# Sustainable Pakistan: Transforming cities for resilience and growth

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**Pakistan's cities face escalating climate risks, from heatwaves to urban flooding, threatening economic stability. Targeted climate adaptation, green infrastructure, and data-driven planning are key to building resilient, thriving urban centres.**

## KEY MESSAGES:

1. **Urban centres are facing growing climate challenges.** Pakistan's cities experience mounting vulnerabilities from heatwaves, flooding, and air pollution, intensified by climate change and unplanned urban growth.
2. **Air pollution remains a major health and economic crisis impacting urban quality of life.** The air quality of Pakistan's cities is among the worst globally, causing close to 200,000+ deaths annually and costing up to 6.5% of GDP, demanding urgent action on transport, energy, and industrial emissions.
3. **Infrastructure and sustainable mobility need to be prioritised for climate-adapted urban development.** Upgrading drainage systems, expanding public transit, and promoting energy-efficient buildings are critical to adapting cities to climate pressures.
4. **Nature-based solutions offer cost-effective and scalable approaches for climate resilience.** Scaling up urban forests, green roofs, and restored wetlands can mitigate urban heat islands, absorb emissions, and manage stormwater effectively.
5. **Data-driven planning and governance can transform climate-resilient urban planning.** Integrating predictive tools like GIS and real-time monitoring systems enables targeted interventions, proactive planning, and disaster management.
6. **Sustainable urban development will need innovative financing solutions:** Property tax reforms, carbon markets, and public-private partnerships can mobilise resources for sustainable infrastructure and urban climate projects.

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Pakistan's cities are pivotal to the country's economy. Almost 40% of the country's population is now urban (Pakistan Bureau of Statistics, 2023), with projections suggesting this figure could reach 59% by 2050 (World Bank, 2022).

The existing economic pressures on cities to cater to a growing population are compounded by climate shocks. These climate shocks are also pushing rural populations into urban areas – between 15-30% of the population of Pakistan's major cities is migrants (Hamid and Waheed, 2022). This creates a dual challenge of resource scarcity and inadequate infrastructure (Singh et al., 2020). Recent migration into cities (Asian Development Bank, 2024) – driven by climate-induced crop failures and natural disasters – has increased the burden on informal housing, congestion, urban services, and job creation.

Moreover, 70% of urban workforce is informal and vulnerable to climate impacts (International Labour Organization, 2021). This underscores the urgency of integrating climate adaptation into urban economic planning. If left unaddressed, these challenges could undermine gains of urbanisation, entrenching inequalities, and slowing economic growth.

This growth brief examines how Pakistan can navigate the dual challenge of urbanisation and climate vulnerability. While there are numerous challenges facing Pakistan's urban centres – ranging from inadequate housing and water scarcity to waste management and energy inefficiency – this growth brief focuses on three core vulnerabilities: air pollution, urban flooding, and heatwaves. Addressing these vulnerabilities is critical for urban resilience and sustainable growth. Climate action in cities remains central to national and global efforts to mitigate climate change.

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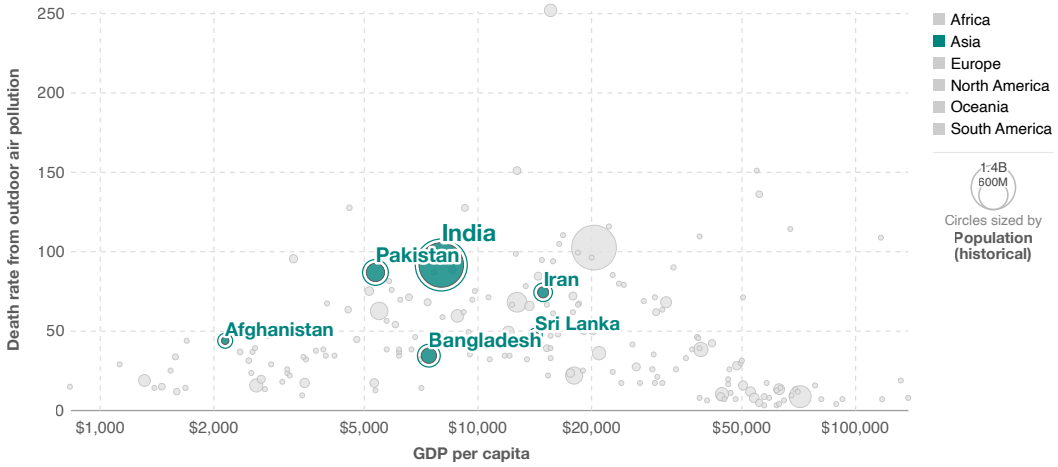
KEY MESSAGE 1

# Urban centres are facing growing climate and environmental challenges.

Pakistan's cities face mounting pressures from more frequent and more severe climate-related events that threaten the lives, health, and livelihoods of millions (IPCC, 2023). By the end of the century, the annual mean temperature in Pakistan is expected to rise by approximately 3℃-6℃, depending on the emissions scenario (United Nations Environment Programme). Scientific estimates suggest climate change will make heatwaves in South Asia (including Pakistan) 30-100 times more likely (Lai, 2022). Simultaneously, all of Pakistan's population live in areas where the annual average particulate pollution level exceeds the WHO guideline (Greenstone and Hasenkopf, 2023) with PM2.5 level of 73.7 ~ μg/m$^3$ - ten times more than WHO's standards (IQAir, 2023). This leads to severe public health concerns and a comparatively high death rate relative to its GDP per capita (Ritchie and Roser, 2024).

