Condega, Nicaragua

I2UD DIGITAL LIBRARY STUDY GUIDE:

URBAN CLIMATE ADAPTATION AND RESILIENCE: PLANNING FOR EQUITABLE AND INCLUSIVE CITIES

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STUDY GUIDE TEAM

BARBARA SUMMERS
JOHN DRISCOLL
RACHAEL ALLEN
DANIEL TSAI

I2UD DIGITAL LIBRARY TEAM

Rachael Allen
John Driscoll
Barbara Summers
Daniel Tsai
Megan Yeo

ABOUT THE I2UD DIGITAL LIBRARY

The Institute for International Urban Development (I2UD) is a not-for-profit institution dedicated to improving urban environments for vulnerable communities, by providing research on spatial development issues, advisory services to city leaders, and urban planning education programs.

The I2UD Digital Library is an educational database of 40+ years of urban planning research, designed to facilitate a global perspective of urban planning history for a broad, diverse public audience. The Library is coupled with an archival photography collection documenting urban development conditions in over 13 countries. The Library's curated Study Guides will provide a resource for engaging critical urban issues in classrooms, conferences, and development projects. Collectively, these resources offer comprehensive practical documentation and essential materials for understanding both successful and unsuccessful urban development practices, shedding light on the evolving approaches in this field over decades.

The Library opens a longitudinal knowledge bank of historical documentation to inform future research agendas for sustainable urban development. This project seeks to provide crucial historical resources for students, citizens, local governments, and young professionals to understand current issues threatening the environmental mosaic of our shared world. The I2UD Digital Library offers a comprehensive historical perspective on urban development initiatives in Global South cities, filling a notable research gap often skewed towards Western/Global North viewpoints.

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INTRODUCTION

Cities are central to both the causes and the solutions of the climate crisis. Although they occupy less than 2% of the Earth's surface, they consume nearly 78% of the world's energy and generate more than 60% of carbon dioxide emissions.[1] They also concentrate people, infrastructure, institutions, and innovation that can drive transformative climate action. As UN-Habitat notes, cities are "both victims of climate change and among its worst perpetrators", producing the majority of greenhouse gas emissions while also being disproportionately exposed to floods, heatwaves, droughts, and sea-level rise.[2]

Urbanization has dramatically increased human exposure to climate hazards. Over 4.2 billion people, more than half the global population, now live in cities, and this number is projected to rise to 6.7 billion by 2050, with 90% of this growth concentrated in Africa and Asia. Every year, an estimated 67 million people move into cities, with the fastest growth in small and medium-sized settlements where adaptive capacity is weakest.[3] By mid-century, 70% of the world's population will live in urban areas, making cities the frontline of both climate impacts and adaptation action.[4]

According to the IPCC's Sixth Assessment Report, "what happens in cities is crucial to successful adaptation." Urban areas now concentrate most of the world's people and assets, meaning that the majority of climate-related risks, and opportunities for resilience, are urban in nature. Much of this growth is occurring in unplanned and informal settlements, which are the most exposed to hazards and least equipped to adapt.

The "urbanization of climate risk" is increasingly evident, with urban exposure to hazards such as flooding, heat, and storms growing more than three times faster than in rural areas.[5] By 2040, more than 2 billion urban residents could experience an additional 0.5°C increase in temperature, and 2,000 cities will be located in low-lying coastal zones below 5 meters above sea level. More than 517 million people in cities are expected to be exposed to severe flooding by 2030.[6] The IPCC further warns that more than 1 billion people could be at risk from coastal-specific climate hazards, such as storm surges and sea-level rise, by mid-century.[7] Meanwhile, recent warnings from the UN emphasize that humanity has now missed the goal to limit global warming to 1.5°C, a threshold once considered a guardrail, and that "devastating consequences" are now inevitable unless we "change course" rapidly.[8]

In this context, preparing cities for the realities of the climate crisis is both urgent and essential. Adaptation means more than coping with rising temperatures or managing disasters; it is about fundamentally rethinking how cities are planned, governed, and experienced as climate impacts intensify. It involves strengthening social, physical, and institutional systems so that cities can withstand shocks, recover quickly,

1 United Nations Framework Convention on Climate Change (UNFCCC). (2021). Seven ways cities can take climate action.
2 UN-Habitat. (2024). World Cities Report 2024: Cities and Climate Action. United Nations Human Settlements Programme.
3 Dodman, D., Hayward, B., Pelling, M., Castán Broto, V., Chow, W., Chu, E., Dawson, R., Khirfan, L., McPhearson, T., Prakash, A., Zheng, Y., & Ziervogel, G. (2022). Cities, settlements and key infrastructure (Chapter 6). In H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, ... B. Rama (Eds.), Climate Change 2022: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 907–1040). Cambridge University Press.
4 ICLEI – Local Governments for Sustainability. (2019). Resilient cities, thriving cities: The evolution of urban resilience. Bonn, Germany: ICLEI – Local Governments for Sustainability e.V.
5 UN-Habitat. (2024).
6 UN-Habitat. (2024).
7 IPCC, AR6 WGII, Chapter 6 (2022).
8 Carrington, D. (2025, October 28). Change course now: Humanity has missed 1.5°C climate target, says UN head. The Guardian.

and evolve in fairer and more sustainable ways.

Effective adaptation addresses both immediate risks and the structural inequalities that magnify them. When linked with poverty reduction, informal settlement upgrading, and disaster risk management, it builds resilience from the ground up, expanding access to safe housing, basic services, and secure livelihoods. This approach recognizes that climate risk is not evenly distributed, and that reducing vulnerability requires confronting long-standing social and spatial inequities.

As UN-Habitat underscores, people-centered climate action, anchored in participation, inclusion, and equity, delivers multiple co-benefits: stronger communities, healthier environments, and more responsive institutions. Embedding adaptation into the everyday systems that sustain urban life transforms it from a technical response into a framework for justice and renewal, enabling cities to not only survive the climate crisis but to thrive through it.[9]

9 UN-Habitat. (2024).

DEFINING ADAPTATION AND RESILIENCE IN URBAN CONTEXTS

Cities are now at the center of climate action. To understand how they can respond effectively, it is essential to clarify the key concepts that underpin climate adaptation and resilience. These concepts shape how risks are understood and how cities can plan for equitable and sustainable futures.

As defined by UN-Habitat, **Adaptation** encompasses all actions that help reduce vulnerability to the current or anticipated effects of climate change, such as sea-level rise, temperature extremes, biodiversity loss or food and water insecurity. It includes developing climate-resilient infrastructure, strengthening early warning systems, and expanding social protection mechanisms that enable communities to prepare for and recover from impacts.[10]

Mitigation, by contrast, targets the causes of climate change—reducing or preventing greenhouse gas emissions through renewable energy, low-carbon transport, sustainable land-use practices, and shifts in production and consumption patterns.

Vulnerability reflects how likely people, places, or systems are to experience harm from climate impacts. It is shaped by four interrelated factors:

- **Hazard** – the climate event or process (e.g., heatwave, flood, drought, sea-level rise);
- **Exposure** – the presence of people and assets in harm's way, such as settlements in floodplains or on unstable slopes;
- **Sensitivity** – the degree to which those exposed are affected, depending on housing quality, health, or livelihoods; and
- **Adaptive capacity** – the ability to anticipate, respond, and recover, influenced by access to resources, information, and governance.

Vulnerability differs within and between communities and evolves over time, often reflecting patterns of inequality—where the poorest residents live in the most exposed areas and have the least capacity to adapt.

Maladaptation refers to adaptation measures that unintentionally increase vulnerability, reinforce inequality, or shift risks onto other groups or places. It occurs when policies or projects designed to reduce climate risks end up creating new forms of exclusion or environmental harm. For example, green infrastructure projects that displace informal residents from ecologically sensitive areas in the name of environmental protection, which is also referred to as green dispossession. Other examples include flood barriers that protect wealthier districts while redirecting floodwaters toward poorer neighborhoods, and climate-resilient redevelopment projects that raise property values and trigger gentrification and displacement of low-income residents.

