-defined projects
- preparation of community resilience plans
- the implementation of chosen projects
- sustaining the plans in the long term

UCCRTF Strengthening Knowledge and Actions for Air Quality Improvement

Supporting:

- technical assistance to enhance the knowledge and capacity to develop policy actions and technological solutions for air quality management.
- preparation of City Level Clean Air Action Plans and accompanying investment plans.

UCCRTF Spatial Data Analysis Explorer (SPADE)

Supporting:

- improved city-level climate and geospatial data
- project preparation, consultation and map production

According to the baseline assessment, Vinh Yen demonstrates many qualities that support its resilience across all four dimensions: health and wellbeing, economy and society, infrastructure and ecosystems, and leadership and strategy. The city has benefited from strong economic growth, which has provided good employment opportunities and low poverty levels. However, as the population continues to expand, Vinh Yen, could increase its resilience by investing to secure the city as a hub for manufacturing in the region, whilst supporting the growth of other sectors, including education and tourism. Improvements to green infrastructure and the public realm will be essential to achieve this.

Further, Vinh Yen provides good levels of basic services to its population. However, as climate risks such as cyclones, potentially heavier rainfall spells and heatwaves increase in the region, the city will need to invest to ensure its critical infrastructure systems remain fit for purpose. In this regard, investment in waste and sanitation infrastructure would be highly recommended, as well as new public transport infrastructure that promotes walking and cycling.

The results of the household survey indicate that the population in Vinh Yen's vulnerable wards perceive that they have relatively low levels of resilience for the provision of integrated infrastructure. The household survey also shows that the majority of respondents feel they are well placed to respond to shocks and stressors, which confirms the relatively high scoring baseline score for "effective safeguards to human health and life".

To contribute to improved resilience in Vinh Yen, ADB approved the 'Secondary Green Cities Development Project', which supports environmentally sustainable and socially inclusive development in the cities of Vinh Yen, Hue, and Ha Giang. The total loan amount for the project stands at just over \$224 million covering all the three cities and will finance sub projects to (i) control urban stormwater runoff and reduce flood risks, (ii) improve sanitation for public health, (iii) enhance green landscaping and public amenities, (iv) upgrade urban road networks and their connectivity, and (v) promote public participation in planning.

In Vinh Yen, the project will dredge the Dam Vac Lake, landscape the surrounding area to create new green spaces, and construct a tertiary sewer network improving sanitary conditions for over 30,000 residents

in four wards as well as a new wastewater treatment plant for 10,000 households in the remaining three wards and a loan fund for household sanitation and wastewater connections. They will also help finance installing new infrastructure for accessing the university and developing a 'Center for Supporting Industrial Production' to incubate green technology industries.

ADB is also providing a Technical Assistance project 'Strengthening Knowledge and Actions for Air Quality Improvement' which will enhance the knowledge and capacity Vinh Yen to develop policy actions and technological solutions for air quality management.

Resilience Building and the Urban Climate Change Resilience Trust Fund

Alongside ADB's loan investment in the city, UCCRTF supported the following interventions: i) Technical assistance to support the planning and preparatory stages of projects, and prepare Green City Action Plans and integration of nature-based solutions; ii) Grant-funded community led initiatives to increase the resilience of vulnerable communities; iii) A geo-spatial data tool the 'Spatial Data Analysis Explorer (SPADE) to increase data access; and iv) Strengthening Knowledge and Actions for Air Quality Improvement. These projects contribute to improving key areas where Vinh Yen's resilience might be increased, according to the baseline study.

Green City Action Plans and integration of nature-based solutions: In Vinh Yen, the UCCRTF supported the preparation of green city action plans, feasibility studies for climate resilient urban infrastructure investments, preparation of preliminary engineering designs for each urban infrastructure subproject, capacity building programs on planning and management for green city development, and other workshops and consultations associated with these activities.

Community-led initiatives: Funded through an investment grant of \$2 million for Vinh Yen, a series of community-led initiatives will support a range of activities to improve the resilience of the most vulnerable communities. While the specific interventions supported by the investment grant will be defined by the communities themselves, the project will support the preparation of community resilience plans; the

the preparation of community resilience plans; the implementation of the projects; and sustaining the plans in the long term. community-led initiatives to support vulnerable communities in the city, strengthen participation, good governance, and build collective identity and community support.