**Figure 1:** Death rate from outdoor air pollution by GDP per capita




Notes: The chart illustrates the relationship between GDP per capita and death rates from outdoor air pollution across countries from 1990 to 2021. Larger circles represent countries with higher populations, and they highlight how lower-income countries tend to experience higher air pollution-related mortality rates compared to wealthier countries. Despite a lower GDP per capita than many countries, Pakistan experiences significant health impacts from air pollution. Its proximity to similarly affected countries like India and Bangladesh underscores the regional nature of the issue, with industrial emissions, vehicle pollution, and urbanisation being key contributors. Source: Our World in Data.

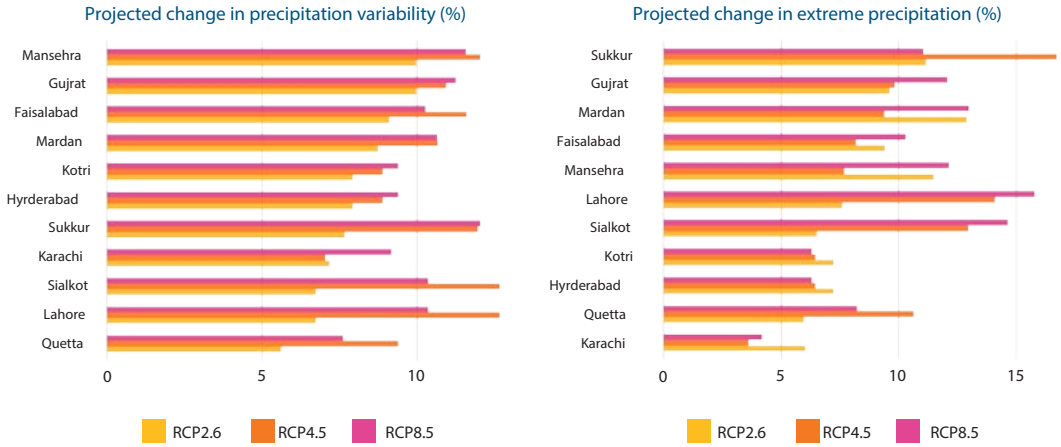
## Cities face multiple spatial vulnerabilities

1. **Heatwaves and urban heat islands:** Climate change is intensifying heatwaves in Pakistan's cities, with dense urban infrastructure trapping heat and making urban centres significantly warmer than surrounding rural areas. In May 2024, temperatures reached nearly 52.2°C, with Mohenjo Daro in Southern Sindh ranking among the hottest places in the world (Soomro and Shahid, 2024). Cities in Punjab and Sindh regularly face extreme heat events, worsened by the Urban Heat Island (UHI). UHI is a phenomenon where urban areas experience higher temperatures than surrounding rural areas resulting from human activities, dense infrastructure, and reduced vegetation. Due to the UHI effect, temperatures in Karachi have gone up by almost 5-7°C compared to rural suburbs, increasing the incidence of heat-related illnesses and deaths, and further straining public health systems (NASA Earth Observatory, 2024). The 2015 heatwave in Karachi caused over 1,200 fatalities (Safi, 2018). During the last century, average annual temperatures in Pakistan have increased by 0.6°C (Ministry of Climate Change). In the absence of corrective measures, peripheral areas in cities like Lahore could see an additional 0.6°C increase by 2050 (World Bank, 2022).

2. **Urban flooding:** Urban flooding is a growing threat in Pakistan, driven by high precipitation, poor drainage, urban sprawl, and loss of green spaces but worsened by climate change. An increase in the frequency of short-duration heavy rainfall leads to higher water runoff. The UHI effect further intensifies rainfall in urban areas. These vulnerabilities are compounded by low-quality infrastructure. Between 1980-2020, Karachi's urban area expanded by 286%, resulting in the obstruction or elimination of approximately 870 km of natural streams (Baig, Atif, and Tahir, 2024). Lahore has the largest settlement area exposed to fluvial flooding (163 $km^2$) and pluvial flooding (129 $km^2$)[1]. Karachi has the second-largest settlement area exposed to pluvial flooding (World Bank, 2022). Even smaller cities like Sialkot have seen a sevenfold increase in flood-exposed settlements (World Bank, 2024). Integrated urban planning and upgraded drainage systems can mitigate flooding risks.

1. Fluvial flooding: when a river overflows its banks, Pluvial flooding: when heavy rainfall overwhelms a city's drainage system.

**Figure 2:** Projected changes in precipitation variability and extreme precipitation in major cities




Notes: Climate projections show that precipitation variability and extreme precipitation in cities are both expected to rise. Source: Pakistan's National Adaptation Plan 2023 (Government of Pakistan, 2023)

3. **Air pollution:** Pakistan is one of the most polluted countries in the world. In 2024, Multan's Air Quality Index (AQI) exceeded 2000, highlighting the severity of the crisis (Times of India World Desk, 2024). Air pollution, driven by industrial emissions, vehicular pollution, and unsustainable urban practices, costs the country up to 6.5% of its GDP annually (World Bank, 2022), reflecting both healthcare expenditures and productivity losses. In Lahore, the transportation sector remains the largest contributor to air pollution (83% of the city's emissions), followed by industrial activities at 9% and crop residue/open waste burning at 7% (The Urban Unit, 2023). Bad air contributes to 128,000 deaths annually (State of Global Air, 2019) and reduces life expectancy by 3.8-4.3 years on average and nearly 7 years in Lahore (Greenstone and Fan, 2019). Many air pollutants such as black carbon and methane also contribute to global warming and can accelerate glacier melt and extreme weathers, creating a feedback loop that intensifies both challenges. Thus, policies promoting energy efficiency and renewable energy can simultaneously address air pollution and climate change (AQLI). Targeted measures (clean transportation, improved industrial technologies, eliminating open burning) can reduce air pollution.