Nature-based Solutions for Adaptation (NbS-A), as defined at the United Nations Environment Assembly, are "actions aimed at protecting, conserving, restoring, and sustainably managing natural or modified terrestrial, freshwater, coastal, and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits".[11] Examples of NbS-A include such as creating urban green spaces like greenroofs, street trees, and parks; restoring ecosystems through rewetting wetlands or rehabilitating mangrove

10 UN-Habitat. (2024).
11 United Nations Environment Programme (UNEP). (n.d.). Overview: Nature-based solutions.

forests; applying sustainable land management practices such as agroforestry and soil conservation; and implementing natural water management systems like permeable pavements, bioswales, and retention basins to reduce flooding and enhance resilience. The term ecosystem-based adaptation (EbA) is often used interchangeably with NbS-A.

Resilience is the capacity of individuals, communities, institutions, and systems within a city to withstand, adapt to, and recover from shocks and stresses while continuing to function and evolve. According to ICLEI, Local Governments for Sustainability, a resilient city is one "prepared to absorb and recover from any shock or stress while maintaining its essential functions, structures, and identity."

Urban resilience brings together physical, social, and institutional capacities that enable cities to manage risks and sustain critical systems, housing, infrastructure, governance, and livelihoods, under changing conditions. It goes beyond emergency response to encompass adaptive governance, inclusive planning, and social learning, enabling cities to adjust and improve through experience.

Resilience must address both chronic stresses—slow-moving pressures that weaken urban systems—and acute shocks, which cause sudden disruption.

- **Chronic stresses** include unemployment, inadequate transportation, or persistent shortages of food and water.
- **Acute shocks** include floods, earthquakes, disease outbreaks, and extreme weather events.

By addressing both, cities can move from reactive crisis management to proactive risk reduction and equitable recovery, ensuring that resilience-building contributes to long-term sustainability and inclusion.[12] Furthermore, resilience should not be understood narrowly as an environmental or technical challenge. It is a holistic approach that links climate adaptation with social justice, economic opportunity, and inclusion. Alongside environmental hazards, cities face widening inequalities, housing insecurity, migration pressures, and governance gaps that shape who is most at risk and who benefits from recovery efforts.[13]

12 ICLEI. (2019).
13 UN-Habitat. (2024).

CLIMATE RISK AND VULNERABILITY IN CITIES

CLIMATE RISKS FACING CITIES

As climate impacts intensify, cities are becoming the most visible frontlines of disruption. Their dense built form, concentration of assets, and interconnected systems mean that a single hazard can cascade across multiple sectors, from housing and energy to health and food security. The IPCC Sixth Assessment Report notes that urban risk from climate-related hazards has increased in every region, driven by the interaction of urbanization, inequality, and underinvestment in basic services.

Climate change manifests through interconnected hazards that expose the physical, ecological, and institutional weaknesses of urban systems. The most critical include:

Flooding

Intense rainfall and sea-level rise, combined with poor drainage and land subsidence, cause recurrent inundation in both inland and coastal cities. According to UN-Habitat, urban flood exposure has grown three times faster than in rural areas since 1975.[14] By 2040, more than 517 million people in cities are expected to be exposed to riverine flooding events with a 100-year return period.[15] Such events disrupt transport networks, damage housing and infrastructure, and contaminate drinking water, heightening the spread of waterborne diseases. Flooding also erodes livelihoods and disproportionately affects low-income and informal settlements, where drainage is poor, and recovery resources are limited.

Extreme Heat

The Urban Heat Island effect, dense construction, dark surfaces, and limited vegetation, can make cities several degrees warmer than surrounding areas. As global temperatures rise, heat extremes will become more frequent, intense, and prolonged, heightening risks of dehydration, heat stroke, cardiovascular illness, and premature death, especially among children, the elderly, and the poor. By 2050, 1.6 billion people in nearly 1,000 cities will regularly experience extreme heat above 35 °C, worsening health risks and productivity losses.

Drought

More frequent and prolonged dry spells will strain already fragile water systems and heighten competition for limited resources. By mid-century, more than 500 cities could face chronic water scarcity, affecting 650 million residents. At the same time, population growth and rapid urbanization are driving a steep rise in demand, with global water use projected to increase by 55% by 2050, putting immense pressure on infrastructure and governance systems. Water quality will also decline as reduced flow concentrates pollutants and weakens sanitation systems, thereby heightening the risk of disease.

14 UN-Habitat. (2024).
15 C40 Cities. (2023). The future we don't want: How climate change could affect cities — and how we can avoid it.

Storms

More frequent and intense tropical storms and cyclones damage homes, roads, and energy networks, while disrupting informal and service economies that sustain urban livelihoods. The impacts are greatest in low- and middle-income cities, where informal housing and weak infrastructure amplify losses. Storms also disrupt transport, trade, and essential services, with long recovery times that deepen economic vulnerability. Secondary hazards—such as landslides and flash floods—further endanger hillside and riverbank settlements. Between 1980 and 2020, tropical cyclones accounted for nearly one-third of global disaster losses, a share expected to rise as warming oceans intensify storm activity and rainfall extremes.[16]

Sea-Level Rise

By the 2050s, more than 800 million people in over 570 coastal cities will be at risk from at least 0.5 meters of sea-level rise and associated coastal flooding. Ten percent of the world's population already live in low-elevation coastal zones less than 10 meters above sea level. Rising seas, compounded by land subsidence, rapid urbanization, and ecological degradation, are intensifying risks of permanent inundation, shoreline erosion, and saltwater intrusion into freshwater aquifers. Coastal and deltaic cities, many of which are global hubs for trade and economic activity, face growing threats to infrastructure, housing, and critical services concentrated along waterfronts and floodplains.

Note: Many of the statistics and projections in this section are drawn from C40 Cities' study, The Future We Don't Want (2018), which assessed climate risks for urban areas with populations over 100,000. It is important to note that this represents only a fraction of the world's urban landscape, excluding the vast number of smaller and rapidly growing towns where adaptive capacity is weakest. The real extent of climate risk is therefore significantly underestimated, as many of the most vulnerable settlements fall below this population threshold yet face equal or greater exposure to climate hazards.

Urban climate impacts rarely occur in isolation. Compound events, such as heat interacting with air pollution, or flooding with poor water quality, generate systemic losses across health, infrastructure, and governance systems.[17] Hazards also interact with slower-moving stresses, ageing infrastructure, pollution, and service deficits—that erode resilience over time. Prolonged heat increases energy demand and health risks; flooding disrupts sanitation systems; drought weakens food and water security; and extreme events disrupt supply chains and strain municipal budgets. Together, these pressures reveal how urban vulnerability is systemic, extending beyond environmental exposure to encompass the interdependence of physical and social systems.

INFORMALITY, INEQUALITY, AND CLIMATE INJUSTICE IN CITIES

More than one billion people live in slums and informal settlements, with that number projected to double by 2030.[18] These communities are often situated in hazard-prone environments such as floodplains, unstable slopes, and reclaimed wetlands, where exposure to flooding, landslides, and heat is highest. UN-Habitat describes this as a "double climate injustice": those who contribute least to greenhouse gas emissions face the greatest exposure and possess the least capacity to adapt.[19]

16 IPCC, AR6 WGII, Chapter 6 (2022).
17 Ibid.
18 UN-Habitat. (2024).
19 Ibid.

Informality concentrates risk and exclusion. Residents of informal settlements experience overlapping stresses, extreme heat, flooding, water scarcity, and air pollution, while already coping with insecure livelihoods, unemployment, and poor access to services. Insecure tenure, substandard housing, limited infrastructure, and weak institutional support trap residents in a cycle of loss and recovery where each hazard deepens poverty. Informality is therefore not only a housing condition but a structural marker of climate vulnerability, reflecting the unequal distribution of safety, services, and rights in cities.

Urban risk is inseparable from patterns of inequality and land governance. In many cities, the formal housing market excludes low-income residents, pushing them toward unregulated and hazardous land. Meanwhile, urban expansion into floodplains, wetlands, and coastal zones—often driven by speculative or elite real estate development—intensifies climate risk by destroying natural buffers and displacing poorer residents to even more hazardous areas. Even well-intentioned climate-responsive land-use planning can become maladaptive when it leads to the displacement of marginalized groups from ecologically sensitive zones—a process known as 'green dispossession' or 'eco-cleansing.'[20]

Climate vulnerability is also shaped by social and demographic factors.