SPADE: UCCRTF SPADE is a web-based tool and data repository that contains various geospatial data that can be used for consultation, project preparation, production of maps, and analysis of climate change impacts. UCCRTF is providing technical assistance to Vietnam in order to help build capacity in preparing and responding to climate change-induced shocks and stresses in medium-sized and secondary cities, such as Vinh Yen. The maps and socio-economic surveys carried out in the city have been digitized and available on SPADE.

Strengthening Knowledge and Actions for Air Quality Improvement: Knowledge and support technical assistance has been given to enhance the knowledge and capacity of Vietnam to develop policy actions and technological solutions for air quality management. The project aims to also help build the business case through the preparation of City Level Clean Air Action Plans (CAAPs) along with investment plans to implement the CAAPs.

Suggested future investments

The baseline assessment provides a snapshot of perceived levels of resilience in Vinh Yen, it does not represent a full assessment of the investment needed to build urban resilience. However, the results of the study do suggest possible areas of focus for resilience investment, these include:

- 1. Strengthened efforts to foster community engagement and collective identity.**
- 2. Increased investment in critical infrastructure systems especially solid waste management and sewerage systems.**
- 3. Improvements to the public realm, especially around the Dam Vac lake to increase the green space available for citizens and encourage tourism.**
- 4. Improvements to existing road infrastructure to ensure it is resilient to future increases in rainfall.**
- 5. Investment in affordable public transportation options and improvements in the public realm to encourage walking and cycling.**

ENDNOTES

1. Katzfey, JJ, McGregor, JL and Suppiah, R (2014). High-Resolution Climate Projections for Vietnam: Technical Report. CSIRO, Australia. 266 pp. <http://vnclimate.vn/publications/Reports/Reports-10/>
2. Asian Development Bank (2017) Secondary Green Cities Development Project (Resettlement Plan)
3. Katzfey, JJ, McGregor, JL and Suppiah, R (2014). High-Resolution Climate Projections for Vietnam: Technical Report. CSIRO, Australia. 266 pp. <http://vnclimate.vn/publications/Reports/Reports-10/>
4. Asian Development Bank (2015) Vinh Yen GrEEEn city action plan
5. Katzfey, JJ, McGregor, JL and Suppiah, R (2014). High-Resolution Climate Projections for Vietnam: Technical Report. CSIRO, Australia. 266 pp. <http://vnclimate.vn/publications/Reports/Reports-10/>
6. Asian Development Bank (2017) Secondary Green Cities Development Project (Resettlement Plan)
7. WRI (2015) Aqueduct <https://www.wri.org/publication/aqueduct-water-stress-projections-decadal-projections-water-supply-and-demand-using>
8. Asian Development Bank (2015) Vinh Yen GrEEEn city action plan
9. Asian Development Bank (2015) Vinh Yen GrEEEn city action plan
10. Asian Development Bank (2015) Vinh Yen GrEEEn city action plan

The City Resilience Profiles are developed using the City Resilience Index. Developed by the Rockefeller Foundation and Arup, the CRI is a comprehensive, technically robust framework for measuring city resilience based on over five years of research and application in cities globally. For further information, visit: <http://cityresilienceindex.org/>

The City Resilience Profile was developed by Arup for the ADB Urban Climate Change Resilience Trust Fund in partnership with Daira, Acclimatise, Plan International, and Oxford Consulting Partners.

Methodology

The CRPs present the results of baselining work undertaken by UCCRTF in 2018 as part of a broader assessment to measure resilience in UCCRTF-supported cities. This work is part of ADB's efforts to understand and measure how their investments affect community resilience.

Data was collected at the city level and, for certain cities, at the household level:

- At the city level, data collection included conducting surveys with city officials, surveys with key informants, and focus group discussions with key city stakeholders. The city-level methodology was adapted from the City Resilience Index, developed by Arup and the Rockefeller Foundation.
- The household data was collected through direct surveys with around 100 households in twelve target cities. A larger sample size was not possible due to time and resource constraints, and while these results are not statistically significant, they provide a general indication of household perceptions of resilience. Survey information was used to test against five resilience dimensions: access to basic services; assets; adaptive capacity; income and food access; and social safety nets.

A more detailed assessment, as designed for the City Resilience Index methodology, can be undertaken separately with the city by request to Arup. More information about the City Resilience Framework and City Resilience Index can be found here: <https://www.cityresilienceindex.org>.

FOR MORE INFORMATION ABOUT THE PROJECTS MENTIONED IN THIS DOCUMENT PLEASE VISIT:

Regional: Promoting Urban Climate Change Resilience in Selected Asian Cities - Knowledge Management and Resilience Measurement for Urban Climate Change Resilience (Subproject 2): www.adb.org/projects/48317-003/main