## Climate change intensifies vulnerabilities in agriculture-dependent small cities

Smaller cities in Pakistan face unique vulnerabilities to climate change due to their reliance on agriculture. This makes their economies more susceptible to climate shocks. Rising temperatures and unpredictable weather patterns affect crop yields, with losses projected to range between 14%-50% under varying climate scenarios (Chaudhury and Ayub, 2017). Since agriculture consumes more than 90% of the water in Pakistan, inadequate water management systems make these cities more vulnerable to water scarcity arising from changing precipitation patterns (Saeed, 2023). Deforestation and soil degradation in regions surrounding smaller cities diminish natural capital and reduce the resilience of agricultural systems. As agricultural productivity

declines, rural-to-urban migration is rising. The 2023 Pakistan Census shows urban populations growing at 3.67% annually, nearly double the rural rate of 1.88%, increasing the number of cities with over 500,000 people from 14 in 2017 to 22 in 2023. With projections indicating that by 2030, over half of Pakistan's population will reside in urban centres, such swift migration places additional stress on urban infrastructure and services in the larger urban centers while depleting the labour pool in smaller cities underscoring the need to support smart climate agriculture.

## Climate vulnerabilities disproportionately impact low-income and marginalised groups

Global estimates suggest that the bottom 40% of income groups in low- and middle-income countries can suffer up to 20% higher income losses than wealthier populations due to climate change (Burgess et al., 2023). The 2022 floods in Pakistan pushed an estimated 8.4-9.1 million people into poverty (Government of Pakistan, 2022), with significant impacts on urban poor households due to destroyed infrastructure. An estimated 50% of Karachi's urban population resides in informal settlements (Hasan, 2020), highly vulnerable to climate-induced shocks like floods and heatwaves. These people lack the financial resources to invest in adaptive measures like resilient housing, cooling systems, or relocation. Low-income neighbourhoods are also disproportionately impacted by floods, as drainage systems and infrastructure are often neglected. Informal workers who labour outdoors without adequate protection are also exposed to extreme heat and its associated health risks.  Recent research shows that high temperatures significantly reduce informal workers' earnings and increase health costs, especially in cities (Saudamini, Das, & Somanathan, 2024). A 1°C rise above 34°C leads to a 28% drop in earnings and a 42% rise in health spending. These findings highlight the need for urban heat adaptation measures such as early warnings, shaded workspaces, and targeted social protection.

## Cities are both contributors to and solutions for climate change

While Pakistani cities are increasingly vulnerable to the impacts of climate change such as flooding, heatwaves, and air pollution (as discussed above), they also significantly contribute to the problem. Rapid and often unplanned urbanisation has led to sprawling cities that lock in high-emission lifestyles, increase infrastructure inefficiencies, and strain basic services. However, cities can also be part of the solution. As highlighted by the IGC (Delbridge et al., 2022), well-planned, dense urban growth can lower per capita emissions by up to 25% compared to sprawling development. Compact urban design facilitates energy-efficient transport, reduces infrastructure costs, and supports more effective public service delivery. In Pakistan's context where the country faces fast paced growth of urban population this is a critical opportunity. Investing in compact, mixed-use, and transit-oriented development in rapidly growing cities like Lahore, Karachi, and Faisalabad can simultaneously reduce emissions and improve resilience to climate shocks. Without such planning, Pakistan risks locking in decades of high emissions and vulnerability.

KEY MESSAGE 2

# Nature-based solutions offer cost-effective and scalable approaches for climate resilience.

Nature-based solutions (NBS) present a transformative (but underutilised) opportunity to address climate risks and improve urban liveability. Such interventions offer cost-effective strategies to mitigate climate hazards due to their ability to provide multiple co-benefits at a lower cost than traditional engineered solutions/conventional infrastructure.

Green infrastructure, including urban forests, green roofs, parks, and permeable surfaces, can combat UHI effects, reduce air pollution, manage stormwater, and mitigate flooding. While such initiatives are limited in Pakistan, success stories from cities globally underscore their effectiveness in flood control, temperature regulation, and carbon sequestration. These solutions require less upfront capital investment and lower maintenance costs and provide long-term benefits and multiple co-benefits (such as carbon sequestration, biodiversity conservation, and livelihood generation). Following are some opportunities for integrating NBS into Pakistan's urban planning to enhance the climate resilience of its cities.

1. **Restoring floodplains and wetlands mitigates urban flooding risks.** Urban flooding is a persistent challenge in cities like Karachi, Lahore, and Sialkot, driven by heavy rainfall, inadequate drainage systems, and rapid urbanisation. Restoring natural floodplains and wetlands offers a sustainable way to absorb excess water during heavy rainfall, acting as natural buffers against floods. Wetland restoration in urban peripheries can reduce flood risks, enhance groundwater recharge, and provide critical support in water-stressed regions such as Sindh and Punjab (World Bank, 2022). In Pakistan, groundwater recharge is particularly critical as agriculture consumes more than 90% of available water, and groundwater levels in urban areas are depleting rapidly. By restoring wetlands, excess water can be redirected to replenish aquifers, ensuring a more sustainable water supply for urban and rural needs. In coastal Sindh, mangroves in the Indus Delta help protect cities like Karachi from storm surges and tidal flooding, while supporting water retention and biodiversity. Pakistan has significantly expanded its mangrove cover from 48,000 hectares in 1986 to nearly 144,000 hectares in 2020 (Khan, 2024), despite losing around 200 hectares to development between 2010 and 2022 (WWF-Pakistan, 2024). Scaling up restoration efforts can further boost climate and flood resilience in coastal urban areas.