- **Children and Youth:** Children and youth, particularly those under the age of five, face higher risks from heat stress, malnutrition, and disease linked to floods and poor air quality. Climate hazards threaten and disrupt education, safety, and long-term development prospects.
- **Women:** Gender roles and social norms often limit women's access to income, land, and decision-making power, constraining their adaptive capacity. Maternal and reproductive health are especially vulnerable to heat, contaminated water, and disrupted healthcare systems.
- **Migrants and Displaced Populations:** Climate-induced migration is reshaping cities across the Global South. By 2050, an estimated 216 million people could be internally displaced by climate impacts, most of whom would end up in urban informal settlements.[21] Migrants often lack access to formal housing or social protection, increasing their exposure to hazards.
- **Other vulnerable groups** include elderly or disabled people. Outdoor and/or informal workers are also highly vulnerable to heat-related illnesses, air pollution exposure, skin cancer risk, and injuries from extreme weather events.

These intersecting vulnerabilities reflect deep-rooted environmental injustices embedded in urban planning and governance. Decades of discriminatory zoning, forced relocations, and uneven infrastructure investment have concentrated climate risks in marginalized neighborhoods while shielding wealthier enclaves. UN-Habitat warns that "bourgeois environmentalism"—the framing of informal settlements as ecological threats—can justify evictions and exclusion in the name of environmental protection.[22]

Climate change now amplifies these inequalities, reshaping the geography of urban risk. Without secure tenure or access to essential services, the urban poor are not only more exposed to hazards but also systematically excluded from protection systems and recovery resources. Recurrent floods, heatwaves, and pollution translate into chronic health burdens, eroded livelihoods, and intergenerational poverty. Each shock compounds existing marginalization, widening the divide between those insulated from climate impacts and those whose survival depends on fragile urban systems.

20 UN-Habitat. (2024)..
21 Ibid.
22 Ibid.

I2UD'S CLIMATE CHANGE ADAPTATION FRAMEWORK

Building on the understanding that resilience extends beyond environmental or technical measures, the I2UD Framework offers a practical approach for cities to translate these concepts into locally grounded action. Developed through field-based research in Cartagena, Colombia, and Condega, Nicaragua, the framework addresses the growing climate risks faced by informal and low-income urban settlements. It provides a roadmap for localizing adaptation, helping cities move from reactive disaster management toward long-term, people-centered resilience building.

I2UD's framework rests on three guiding principles:

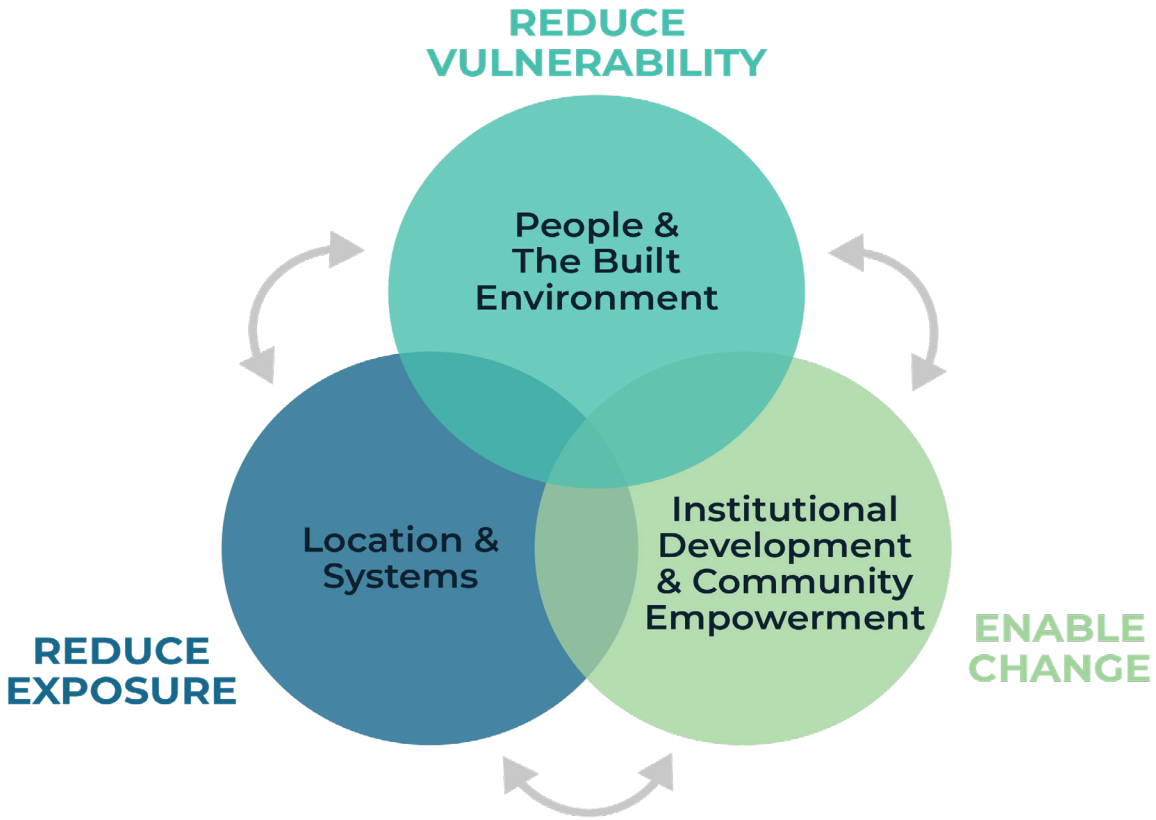
1. **Local Focus** – Adaptation must occur where impacts are felt and solutions can be shaped: at the local and neighborhood level.
2. **Participation** – Building resilience requires collaboration between communities, civil society, and local authorities.
3. **Flexibility** – Adaptation is a continuous and dynamic process that must respond to changing risks, politics, and local realities.

The Three Components of Urban Risk

Drawing from the IPCC's conceptualization of risk, I2UD defines urban climate risk as the interaction of:

- **Exposure** – geographic location and physical hazards (e.g., floods, slopes, surges);
- **Vulnerability** – socioeconomic conditions that limit people's ability to cope; and
- **Institutional Capacity** – the strength of governance systems, infrastructure, and policy frameworks to enable adaptation.

The framework structures climate adaptation around three pillars of intervention:



- **Reduce Exposure** focuses on the physical and environmental dimensions of risk, guiding urban growth away from hazard-prone sites through better land management, planning, and environmental protection—especially in floodplains, coastal zones, and steep slopes.
- **Reduce Vulnerability** addresses the social and economic roots of risk—poverty, exclusion, and lack of access to services—by strengthening livelihoods, housing, health, and education, and ensuring that adaptation reduces inequality as well as hazard exposure.
- **Enable Change** emphasizes institutional and governance capacity, highlighting the importance of community empowerment, participatory decision-making, and technology to improve coordination, accountability, and inclusion.

The framework begins with a diagnosis of local exposure and sensitivity, situating adaptation within the lived realities of low-income residents. It underscores that resilience-building extends beyond infrastructure to include livelihoods, inclusion, and empowerment, with institutional development and participatory governance as critical enablers.

By embedding adaptation into urban planning and land management and addressing the land and service needs of the urban poor, the framework bridges policy and practice—steering growth away from high-risk zones. Ultimately, I2UD's framework views adaptation as a transformative process that reshapes urban governance, equity, and opportunity.

EVOLUTION OF GLOBAL VIEWS AND AGREEMENTS ON CLIMATE CHANGE AND CITIES

1. 1970s-1990s: Environmental Awareness and Early Urbanization Concerns

Overarching Views

Climate change framed as a global environmental problem, largely driven by industrial emissions, cities seen mainly as ***polluters***, not sites of vulnerability

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Milestones and Action

- **1972 Stockholm Conference:** The first world conference to make the environment a major issue. Made the first link between environment and development. Led to the creation of the UN Environment Programme (UNEP).
- **1988:** Creation of the Intergovernmental Panel on Climate Change (IPCC) to provide policymakers with regular scientific assessments on the current state of knowledge about climate change. No explicit focus on cities.
- **1992: Rio Earth Summit & United Nations Framework Convention on Climate Change (UNFCCC) creation:** Established an annual forum, known as the Conference of the Parties, or COP, for international discussions aimed at stabilizing the concentration of greenhouse gases in the atmosphere. Recognized climate as a global governance issue; cities largely absent.
- **1996: Habitat II (Istanbul)** began connecting urbanization and sustainability, but climate change was not a significant focus.