2. **Expanding urban green cover helps combat UHI effects.** The UHI effect is particularly severe in dense cities like Lahore and Karachi, where concrete infrastructure retains heat, raising temperatures significantly above those in surrounding rural areas. Green roofs, urban forests, and street-level vegetation can lower ambient temperatures, providing thermal comfort and reducing energy demands for cooling. Increasing urban green cover (trees, green roofs, and urban forests) can decrease land surface temperatures by 0.3-3℃ (Farid et al., 2022), mitigating the UHI effect and enhancing public health. Large green spaces can experience land surface temperatures 1-4℃ lower than surrounding built-up areas (Arshad et al., 2022), demonstrating their potential for high-impact climate adaptation. Urban green policies can consider mandating a minimum green cover percentage in city planning.
3. **Urban green spaces reduce pollution and capture carbon.** Urban green spaces function as carbon sinks and air filters, simultaneously addressing air pollution and climate change. Lahore's urban forest initiatives (Urban Nature Atlas, 2021) including the Miwaki method exemplify a proactive approach to reforestation and urban liveability (Ilyas, Saeed, and Ashraf, 2019). However, more research is needed to evaluate their long-term environmental and social impacts. A mature tree can absorb approximately 21 kg of carbon dioxide annually, making urban forestry an efficient and scalable solution for reducing urban carbon footprints (EEA, 2011). Urban vegetation also traps particulate matter (PM2.5, PM10), nitrogen oxides, and sulphur dioxide, improving air quality in high-density areas by up to 25% and thus providing substantial health benefits (Chen et al., 2019; Diener and Mudu, 2021; Chen et al., 2022). Nationwide urban forestry programmes, afforestation in high-density urban areas, and incentives for private entities can help manage and expand urban green spaces.

KEY MESSAGE 3

# Data-driven planning and governance can transform climate-resilient urban planning.

Despite escalating climate risks, urban responses in Pakistan remain reactive, constrained by fragmented data and limited predictive tools, exacerbating vulnerabilities in high-risk areas. Data-driven approaches can revolutionise urban governance by enabling precise mapping, resource allocation, and climate planning. Empowering local governments with these tools and decentralised models is vital for integrating climate resilience into urban development.

1. **Innovative use of data can transform urban climate planning.** Limited use of data-driven systems results in reactive responses to climate risks. This is exemplified in multiple ways. Pakistan lacks an integrated database to monitor migration patterns and climate-induced urbanisation (UN-Habitat, 2023), leaving cities like Karachi and Lahore struggling to absorb the influx of climate migrants. Pakistan's population census data remains weak. It is neither collected at appropriate and regular intervals, nor is it comprehensive and therefore unable to provide reliable urban demographic information. This hinders effective evidence-based policymaking. Effective air quality management depends on reliable data collection and utilisation. In Punjab, plans to expand air quality monitoring - with 30 new air quality monitors - and to leverage the National Socio-Economic Registry (NSER) to overlay income data with climate risks can help identify vulnerable communities and guide social protection efforts. However, gaps in monitoring leave critical areas unaddressed, weakening pollution management. Overall, better integration, real-time monitoring, and public accessibility can drive more targeted and timely interventions

   While various government departments collect climate-related data, lack of coordination especially across federal, provincial and local levels creates inefficiencies in planning, disaster response and service delivery. A centralised data integration platform, accessible across ministries, provinces and municipalities, can help consolidate climate, socioeconomic, and urbanisation data across government departments to enable data-driven interventions. Mobile data, such as Call Data Records (CDR), can provide real-time insights into migration patterns, aiding resource allocation and adaptive infrastructure planning. Cities such as Dhaka (Yasumoto et al., 2018) have effectively used such data to map heat exposure (Yasumoto et al., 2019) and population density, enabling targeted interventions like cooling shelters.

Below are some data-collecting initiatives by different government entities that could be aligned into a more coordinated system.

- The Urban Unit in Punjab has developed spatial *mouza* (an administrative land unit) dashboards that integrate climate and socioeconomic data to guide urban planning (The Urban Unit).
- Overlaying income data with climate risks through the NSER can enable focused social protection and infrastructure planning. This would allow Pakistan's flagship social protection programme, Benazir Income Support Program (BISP), to target climate-affected households more effectively, particularly in flood- and drought-prone regions for cash transfers. This could guide both emergency relief and long-term adaptation support.
- CDR provide real-time insights into migration and population density changes, essential for adaptive resource allocation (24 Justice PK).
- Punjab Environment Protection Agencies (EPA)'s expansion of air quality monitoring networks improves data accessibility for better pollution management.
- In collaboration with the Punjab Agriculture Department, IGC researchers are overlaying flood data with transport routes to evaluate climate-driven vulnerabilities affecting market access and food security, providing insights into resilience and mitigation practices in agricultural supply chains.

2. **Predictive tools and early warning systems can make resource allocation more responsive to climate shocks.** The absence of advanced predictive tools limits the ability to anticipate climate risks. Geospatial mapping, remote sensing, and digital dashboards can enable informed decision-making and targeted resource allocation and precise mapping of vulnerable zones, such as flood-prone areas and urban heat islands.

   Cities like Jakarta have successfully utilised GIS to create detailed flood hazard maps, improving preparedness and planning (Sibandze et al., 2024). Pakistan can adopt similar approaches by incorporating geospatial tools into district planning, zoning, and infrastructure projects, including those under China Pakistan Economic Corridor (CPEC) – an investment initiative between China and Pakistan aimed at improving connectivity. Provincial Annual Development Plans (ADPs) – that earmark funds for specific projects – can integrate these tools to prioritise climate-resilient infrastructure, such as drainage systems, urban green spaces, and flood mitigation projects.