The Big Idea for Urban Adaptation

- Local governments had minimal involvement; adaptation and urban planning were treated separately.

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- **1989 - Environmental Factors in Housing Study.** In a period when climate change, urbanization, and vulnerability were still treated as separate global agendas, this early I2UD study, supported by the Ford Foundation and WHO, broke ground by examining how environmental hazards, housing typologies, and public health conditions interact in informal and low-income settlements. Although predating the language of "climate adaptation," the work identified many of the same structural drivers now central to resilience planning, air pollution exposure, inadequate ventilation, proximity to environmental hazards, and social and economic constraints faced by slum residents. The study positioned informal settlements as sites of environmental vulnerability long before they appeared in global climate frameworks, marking an early effort to link urban conditions, health, and environmental risk, foreshadowing today's adaptation debates.

2. 2000–2010: Recognizing Urban Vulnerability

Overarching Views

During this decade, growing scientific and policy attention reframed cities from being solely sources of emissions to being sites of vulnerability and innovation. Rapid urbanization, combined with evidence of cities' exposure to floods, heat, and storms, led to a shift toward understanding the urban dimensions of climate risk.

Milestones and Action

- **2001 & 2007 - IPCC Third and Fourth Assessment Reports:** First IPCC reports to highlight urban vulnerability, exposure, and adaptive capacity, and to call attention to local governance and infrastructure deficits.
- **2008 - UN-Habitat "Cities in Climate Change Initiative":** Launched efforts to strengthen municipal capacities and integrate climate adaptation into urban planning.
- **2009 - Copenhagen COP15:** Established the first global climate finance pledge of $100 billion annually for developing countries and formalized the goal of limiting warming to 2 °C. Marked the first significant inclusion of cities and mayors in UNFCCC discussions, signalling that local governments were essential to global climate governance.

The Big Idea for Urban Adaptation

- Urban adaptation emerged as both a developmental and governance challenge — shifting focus from environmental management toward institutional reform, decentralization, and local capacity to act.

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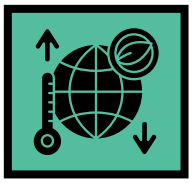
- **2009 - Climate Change in the Local Development Agenda: Promoting Resilience Through Enhanced Understanding of Early Threats.** This World Bank–funded study examined how climate risks manifest in two rapidly growing coastal cities, Alexandria, Egypt, and Cotonou, Benin, highlighting the gap between global climate discourse and the day-to-day realities of cities in the Global South. Using spatial analysis, neighborhood-level assessments, and environmental threat mapping, it showed that hazards such as sea-level rise, coastal erosion, storm surge, and flooding intersect with rapid urbanization, overstretched services, and large informal settlements to create sharply uneven patterns of risk. The most severe impacts fall on informal and low-lying districts where weak infrastructure, inadequate services, and limited economic options compound exposure.

  The study further underscored that even as climate threats intensify, local authorities must also address economic development, job creation, and basic service provision—making climate strategies inseparable from immediate social and political priorities. It revealed the structural constraints facing coastal cities like Alexandria and Cotonou: limited local data, constrained budgets, and development pressures that continue pushing growth into exposed zones. The findings emphasized the need for land management policies that direct expansion away from vulnerable areas and for regional coordination to address impacts that cross jurisdictional boundaries. Ultimately, the study made clear that adaptation must be embedded within core urban planning and development decisions rather than treated as a separate technical exercise.



3. 2010–2015: Institutionalizing Urban Resilience

Overarching Views

This period marked the mainstreaming of resilience as a unifying concept in global urban policy. Cities were increasingly recognized not just as vulnerable spaces but as strategic spaces for adaptation, innovation, and governance reform. “Urban resilience” began to link climate adaptation with risk management, urban planning, and social inclusion.

Milestones and Action

- **2010 - ICLEI Resilient Cities Congress:** Established an annual global platform connecting local governments to international climate adaptation dialogues.
- **2011 - COP 17 and the Durban Adaptation Charter:** Endorsed by 114 mayors, it committed cities to integrating climate adaptation into local development and decision-making.
- **2013 - 100 Resilient Cities (Rockefeller Foundation):** Launched after Hurricane Sandy impacted New York City, reframing resilience as a systemic, citywide approach that connects infrastructure, governance, and communities.
- **2014 - IPCC Fifth Assessment Report (AR5):** Introduced the first urban-focused chapter, identifying cities as “crucial sites of risk and opportunity” in global adaptation.

The Big Idea for Urban Adaptation

- By mid-decade, urban resilience had become a global agenda. Cities were acknowledged as leading actors in adaptation, yet most frameworks remained fragmented, focused on infrastructure and emergency management rather than governance, equity, or long-term transformation.

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- **2012 - Climate Change Adaptation and Resiliency Framework: Development Strategy for Cartagena (Colombia) and Condega (Nicaragua).** This research examined how Cartagena and Condega were addressing climate risks in informal and lower-income settlements, highlighting both progress and persistent vulnerability. It found that reactive, emergency-driven approaches were insufficient for cities facing recurrent flooding, heat, and environmental hazards. The report argued for integrating adaptation into land management, urban planning, and social development, showing how exposure, socioeconomic vulnerability, and limited institutional capacity interact to shape climate risk. Its evaluation of both cities’ strategies directly informed the creation of I2UD’s Climate Change Adaptation and Resiliency Framework, a tool designed to help cities operationalize resilience within everyday planning decisions.

- **2013 - Strategic Land Use Planning for Climate-Change-Driven Water Shortages in El Alto, Bolivia.** This study explored how El Alto, a rapidly growing, high-altitude city facing shrinking watersheds and declining glacier melt, could manage escalating water scarcity through land-use planning. By using future land-use scenarios and modeling their water-demand implications, the report showed that resilience to drought is not only about infrastructure, but also about directing urban growth, strengthening institutions, and protecting vulnerable communities. It underscored that for cities like El Alto, adaptation requires aligning spatial planning with water governance to prevent shortages from deepening existing inequalities.

I2UD Digital Library Resources - continued

- **2012–2014 - Belize Municipal Development Plans (MDPs): Technical Assistance and Capacity Strengthening.** As Belize decentralized and urbanized rapidly, this technical assistance program supported seven municipalities in developing Municipal Development Plans as tools for resilient, inclusive growth. I2UD worked with Local Planning Working Groups to strengthen municipal planning skills, integrate environmental and climate risks into land-use decisions, and improve local revenue and service planning. The project showed that when municipalities build interdisciplinary planning capacity, even from a very low baseline, they are better able to steer development away from hazard-prone areas and embed climate considerations into routine governance, even without sophisticated data systems.
- **2015 - Arusha City Resilience Index (CRI) Pilot Program, Tanzania.** Arusha was one of five global pilots for the Rockefeller Foundation's City Resilience Index, selected specifically as a lower-capacity, data-poor city. The pilot revealed a significant mismatch between the CRI's data-intensive requirements and the realities of local government capacity in many Global South cities. While Arusha's authorities were highly engaged, gaps in data availability, institutional resources, and local technical expertise hindered full implementation. The project highlighted a broader lesson of this era: resilience assessment tools must be adapted for diverse city contexts, or they risk reinforcing global inequities in who can measure, and therefore plan for, urban resilience.

4. 2015–2016: Converging Global Agendas

Overarching Views

This period marked a turning point in global climate governance. For the first time, urban resilience, sustainable development, and disaster risk reduction were jointly framed as interconnected pillars of climate action. Cities moved from the periphery of global climate negotiations to the center, formally recognized as essential partners in delivering resilience, equity, and sustainability.