   Data-backed systems can also act as early warning mechanisms. The IGC-supported Lahore Smog Alert System demonstrates how real-time air quality data can issue timely alerts and actionable recommendations for citizens and policymakers (Nasim and Rezaee). Scaling such platforms nationwide and integrating them with governance frameworks and disaster management protocols can strengthen warning systems. The use of predictive tools and spatial planning can align urban development with climate resilience goals more effectively.

3. **Integrating data into governance and planning is critical for effective climate interventions.** Despite availability of climate data, its inadequate integration into urban planning often leads to ad hoc decision-making (World Bank, 2022). For instance, while urban heat islands in Lahore are well-documented, investments in green roofs, urban forestry, and cooling infrastructure remain insufficient due to fragmented planning and funding priorities. Establishing comprehensive monitoring systems and data platforms requires significant investment, often deprioritised in favour of other urban development needs (Khan and Shahid, 2024).

   At the same time, decentralised governance is critical to enabling municipalities to address local climate challenges effectively. Countries like the Philippines have successfully reduced disaster response times and enhanced climate planning by empowering local governments with the authority and resources to act (UNDP, 2022). Pakistan can adopt similar decentralised models by establishing a phased roadmap that includes capacity-building programmes, clear mandates for municipalities, and robust monitoring and evaluation mechanisms to align urban development with long-term climate goals.

   Stronger coordination across federal and provincial governments is also essential. Currently, data remains siloed across agencies and jurisdictions. A data governance model where provinces retain control but contribute to a shared national platform may enable synergised planning, reduce duplication, and support proactive risk management aligned with national climate priorities. Incentivising provinces and line ministries to contribute data, while building capacity to interpret and act on it at the local level, is essential for proactive and equitable urban climate planning.

KEY MESSAGE 4

# Sustainable urban development will need innovative financing solutions.

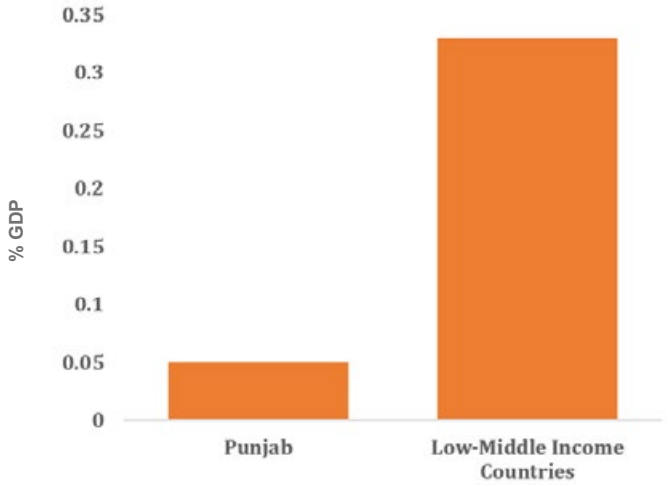
Pakistani cities face significant challenges in addressing urban climate vulnerabilities due to limited fiscal capacity and heavy reliance on intergovernmental transfers. Key taxes, including the Urban Immovable Property Tax (UIPT), continue to be administered by provincial governments, even though the 18th Constitutional Amendment (2010) mandated devolution to local governments. Resultantly, municipalities end up with responsibility for service provision but remain unable to raise or manage funds effectively. Reforms to empower municipalities to raise property tax more effectively are critical for enabling locally led climate action. Cities must also explore innovative financing solutions such as carbon markets, and climate funds and expand existing financing solutions such as property tax. With high estimates of adaptation needs – at approximately USD 7-14 billion until 2050, 70% of which will be required for infrastructure – mobilising resources through these mechanisms is imperative (MoCC, Government of Pakistan, 2021).

## Property tax reforms can unlock revenue for climate-resilient urban planning

Property taxes remain an underutilised revenue source in Pakistan, contributing only 0.05% of GDP, far below the average of 0.35% for low- and middle-income countries (Abbas et al., 2022). Property tax revenue in Pakistan lags significantly behind regional peers due to outdated valuation methods, limited coverage, and inefficiencies in collection systems. IGC research in Pakistan has shown how to improve tax collection and valuation (Wani, 2018; Zaffar and Taj, 2022). Countries like the Philippines (Fuchs et al.,) and India (Esri India, 2023) have successfully implemented GIS-based property mapping to improve valuation accuracy, expand tax coverage, and ensure transparent allocation of revenues to urban infrastructure projects. Adopting similar reforms in Pakistan, such as expanding Punjab's GIS-based system nationwide, could increase collection efficiency by up to 30% (The Urban Unit) and generate significant funds for climate-resilient infrastructure, including energy-efficient buildings (Wani, Shaikh, and Harman, 2020; Khan et al., 2022; Abbas et al., 2022; Shaikh, 2024), drainage systems, and green mobility solutions.

However, political and administrative hurdles can make such reforms difficult to implement. Experience with past reform efforts shows that entrenched resistance from officials, weak municipal capacity, and over-centralised fiscal control can stall past efforts to expand property tax systems. Linking taxes to visible local improvements, such as better roads or waste management, can increase public buy-in (Khan et al., 2022). Effective reforms will require incentives for local governments and sustained political commitment.

**Figure 3:** Punjab's property tax utilisation compared to low- and-middle-income countries

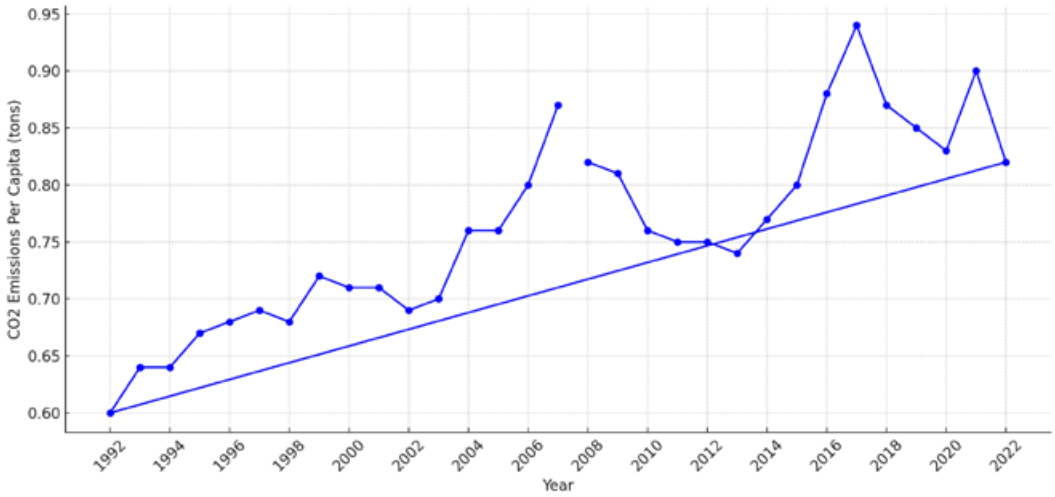



Notes: Punjab collects 0.05% of its GDP as property taxes, nearly seven times lower than average utilisation in low- and middle-income countries (2021-22). Sources: Abbas et al., 2022

## Carbon markets provide opportunities to fund sustainable urban infrastructure and incentivise low-carbon growth

Carbon markets can generate revenue and incentivise low-carbon development by creating tradable carbon credits from activities like renewable energy, reforestation, energy efficiency, and methane capture. These credits can be sold in compliance or voluntary markets, projected to grow from USD 2 billion in 2021 to USD 10-40 billion by 2030 (Reuters, 2023). However, caution is necessary. Transparency, credibility, and fair international rules governing carbon trading must be established to prevent greenwashing and ensure meaningful emission reductions. Effective regulatory frameworks are essential to ensure that carbon credits are genuine, verifiable, and equitably distributed to avoid market manipulation and inequitable benefits. Pakistan's frameworks are still evolving, and institutional coordination will be critical to ensure that carbon markets benefit urban resilience efforts.

**Figure 4:** Carbon dioxide emissions per capita in Pakistan (1992-2022)




Notes: The graph shows a rising trend in $CO_2$ emissions per capita in Pakistan from 1992 to 2022, with notable spikes around 2006-2007 and 2016-2018, likely due to industrial growth and infrastructure projects. A dip between 2008-2012 may reflect economic slowdowns, while the 2020 drop is likely linked to COVID-19-related disruptions. Source: Worldometer

## Access to climate finance

Pakistan's limited access to international climate finance hinders its ability to address climate challenges effectively. Pakistan secured over USD 9 billion in climate finance pledges from international partners (Al Jazeera, 2023) including a USD 20 billion World Bank commitment over 10 years, USD 15 million from the Green Climate Fund for climate startups, and ongoing USD 1 billion IMF financing talks (Shahid, 2025). Despite these inflows, challenges in policy alignment, institutional capacity, and private-sector engagement continue to hinder effective mobilisation and utilisation of funds. Institutional inefficiencies and policy misalignment between key ministries, such as Energy and Climate Change, weaken climate strategies and funding proposals (Shaikh, 2024). Additionally, gaps in climate data restrict the development of localised finance schemes, reducing Pakistan's competitiveness compared to India and Bangladesh. To attract concessional and commercial capital, Pakistan must build a pipeline of bankable, climate-resilient projects. This requires a shift toward financial innovation (Nabi, Mako, and Mahmood, 2022), institutional reform, and private-sector engagement, positioning climate action as a driver of green growth and unlocking investments in renewable energy, sustainable agriculture, and clean technologies.

KEY MESSAGE 5

# Infrastructure and sustainable mobility need to be prioritised for climate-adapted urban development.

Without targeted investments in modern infrastructure and sustainable urban mobility, cities will struggle to cope with rising climate pressures, threatening public safety, economic stability, and urban liveability. Some quick wins are discussed below.

## Upgrading drainage systems are essential to address urban flooding

Outdated drainage systems and poor planning exacerbate urban flooding, with large settlement areas in Lahore (129 $km^2$) and Karachi (61 $km^2$) exposed to flood risks. Low-lying neighbourhoods suffer the most due to clogged or poorly maintained drains. In addition to infrastructure upgrades, regular maintenance, clearing blockages, and preventing solid waste from entering drainage networks are critical to ensure system functionality during peak rainfall. Nature-based solutions (NBS) like green roofs, bioswales, and wetlands can complement traditional drainage systems by absorbing and slowing stormwater runoff. Singapore's *Active, Beautiful, Clean (ABC) Waters* programme (Ap-Plat) exemplifies how integrating NBS with conventional systems can effectively manage floods. There is an urgent need to upgrade drainage systems while mandating NBS integration into urban designs to enhance resilience.

## Expanding public transport and incentivising electric vehicles can encourage green mobility

Sustainable urban mobility is vital not only for reducing greenhouse gas emissions and improving air quality, but also for driving economic growth and enhancing urban productivity. Efficient transport systems lower travel time, improve access to jobs and services, and reduce energy costs, making cities more competitive and inclusive.