Milestones and Action

- **2015 - Sendai Framework for Disaster Risk Reduction:** Identified urbanization as a key driver of risk and shifted the global approach from disaster response to proactive risk reduction.
- **2015 - Paris Agreement (COP21):** The Paris Agreement—the most significant global climate accord to date—requires all countries to set emissions-reduction targets (NDCs) aimed at keeping warming well below 2°C and pursuing 1.5°C, while moving the world toward net-zero emissions later this century. It also formally recognized cities as Non-Party Stakeholders and called for multi-level climate governance, urging national governments to embed adaptation and resilience into planning.
- **2015 - Sustainable Development Goals (SDGs):** An update to the UN's Millennium Development Goals, which introduced 17 new goals for the period 2015-2030. SDG 11 was the first global goal dedicated to inclusive, safe, resilient, and sustainable cities..
- **2016 - Habitat III and the New Urban Agenda (Quito):** The agreement from Habitat III articulated a vision of cities grounded in the right to the city and urban resilience, emphasizing inclusive planning and equity as pathways to sustainability.

The Big Idea for Urban Adaptation

- This was the moment of convergence—when climate, disaster, and urban agendas became aligned. Cities were formally embedded in global climate frameworks, recognized not only as sites of concentrated risk but as critical drivers of adaptation and resilience worldwide.

I2UD Digital Library Resources - continued

- **2014 - National Urban Policies in Arab States.** This regional assessment for UN-Habitat examined National Urban Policies (NUPs) in Egypt, Jordan, Morocco, Saudi Arabia, and Sudan as part of the preparatory process for Habitat III. The analysis found that although climate risks—water scarcity, heat, coastal exposure, and energy stress—are shaping urbanization across the region, adaptation and resilience measures remained marginal in most NUPs. Instead of being integrated into urban policy, climate issues were typically addressed through sectoral strategies managed by central agencies or through isolated development programs. The report underscored the gap between emerging global commitments to urban resilience and the limited institutional mechanisms available within Arab States to mainstream climate considerations into land policy, housing, infrastructure, and metropolitan governance.

- **2015–2016 - Habitat III Regional Report for the Arab Region.** Prepared as one of the five official regional reports for Habitat III, this assessment synthesized two decades of urban change in the Arab region—rapid growth, conflict and displacement, informality, economic restructuring, governance constraints, and mounting climate stresses. The report argued that climate change is inseparable from broader urban challenges: water scarcity, energy insecurity, and environmental degradation are directly influencing urban stability, equity, and development trajectories. It stressed that without systemic reforms—improving water and energy efficiency, strengthening pollution control, investing in resilient infrastructure, and addressing inequality—cities risk deepening social tensions and declining livability. The report positioned climate resilience as a core pillar of the New Urban Agenda, not a sectoral add-on.

- **2016 - Urban Resiliency & the Challenge of Coordinating Climate Adaptation Strategies at Different Scales (Zofnass Program, Harvard GSD.** In this workshop presentation, Dr. Mona Serageldin highlighted lessons from I2UD's adaptation work in Cartagena, Colombia and Arusha, Tanzania, emphasizing the central role of infrastructure in shaping urban resilience. The presentation argued that in resource-constrained cities, well-targeted, layered infrastructure investments, transport, drainage, water systems, and public spaces can guide land use, protect vulnerable ecosystems, and support economic opportunity. It stressed that coordinating adaptation across scales (local, metropolitan, and national) is essential for meeting the SDGs and the New Urban Agenda: sustainability and resilience must be understood together, with infrastructure acting as the connective tissue linking climate goals to long-term spatial development.

5. 2016-2020: Institutionalization and Local Leadership

Overarching Views

This period solidified cities as central actors in global climate governance. Urban networks expanded rapidly, scientific partnerships strengthened, and local governments began formalizing climate commitments through standardized methodologies.

Milestones and Action

- **Expansion of city networks:** Organizations like C40 Cities, UCLG, and the Global Covenant of Mayors (GCoM) expanded city diplomacy and collective target-setting, accelerating peer learning and coordinated climate action.
- **2018 — Launch of CitiesIPCC:** A major partnership linking urban practitioners with climate scientists, designed to close knowledge gaps and embed cities in global climate research.
- **UN-Habitat & ICLEI:** Introduced formal tools such as Voluntary Local Reviews (VLRs) for tracking SDG progress and integrating resilience into municipal planning.
- **Expansion of local climate strategies:** More cities adopted climate action plans aligned with the Paris Agreement, with increasing attention to adaptation and equity (though implementation capacity varied widely).

The Big Idea for Urban Adaptation

- Urban climate action advanced from high-level advocacy to structured, measurable planning, yet financing for adaptation, especially in low-income cities, remained inadequate, limiting the scale and pace of transformational change.

I2UD Digital Library Resources - continued

- **2014–2018 - National Urban Strategy for Governorates in Iraq.** This strategy supported Iraq's governorates in rebuilding urban systems after years of conflict while preparing for the acceleration of climate pressures. By mainstreaming ecological and climate-risk considerations into national and governorate planning, the work emphasized that adaptation cannot be limited to infrastructure rehabilitation. Governorates must integrate climate risk into land-use decisions, protect scarce water and natural resources, and manage competing demands over land and infrastructure. The strategy underscored that in a fragile context, proactive, cross-sector, and participatory planning is essential to safeguard vulnerable communities, reduce future disaster losses, and steer urban growth toward long-term resilience.

- **2015–2016 - Planning for Climate Adaptation in Four Municipalities, Dominican Republic.** This USAID-funded program helped four Dominican municipalities integrate climate considerations directly into land-use planning while building models that could be replicated through the International City/County Management Association's (ICMA) peer-learning network. I2UD documented community-based practices and provided tools for participatory engagement that center household realities, local knowledge, and trusted intermediaries. The work demonstrated that structured community participation improves vulnerability assessments, strengthens trust, and ensures that adaptation priorities meaningfully shape municipal planning decisions. By embedding these methods in a networked learning process, the project supported municipalities in transitioning from high-level climate awareness to practical, place-based planning capacities.

- **2016–2019 - Exploring the Use of Land Value Capture Instruments for Green Resilient Infrastructure Benefits.** This research investigated how land value capture could finance green resilient infrastructure (GRI) in rapidly urbanizing, climate-exposed cities, using a flood-mitigation and river restoration project in Santiago de Cali as a case study. The findings showed that GRI measurably increases land values, largely due to improved amenities and environmental quality rather than flood control alone, providing a real financial basis for climate adaptation. However, the study cautioned that without strong institutions, safeguards, and anti-displacement measures, value capture risks reinforcing inequality. It highlighted both the promise and the governance challenges of using market-based tools to scale resilience in lower-income urban areas.

6. 2020–Present: Climate Justice and Locally Led Adaptation

Overarching Views

A shift toward understanding cities as systems of interdependence, where climate risk, inequality, and informality are tightly linked. Adaptation is increasingly framed as a justice-led, locally driven transformation, rather than a technical add-on, with Nature-Based Solutions for Adaptation (NbS-A) emerging as core strategies.

Milestones and Action

- **2022 - IPCC Sixth Assessment Report (AR6):** Declared that "what happens in cities is crucial to successful adaptation" and identified informal settlements as global risk hotspots, highlighting governance, inequality, and infrastructure deficits as core drivers of vulnerability.

- **COP26–COP28:** Introduced major shifts in global adaptation architecture:
    - Glasgow–Sharm el-Sheikh Adaptation Agenda: A global framework for resilience by 2030, including targets on early warning systems, climate-resilient infrastructure, water security, and expanded urban NbS.
    - The Loss and Damage Fund: Established to support countries and communities experiencing irreversible climate impacts, acknowledging historical responsibility and directing resources to those most vulnerable—including low-income urban neighborhoods facing extreme heat, flooding, and sea-level rise.
    - Local Climate Stocktakes: Brought cities, local governments, and communities into the formal UNFCCC reporting process, strengthening accountability and ensuring local knowledge and risk data inform global climate action.
- **2024 - IPCC Special Report on Climate Change and Cities commissioned:** Firmly established climate change as a core urban development priority, emphasizing that effective adaptation must be people-centered, locally led, and grounded in justice to address the unequal vulnerabilities shaping cities today.
- **2025 - COP30:** Marked by ambitious rhetoric on local climate action, COP30 elevated cities as key implementers through new multilevel partnerships and heat-resilience initiatives. However, outcomes remained non-binding and underfunded, with limited direct finance or authority devolved to cities—leaving urban adaptation, especially in informal settlements, visible in principle but weak in delivery and climate justice impact.