Systems like Bus Rapid Transit (BRT) reduce reliance on private vehicles, with a bus replacing up to 40 cars and emitting $CO_2$ equivalent to only 3.6 cars per kilometre (Abedullah, 2022). Lahore's BRT has achieved a 4% modal shift, decreasing private vehicle use and emissions (Batool, Irshad, and Abid, 2020). Expanding electric vehicles (EVs), especially for 2-3 wheelers, and supporting charging infrastructure can further enhance sustainability.

Managing urban congestion requires not just infrastructure but targeted policy interventions, such as parking fees and congestion charges, to regulate private vehicle use and encourage public transport uptake. Integrating informal transport services into urban mobility planning can also improve last-mile connectivity and enhance access for low-income users (IGC, 2023). (Abedullah, 2022).

**Using AI to optimise traffic flow and reduce urban emissions**

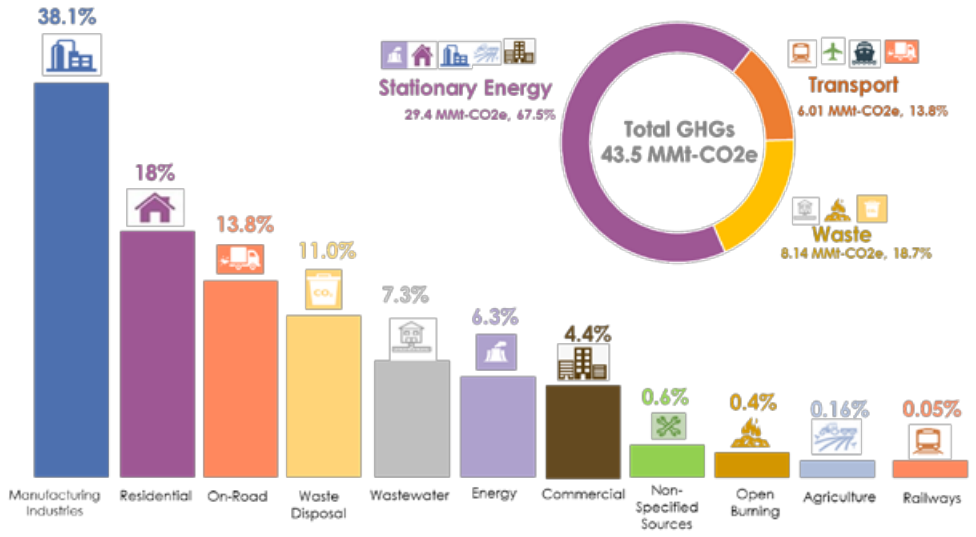
Google's AI-powered project Green Light, already collaborating with 12 cities including Manchester, Rio de Janeiro, Jakarta, and Abu Dhabi, is expanding to Lahore. It will help reduce stop-and-start traffic events through AI-supported traffic light management, with early indicators showing potential for up to a 30% reduction in stops, which could reduce emissions at intersections by up to 10% (Abbasi, 2024).

## Energy efficiency in urban buildings can reduce emissions and save energy

Buildings are major contributors to urban emissions. Climate-smart designs and retrofitting older buildings with energy-efficient technologies can reduce energy consumption and enhance disaster resilience. Rooftop solarisation, as seen in Lahore, demonstrates the potential for clean energy adoption. Enhancing building envelope efficiency can lower air conditioning energy use by 20% (Asad and Khurram, 2023). The sector consumes the most electricity in urban areas, with effective energy efficiency and conservation measures saving up to 2.63 million tons of oil equivalent annually (Government of Pakistan, 2023). Policymakers can mandate green building standards, promote retrofitting programmes, and incentivise rooftop solar installations for public and private buildings.

Both public procurement rules and building codes present actionable entry points to integrate climate-smart design and energy efficiency in urban development. Punjab has piloted some energy-efficient retrofits in government buildings with GIZ support, but these are not yet system-wide or mainstreamed through Punjab Public Procurement Regulatory Authority (PPRA) rules (GIZ). In 2023, Pakistan also introduced a Green Building Code and an Energy Conservation Building Code (International Code Council, 2023) but implementation is in early stages and will require concerted efforts.

**Figure 5:** GHG emissions by sector in Karachi (2024)




Notes: The chart shows total GHG emissions (43.5 million metric tons of carbon dioxide equivalent) by sector, with manufacturing industries (38.1%) as the largest contributor, followed by residential buildings (18%). Residential emissions highlight the need for energy-efficient designs and renewable energy to reduce their carbon footprint. Source: The Urban Unit, 2024.

Photo: iStock | Aleem Khan

## 1. Addressing urban climate vulnerabilities: heatwaves, flooding, and inequality

**Prioritise supporting vulnerable populations to ensure equity in climate adaptation:** Identify and map vulnerable populations, particularly low-income communities, informal workers, and climate migrants, to prioritise targeted climate-adaption interventions. Integrate equity-focused policies to protect these groups, such as climate-adaptive housing, social protection and health services for heatwaves and floods. Leverage tools like the National Socio-Economic Registry to design programmes aimed at building resilience in marginalised communities.

**Integrate NBS into urban climate policies:** Scale up urban forestry and green roofing projects to mitigate urban heat islands, absorb carbon emissions and improve air quality. Use wetlands and restored floodplains for natural flood mitigation, particularly in cities prone to urban flooding like Lahore and Karachi. Incentivise private and public partnerships for large-scale NBS implementation.

## 2. Scaling nature-based and infrastructure solutions

**Leverage land use planning and zoning for climate-resilient development:** Use land zoning as a key tool for climate resilience, relocating industrial zones away from residential areas and incentivising environment-friendly practices. Allocate dedicated spaces for renewable energy projects, such as EV charging stations and solar farms, through zoning policies. Encourage urban nature-based solutions by creating green corridors, urban forests, and community parks.

**Seize low-hanging fruits to accelerate climate gains:** Mainstream green building standards and codes, such as those of the Pakistan Engineering Council, into local government bylaws for energy efficiency in new constructions. Prioritise retrofitting residential and commercial buildings to reduce GHG emissions. Promote affordable solarisation programmes for households and small businesses, focusing on high-pollution urban areas.

**Expand green mobility through policies and infrastructure development:** Develop policies to promote EVs, especially for 2-3 wheelers, through subsidies and infrastructure development. Optimise public transport systems, such as Bus Rapid Transit (BRT), with AI-supported route planning for reduced emissions and congestion. Enhance green public transport systems and integrate climate resilience into urban mobility plans.

## 3. Enabling data-driven urban climate planning

**Adopt predictive tools and data-driven strategies for climate planning:** Expand the use of predictive tools, such as geospatial mapping, weather forecasting, and climate risk dashboards, for proactive urban planning. Institutionalise evidence-based interventions by integrating dynamic socioeconomic and climate data into decision-making processes. Leverage data from air quality monitors and remote sensing technologies to identify and prioritise climate interventions. Promote partnerships with research institutions to develop predictive climate models and evidence-based policies. By making the Annual Development Plan, the government's yearly budget allocation for development projects at the federal and provincial levels, a tool for proactive climate planning, cities can allocate resources more effectively, target high-impact areas, and ensure sustainable urban development aligned with long-term adaptation goals.

**Scale up digital platforms for climate monitoring and early warnings:** Expand early warning systems for floods, heatwaves, and air quality to cover all major urban centres. Integrate digital platforms like Lahore's Smog Alert System with governance frameworks for actionable citizen guidance, enable timely responses and build public trust. Use mobile data to enhance real-time monitoring of migration, heat exposure, and pollution hotspots.

**Strengthen local governments to implement climate-resilient policies:** Empower municipalities with the authority and resources to integrate climate resilience into city planning. Conduct training programmes for local governments to use climate and socioeconomic data for informed decision-making. Decentralise governance structures to allow local governments to tailor responses to specific urban vulnerabilities.

## 4. Unlocking finance for climate-resilient cities

**Reform financing mechanisms to unlock resources for green projects:** Reform property tax systems with GIS-based valuation to fund green infrastructure (drainage, renewable energy) and climate-resilient projects. Tap into international carbon markets by creating tradable credits from urban reforestation and renewable energy projects. Foster public-private partnerships to reduce fiscal burdens on government budgets while accelerating project implementation.

**Use incentives to drive behavioural and financial climate action:** Implement policy guidelines to encourage private sector and citizen participation in climate adaptation through incentives like tax credits and subsidies. For example, the Green Credit Program in Punjab promotes investments in renewable energy, energy-efficient technologies, and nature-based solutions. Introduce public awareness campaigns and reward systems to foster behavioural shifts towards sustainable practices in civil society.

# Prioritising quick wins for climate-resilient cities

Pakistan's cities are at a critical juncture. By integrating climate adaptation into urban planning, leveraging nature-based solutions (NBS), and strengthening governance, Pakistan can transform its cities into resilient, liveable hubs of economic growth. Immediate, evidence-based action is essential to ensure sustainable urban development (quick wins are highlighted in italics)

| Category | Policy Pathway | Actionable Points | Impact |
|---|---|---|---|
| **1. Address urban climate vulnerabilities** | Ensure equity in climate adaptation | • *Map vulnerable populations, including informal workers and climate migrants*<br>• Introduce climate-adaptive housing and social protection | • Reduces inequality and increases climate resilience of marginalised groups |
| | Integrate NBS into urban policy | • Scale up urban forestry, wetlands, and floodplain restoration<br>• *Incentivise green roofs and private investment in NBS* | • Lowers heat stress, improves air quality, and manages flood risk |
| **2. Scale infrastructure and nature-based solutions** | Modernise drainage systems | • *Audit drainage networks and address blockages*<br>• Integrate NBS such as bioswales and permeable surfaces | • Enhances flood resilience and water absorption |
| | Expand green mobility | • *Optimise Bus Rapid Transit and AI-supported route planning*<br>• *Promote EV adoption (2-3 wheelers), subsidies, and charging infrastructure* | • Reduces emissions and traffic congestion, improves access |
| | Enhance building energy efficiency | • Mandate and enforce green building codes<br>• Retrofit inefficient buildings; promote rooftop solar | • Cuts GHG emissions, lowers energy bills, and improves resilience |
| **3. Enable data-driven urban planning** | Adopt predictive tools and data systems | • *Develop central GIS platforms for vulnerability mapping*<br>• *Expand air quality monitoring and use CDR data for exposure tracking* | • Enables targeted, proactive disaster and development planning |
| | Scale up digital platforms for early warnings | • *Expand smog, flood, and heatwave alerts with citizen features*<br>• Integrate real-time monitoring into governance workflows | • Builds public trust, preparedness, and institutional responsiveness |
| **4. Unlock finance for urban climate action** | Reform financing mechanisms | • Modernise property tax systems using GIS<br>• Tap into carbon markets via reforestation and renewables | • Mobilises domestic and international finance for resilience |
| **5. Strengthen local implementation** | Empower local governance | • Decentralise authority and increase municipal capacity<br>• *Train local officials in predictive tools and data use* | • Aligns planning with local risks and accelerates response |

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