The Big Idea for Urban Adaptation

- The agenda has changed from incremental adjustments to transformational, equity-centered resilience. Locally led adaptation, social protection, and governance reform are now front and center. Enabling implementation remains one of the biggest challenges, particularly expanding access to finance for cities in the Global South. Other challenges include strengthening multi-level governance and embedding justice, informality, and inclusion into all adaptation strategies.

I2UD Digital Library Resources

- **2020–Present - AI Climate: A Decision-Making Tool for Resilience Building in Cities of the Global South.** This initiative advances a remote-sensing and machine-learning platform designed to help fast-growing cities in the Global South with large informal settlements, identify climate hazards and make faster, more transparent planning decisions. By processing satellite imagery and georeferenced datasets, the tool predicts risks such as flooding and landslides while mapping socially vulnerable communities, enabling planners and local partners to co-create adaptation strategies grounded in real-time data. Early prototyping focused on Tegucigalpa, Honduras, where rapid urban expansion, steep terrain, and recurrent flood and landslide risks provided a high-need testing ground; the platform has since been adapted for additional locations, including Monterrey, Mexico, and Ilopango, El Salvador, demonstrating its scalability across diverse urban contexts. Conceived as an open-source, low-cost resource, AI Climate aims to transform traditional planning processes by improving visual access to hard-to-reach areas, enabling frequent risk updates, and integrating technical expertise with community validation, positioning data-driven, locally informed decision-making as essential to navigating the dual pressures of rapid urbanization and increasingly unpredictable climate patterns.

CITIES AT A TURNING POINT: FROM INCREMENTAL ADAPTATION TO TRANSFORMATIONAL URBAN RESILIENCE

Cities are entering a fundamentally different climate reality. Global temperatures are now expected to at least temporarily exceed 1.5°C, entering a period of climate overshoot, where warming surpasses agreed limits before potentially being reduced later in the century.[23] This shift matters not because of the threshold alone, but because it signals a future defined by greater uncertainty, more frequent and severe extremes, and irreversible losses. For cities, climate overshoot means that past experience is no longer a reliable guide for planning. It narrows the margin for error and raises the costs of delayed or inadequate action, particularly for low-income and marginalized urban residents.

In this context, incremental, sector-by-sector adaptation is no longer sufficient. Urban adaptation must now operate under conditions of compounding risk, deep inequality, and constrained institutional capacity. The challenge facing cities is not simply how to manage individual hazards, but how to govern complex, interacting systems in ways that reduce vulnerability rather than reproduce it.

As cities move into a new phase of climate risk, several critical lessons define the path toward effective and equitable adaptation:

- **Urban climate risk is systemic.** Flooding, heat, water stress, health impacts, and displacement are not isolated problems; they cascade across housing, infrastructure, livelihoods, and governance systems. Addressing one risk without attention to others often leads to maladaptation.
- **Informality is not a marginal condition but a structural feature of urbanization in much of the Global South.** Informal settlements concentrate exposure to climate hazards while simultaneously limiting access to services, tenure security, and political voice. Treating informality as an exception rather than a core planning reality undermines effective adaptation**.**
- **Climate vulnerability is inseparable from inequality.** Gender, age, disability, migration status, and income shape who is exposed, who can cope, and who recovers. Adaptation efforts that fail to confront these disparities risk protecting assets rather than people.
- **Governance capacity matters as much as infrastructure.** Institutions that can coordinate across sectors, engage communities meaningfully, and adapt over time are better positioned to manage climate risk than those relying solely on technical fixes.
- **Justice is not an add-on to urban adaptation; it determines outcomes.** How cities allocate resources, regulate land, and include or exclude residents will decide whether adaptation reduces vulnerability or entrenches it. There can be no climate justice without urban justice.

23 United Nations Environment Programme (UNEP). (2022). Global environment outlook – GEO-6: Summary for policy-makers.

What Future-Ready Urban Adaptation Requires

Looking ahead, effective urban adaptation depends less on predicting specific hazards than on building core capabilities.

Cities must strengthen anticipatory governance, planning for cascading and interacting risks rather than single events. They must develop adaptive institutions that can respond to uncertainty, learn from experience, and adjust strategies as conditions change. Integrated land-use planning, water and energy management, housing policy, and public health systems are essential to managing resource pressures and reducing exposure.

Justice-oriented adaptation also requires recognition and inclusion, acknowledging informal settlements as integral parts of the city, securing access to land and services, and ensuring that adaptation investments do not displace or further marginalize at-risk populations. Decision-making power must shift toward those most affected by climate impacts, valuing local knowledge alongside technical expertise.

Data, Digital Tools, and Climate AI as Enablers

Digital technologies are increasingly important enablers of these capabilities. High-resolution satellite imagery, community mapping, mobile surveys, and real-time monitoring systems can make climate risk visible, particularly in data-poor environments. Real-time governance systems, such as early-warning networks, adaptive traffic and water management, and participatory reporting platforms, enable cities to adjust decisions as conditions change. When combined with participatory processes, they can support more transparent, accountable, and responsive governance.

However, data-driven adaptation is not inherently equitable. Without safeguards, digital tools can reinforce existing blind spots, rendering informal settlements invisible or privileging areas where data is easiest to collect. Technology must therefore be embedded within institutions that prioritize inclusion and community participation.

I2UD's Climate AI Project illustrates how artificial intelligence can support applied urban adaptation by integrating remote sensing, machine learning, and ground-level knowledge. The project enables:

- Rapid mapping of climate-vulnerable neighborhoods, even where official data is outdated or incomplete.
- Scenario modelling for flood exposure, landsslides, heat amplification, and land-use change.
- Decision-support tools that help planners target investments toward the highest-risk communities.
- Translation of complex climate data into accessible visuals that strengthen participatory processes.

Climate AI strengthens the institutional capacity pillar of the I2UD framework, providing cities with a practical way to integrate science, local knowledge, and real-time governance. When combined with participatory methods, AI can democratize information, supporting communities in challenging inequitable policies, advocating for services, and co-shaping adaptation priorities.

Intergenerational Stakes and the Role of Youth

Urban adaptation is inherently intergenerational. Decisions made today about land use, infrastructure, housing, and services will shape risk for decades. Yet children and youth, particularly those living in informal settlements, are already experiencing climate impacts through heat-exposed housing, flood-prone neighborhoods, polluted air, and unreliable basic services.

Ensuring intergenerational equity means recognizing young people as present stakeholders, not future beneficiaries. Youth contribute to community-based adaptation through data collection, environmental monitoring, caregiving, and local organizing, yet remain underrepresented in formal decision-making. Excluding their perspectives risks locking in long-term vulnerability and undermining the legitimacy and effectiveness of adaptation strategies.

Global Evidence, Local Imperatives

The forthcoming IPCC Special Report on Climate Change and Cities reflects and reinforces these realities. It is expected to frame cities as engines of climate-resilient development, where adaptation and mitigation must be integrated into everyday urban systems, land management, housing, infrastructure, mobility, and social policy. The report is anticipated to emphasize that climate risk is cascading and compounding, and that transformational, justice-centered adaptation is now required.

Crucially, it will also underline that cities cannot adapt alone. Supportive national frameworks, fiscal decentralization, and sustained access to climate finance are essential to translating global commitments into local action.

Continuing the Work: Learning from Practice

Urban adaptation is not a fixed blueprint but an ongoing process of learning, adjustment, and collaboration. The I2UD Digital Library provides a resource for continuing this work, offering decades of practice-based research, case studies, and tools grounded in the realities of cities in the Global South. These materials demonstrate that many of today's challenges, informality, environmental health, governance constraints, and inequality, have long shaped urban risk, even before they were framed as climate issues.

By engaging with this body of knowledge, practitioners, students, and policymakers can deepen their understanding of how cities have navigated complexity, experimented with solutions, and learned from both successes and failures. In an era of climate overshoot and accelerating urban risk, such grounded, context-specific learning is essential. The future of cities will depend not only on new technologies or global agreements, but on the ability to learn from practice and apply that knowledge in ways that protect lives, rights, and futures.

ANNEX 1 CHRONOLOGICAL LIST OF I2UD RESOURCES ON URBAN CLIMATE ADAPTATION

Below is a complete list of I2UD projects, publications, and research related to urban climate adaptation:

Year	Title	Project Type	Funder/ Sponsor	Countries	Overview	So What?
1989	Environmental Health Factors in Housing	Research and policy discussion	World Health Organization; Ford Foundation	Global	Early study on the relationship between public health, environmental conditions and housing typologies in informal settlements.	While the study does not directly discuss climate change, it delves into the interrelationships among health indicators, housing and environmental conditions in informal settlements. It investigates and provides recommendations on housing design criteria in relation to air pollution, local environmental hazards, etc that are relevant for low-income settlements and their social and economic conditions.
2001	Indicators of Performance for Local Development," Case Study on the LITMUS Programme of Southwark, London	Research and policy discussion	Center for Urban Development Studies at the Harvard Graduate School of Design	England; United Kingdom	Case study analyzing the Local Indicators to Monitor Urban Sustainability (LITMUS) program developed by the London Borough of Southwark in low-income estates in Peckham and Aylesbury Estate. LITMUS was developed as tool for assessing the needs of an area, the indicators are used to create tools that help modify action to make communities more sustainable.	The study examines how local communities (particularly low-income ones) participate in defining and using sustainability indicators. It focuses on the process: how inclusive participation enables community members to identify and monitor dimensions of local development (social, economic, environmental) that matter to them. The study also discusses challenges: data availability, capacity of community groups to sustain measurement, the risk that community-generated indicators may be ignored by formal decision-makers, and the need for linkage between community monitoring and formal governance.

Year	Title	Project Type	Funder/ Sponsor	Countries	Overview	So What?
2009	Climate Change in the Local Development Agenda: Promoting Resilience Through Enhanced Understanding of Early Threats	Research and policy discussion	5th World Bank Urban Research Symposium, June 2009, Marseilles, France	Egypt; Benin	Report for the Fifth World Bank Urban Research Symposium, analyzing the threats posed by climate change — due to flooding, extreme weather events, pollution, and coastal erosion — using example studies from Alexandria, Egypt and Cotonou, Benin.	The study shows that while climate change is well understood globally, cities—especially fast-growing, low-resource port cities—still lack the local data, financing, technical capacity, and clear guidance needed to act. It underscores that effective urban adaptation depends on understanding highly localized impacts, with risks like sea-level rise, erosion, and flooding varying sharply across neighborhoods. Vulnerability is unevenly distributed, and informal settlements face the greatest exposure due to their locations, limited services, and weak infrastructure.
2012	Climate Change Adaptation and Resiliency Framework," Development Strategy for Cartagena, Colombia and Condega, Nicaragua	Research and policy discussion	Lincoln Institute of Land Policy	Colombia; Nicaragua	Research report that documents and evaluates the strategies adopted by the cities of Condega, Nicaragua and Cartagena, Colombia to reduce climate change related risks in informal and low-income settlements and assesses remaining sources of risk.	The report argues that cities, especially those with large informal settlements, must shift from reactive, emergency-driven responses to a proactive, strategic approach that integrates climate adaptation with urban planning, land management, and inclusive development. It presents a framework showing that climate risk arises from exposure, vulnerability, and limited institutional capacity, all of which must be addressed simultaneously. This research led to the creation of I2UD's Climate Change Adaptation and Resiliency Framework.

Year	Title	Project Type	Funder/ Sponsor	Countries	Overview	So What?
2013	Strategic Land Use Planning for Climate Change-Driven Water Shortages in El Alto, Bolivia	Research and policy discussion	Lincoln Institute of Land Policy	Bolivia	Research report that examines how the high-altitude city of El Alto (Bolivia) faces water shortages driven by climate change—declining glacier melt, shrinking watersheds, rapid urban growth—and explores how land use planning and growth management can strengthen urban resilience.	The study shows that managing growth and land-use patterns is as important as water infrastructure: adaptation must integrate spatial planning, institutional capacity and drought resilience to protect vulnerable populations in expanding cities. The study used land use scenarios and projected their impacts on water demands to guide the analysis.
2012-2014	Belize Municipal Development Plan	Technical Assistance Project: Review and Recommendations	Belize Social Investment Fund; World Bank	Belize	Technical assistance project supporting Belize's decentralization and rapid urbanization efforts by helping seven municipal governments develop Municipal Development Plans (MDPs) as tools for local economic development, revenue generation, and disaster-risk reduction. I2UD strengthened the capacity of Local Planning Working Groups through targeted training, planning strategy development, and technical guidance to address gaps in municipal planning skills.	Belize's MDP process helped municipalities integrate environmental and climate risks into growth decisions—especially where to accommodate new development, how to manage infrastructure demand, and how to reduce exposure for vulnerable neighborhoods. By establishing Local Planning Working Groups and building their technical capacity, the project demonstrated how inclusive, interdisciplinary planning structures enable municipalities to mainstream climate considerations even when starting with very limited planning capacity.

Year	Title	Project Type	Funder/ Sponsor	Countries	Overview	So What?
2014	National Urban Policies in Arab States	Research and policy discussion	UN Habitat (Regional and Metropolitan Planning Unit, Urban Planning and Design Branch)	Egypt; Morocco; Sudan; Jordan; Saudi Arabia	Regional assessment report of National Urban Policies (NUPs) in Arab States analysis included in-depth case studies of Egypt, Jordan, Morocco, Saudi Arabia, and Sudan. Prepared in preparation for Habitat III conference.	The case studies and regional level analysis included an assessment on the impacts of climate change on cities and the inclusion of climate resiliency in the NUPs. Overall, in the MENA region and more broadly it was found that climate change adaptation and resilience policies were still rarely integrated into urban policies but are rather dealt with through sectoral strategies of specialized central bodies or are considered in specific development programs.
2014-2018	National Urban Strategy for Governorates in Iraq	Spatial planning and strategies	UN Habitat; Local Area Development Programme (LADP-EU);	Iraq	Development of a National Urban Strategy for Iraq focused on urban systems, development trends, and building local capacities to manage at the national and governorate level.	The development of the plan mainstreamed ecological and climate change considerations into the process at both the national and governorate levels. For urban climate adaptation, this means governorates cannot focus solely on infrastructure repair—they must integrate climate risk, protect natural resources, and manage land and water conflicts to build long-term resilience. The brief underscores that proactive, participatory, and cross-sector planning is essential to safeguard vulnerable communities and steer urban growth toward sustainability.

Year	Title	Project Type	Funder/ Sponsor	Countries	Overview	So What?
2015	Arusha City Resilience Index Pilot Program	Technical Assistance Project: Review and Recommendations	USAID Regional Housing and Urban Development Office	Tanzania	Piloting of the Rockefeller foundation's City Resilience Index (CRI) in Arusha Tanzania with a task force of local authorities to assess the indicators and data collection process and provided recommendations for improving the Index. Arusha was one of five cities selected for piloting the index.	Arusha was selected to represent lower capacity and data poor cities in the Global South. While the local authorities were very supportive and engaged with the process, there was significant mismatch of the availability of data and local government capacity to complete the index process, highlighting that the index had been created primarily for Global North context.
2015	Assessing Alternative Resiliency Strategies in Under-Resourced Coastal Communities in Belize Impacted by Climate Change and Vulnerable to Environmental Risk	Research and policy discussion	Lincoln Institute of Land Policy	Belize	Research assessing climate resilience strategies for Dangriga, Belize, a low-lying coastal municipality vulnerable to sea-level rise, flooding, and severe storms. The study compares grey and green infrastructure approaches while evaluating whether land value capture and other land-based financing tools could support implementation in a low-capacity municipal context.	The report's findings suggest green infrastructure offers a more flexible and cost-effective pathway for resilience, but financing remains constrained by weak land governance and institutional capacity. Land value capture shows promise, yet without stronger planning systems and municipal authority, resilience investments risk being impractical or inequitable, highlighting the need for integrated land-use planning and incremental, community-supported approaches.

Year	Title	Project Type	Funder/ Sponsor	Countries	Overview	So What?
2015	Financing Urban Climate Adaptation through Land Value Capture in Latin America and the Caribbean	Research and policy discussion	Lincoln Institute of Land Policy	Latin America and the Caribbean	This paper examines how land value capture (LVC)—a widely used land policy tool in Latin America—could be leveraged to finance urban climate adaptation, addressing a major gap between rising adaptation costs and limited public funding. While LVC has successfully funded infrastructure and urban development, its application to climate resilience remains largely untested and requires further research and institutional capacity.	Urban adaptation is less constrained by technical solutions than by financing; this paper shows that cities could capture the value they generate through urban growth to fund resilience. However, doing so requires stronger governance, integration of climate risk into land systems, and safeguards to ensure these mechanisms do not reinforce inequality.
2015-2016	Planning for Climate Adaptation Program" for Four Dominican Republic Municipalities	Technical Assistance Project: Review and Recommendations	Santo Domingo National District, Santiago, San Pedro de Macoris and Las Terrenas; International City/County Management Association (ICMA);	Dominican Republic	The USAID funded Urban Resilience Climate Change project focused on mainstreaming climate change into land use planning processes in four cities and developing models that can be sustained locally and replicated throughout the Dominican Republic. The I2UD team advised on methods of and developed case studies on increasing community participation in land use planning and climate change adaptation.	I2UD's work provided relevant case studies and best practices for embedding climate considerations directly into land-use planning and creating structured ways for communities to participate in identifying risks and shaping planning decisions. Training materials emphasized participatory tools such as utilizing trusted local intermediaries, culturally grounded engagement, and community-led processes that center household realities. This approach generates more accurate vulnerability insights, builds long-term trust, and ensures adaptation priorities genuinely reflect and influence citywide planning.

Year	Title	Project Type	Funder/ Sponsor	Countries	Overview	So What?
2015-2016	Habitat III Regional Report for the Arab Region	Research and policy discussion	United Nations Economic and Social Commission for Western Asia (ESCWA); UN-Habitat Regional Office for Arab States (ROAS);	MENA region	Background regional report for the development the New Urban Agenda from Habitat III conference. This was one of 5 regional reports commissioned by UN-Habitat in the preparation for Habitat III. The report analyzed key urbanization trends and dynamics in the region since the Habitat II conference, key topics covered include land, housing, conflict and migration, informality, economic development, social equity, governance, climate change and sustainability.	The report underscores that climate change is not a separate environmental issue but a defining urban challenge in the Arab region, where water scarcity, energy stress, and rising climate risks directly shape urban growth, governance, and social stability. It shows that without systemic action—improving water and energy efficiency, strengthening pollution control, and investing in green, resilient infrastructure—cities will face escalating inequality, unrest, and declining livability.
2016	Urban Resiliency & the Challenge of Coordinating Climate Adaptation Strategies at Different Scales	Education, training, case studies	Zofnass Program for Sustainable Infrastructure; Harvard University Graduate School of Design	Tanzania; Colombia	Presentation given by Dr. Mona Serageldin as part of a workshop organized by the Zofnass Program for Sustainable Infrastructure under the Harvard University Graduate School of Design. The presentation highlighted I2UD's climate adaptation framework, emphasizing the need to prioritize strategic, well-targeted infrastructure investments in resource-constrained cities, drawing on examples from Cartagena, Colombia, and Arusha, Tanzania.	This presentation argues that in Global South cities, infrastructure is the critical entry point for building urban resilience and integrating climate adaptation into urban growth. it highlights how targeted, layered infrastructure investments can shape land use, protect vulnerable environments, and support economic opportunity—even under severe financial constraints. It emphasizes that understanding the link between sustainability and resilience is essential for advancing the SDGs and Habitat III goals.

Year	Title	Project Type	Funder/ Sponsor	Countries	Overview	So What?
2016-2019	Exploring the Use of Land Value Capture Instruments for Green Resilient Infrastructure Benefits	Education, training, case studies	Lincoln Institute publications	Colombia	Research paper that explores how land value capture can finance green resilient infrastructure (GRI) in rapidly urbanizing, climate-vulnerable cities, using a flood-mitigation river project in Santiago de Cali, Colombia as a case study.	This research provides evidence that green resilient infrastructure (GRI) can measurably increase land values—even in flood-prone, low-income urban areas—creating a real financial basis for climate adaptation. By showing that most of the land value uplift comes from green amenities rather than flood control alone, it demonstrates that well-designed GRI can both reduce climate risk and generate revenue that cities could recapture to fund resilience. However, without stronger institutional capacity and safeguards against displacement, land value capture for climate adaptation risks reinforcing inequality rather than financing equitable resilience.

ANNEX 2 ADDITIONAL RESOURCES

KEY ORGANIZATIONS AND GLOBAL PLATFORMS

1. C40 Cities
2. The Global Covenant of Mayors (GCoM)
3. ICLEI – Local Governments for Sustainability
4. Intergovernmental Panel on Climate Change (IPCC)
5. International Institute for Environmental Development (IIED)
6. Global Center on Adaptation (GCA)
7. Urban Climate Change Research Network (UCCRN)
8. UN Environment Programme (UNEP)
9. UN-Habitat
10. United Nations Framework Convention on Climate Change (UNFCCC)
11. Rockefeller Foundation: 100 Resilient Cities
12. World Resources Institute

MAJOR GLOBAL REPORTS

1. Cities Alliance: Climate Finance for the Urban Poor: A Review Of Global Climate Funds (2024)
2. Cities4Children: Children, Climate and Slums: Risks, Realities and Resilience in Action (2025)
3. ICLEI: Resilient Cities, Thriving Cities: The Evolution of Urban Resilience (2019)
4. IPCC: Special Report on Climate Change and Cities: Forthcoming
5. IPCC: Sixth Assessment Report (AR6) (2023)
6. UCCRN, C40, GCoM, and Acclimatise. The Future We Don't Want: How Climate Change Could Impact the World's Greatest Cities (2018)
7. UNEP: Adaptation Gap Report 2025 (2025)
8. UNEP: Smart, Sustainable and Resilient cities: the Power of Nature-based Solutions (2021)
9. UN-Habitat: World Cities Report 2024: Cities and Climate Action (2024)
10. UN-Habitat: RISE UP in action: Global progress and priorities for locally led urban climate resilience (2025)

ANNEX 3 DISCUSSION QUESTIONS

The following discussion questions explore the diverse challenges and complexities of urban climate adaptation and resilience. They are designed to support critical reflection on key themes—including risk, equity, governance, planning approaches, and emerging practices—while encouraging readers to connect global ideas to local contexts. These questions can be adapted for different audiences and learning environments to foster informed dialogue and deeper engagement with the material.

1. What do adaptation, mitigation, and resilience mean for cities, and how are they different from one another?
2. If you mapped climate risk in your city today, which neighborhoods would be most vulnerable, and what factors would explain this pattern?
3. What social, economic, and spatial conditions make certain neighborhoods more vulnerable to climate impacts than others?
4. How do exposure, sensitivity, and adaptive capacity interact to shape climate vulnerability? Can you think of situations where one factor plays a larger role than the others?
5. How do governance systems and decision-making processes influence a city's ability to prepare for and respond to climate risks?
6. Which groups in your city are most at risk from climate impacts, and why? How does this compare to trends seen in cities globally?
7. Why are informal settlements often among the most climate-exposed areas, and what does this reveal about planning and service provision in cities?
8. How can climate adaptation efforts unintentionally cause displacement or exclusion, and how can cities prevent these outcomes?
9. How can climate adaptation be integrated into everyday urban systems—such as housing, infrastructure, and governance—rather than treated as a separate technical issue?
10. How should cities plan for climate change when future risks are uncertain and past patterns no longer predict what will happen next?
11. What are compound risks (when multiple events occur at once) and cascading risks (when one event triggers others)? Can you provide examples, and explain why they make planning more difficult?
12. How have global views on cities and climate change evolved, and what lessons from earlier planning approaches remain relevant today?
13. What role can technology play in helping cities adapt to climate change? Identify examples of technologies that could support adaptation and discuss both their potential benefits and their limitations.
14. How can cities move beyond short-term climate responses toward lasting, equitable change that addresses the root causes of vulnerability? What shifts in leadership, planning, or governance would this require?

Have these questions been useful in your classroom discussions? We would like to know!
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