Descriptive synthesis of IDRC's support to Climate Change research

BUILT ENVIRONMENT: URBAN AND PERI-URBAN AREAS

2005-2017

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BACKGROUND

The world's population is becoming increasingly urban and the proportion of people living in urban centres is expected to increase, reaching 66 per cent by 2050 (UNDESA, 2014[1]). In cities of low- and middle-income countries, this is compounded by other challenges such as poverty, water contamination and the lack of basic urban infrastructure and services. Climate change exacerbates these challenges, putting millions of urban dwellers at risk.

By and large, the climate hazards that most commonly affect urban areas are floods, water shortage, groundwater salinization, severe storms and, in the case of coastal cities, storm surges. All of these hazards have a direct impact on human health. Increasingly, heat waves and air pollution pose additional challenges. The management of water supplies and wastewater is also closely linked to liquid and solid waste management and is an ongoing challenge in developing urban areas. The heterogeneous spatial distribution of these factors contributes to social inequality and insecurity. Making cities inclusive, safe, resilient and sustainable is a priority identified in Sustainable Development Goal 11. The urban and peri-urban environments – the latter defined as the transition from rural to urban areas[2] – have been the focus of IDRC-funded research for several years. Sustainable governance of built environments is one of the most important current development challenges. With the climate change-related risks now faced by communities in urban and peri-urban areas, the built environment has become a significant focus for IDRC's climate change research.

Over the past decade, IDRC has supported more than 40 research projects focusing on urban and peri-urban areas in 42 countries, using different approaches and conceptual frameworks to analyse and identify solutions for adapting to the impacts of climate change. These projects are and have been included in several multi-year research programs, with a total investment of about CA$34.5 million. The Urban Poverty and Environment program (2005-2010), working from a Disaster Risk Reduction framework, supported action-oriented research projects toward reducing vulnerabilities to extreme events in the poor neighbourhoods of a selected group of cities (Moreno, Argentina; Cochabamba, Bolivia; Lima, Peru; Ariana-Soukra, Tunis; Colombo, Sri Lanka; Jakarta, Indonesia; Dakar, Senegal; and Kampala, Uganda).[3] The Climate Change Adaptation in Africa (CCAA) program (2006-2012) sought to build a broad base of African expertise on climate adaptation. It aimed to lower the vulnerability of the continent to climate-related changes by involving communities directly, to better inform policy with high-quality research, and to strengthen African scientists, decision-makers and organizations in their work on adaptation. A significant fraction of CCAA projects focused on the urban and peri-urban environment. The Climate Change and Water program (CCW) (2010-2015) supported research that improved adaptation efforts to water-related impacts of climate change at the policy level and in practice. One of the priority areas of the CCW program was supporting research on urban and peri-urban water and sanitation, with a focus on improving the delivery of such services and the management of water resources to improve lives and livelihoods. Efforts have also targeted

[1] United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352).
[2] Narain, V. 2010. 'Periurban water security in a context of urbanization and climate change: A review of concepts and relationships', Peri Urban Water Security Discussion Paper Series, Paper No. 1, SaciWATERs.
[3] 103554, 104395, 104396, 104397, 103794, 103795, 103796, 103801

coastal megacities,[4] which are already among the most affected by climate variability, being subject to frequent events of coastal inundation and wind damage.

More recently, the Collaborative Adaptation Initiative in Africa and Asia (CARIAA) consortium (2012-2019) has supported collaborative research that tackles climate change adaptation and resilience in hot spots in Africa and Asia – deltas, semi-arid lands, and glacier- and snowpack-dependent river basins – in order to better inform on adaptation policy and practice. Research produced thus far on urban and peri-urban areas has tackled heat stress within urban centres in South Asia, studying its impact on inhabitants and finding adaptation solutions, such as designated green spaces, in order to alleviate the effects. Research has also uncovered deep links between vulnerability environmental change and migratory processes towards urbanized areas, examining the conditions under which human mobility contributes to changes and transfer of vulnerability at the rural-urban interface.

The current Climate Change Program (2015-2020) has a specific line of work that supports research to help cities increase their resilience to the impacts of climate change through demand-driven and policy-relevant research. This work is expected to improve the capacity of cities to prepare for, respond to, and recover from climate change-related hazards, paying specific attention to gender inclusion and equity. Urban resilience will increase through improving the evidence base to inform urban adaptation plans and exploring new public and private investment approaches for climate-resilient infrastructure.

Since April 2015, the Climate Change Program has supported 10 new research projects in 19 countries across the globe, together focusing on 40 cities.[5] The projects are geographically distributed as follows: five projects in Asia (15 cities); three projects in Latin American countries (20 cities) and two projects in Africa (five cities). Table 1 (annex) provides the names of the cities and countries targeted by the current active projects.

In general terms, the research work can be organized into four general (though not exclusive) themes:

1. IMPROVING BASIC URBAN SERVICES IN THE CONTEXT OF CLIMATE CHANGE

The delivery of basic urban services (mainly clean water, sanitation and solid waste services) has been a major focus area, with 27 projects addressing this development challenge through an investment of CA$19.7 million in 24 countries.

Water

Water availability and quality have been considerably reduced by extensive urbanization, conflicting demands for water use, increased variability in water access and saline intrusion, and lowered water quality due to increased contamination during floods. The latter three are direct effects of climate change. Research has aimed to identify methods that can enhance water availability and quality. Both issues are considered to be among the most important facing urban communities and are critically linked to the achievement of SDG 6. Twenty out of the 44 projects focusing on urban and peri-urban areas addressed water challenges from a variety of approaches. These projects generated new knowledge to better understand the complex links between urbanization and water in the face of climate variability. Detailed and accurate new information was made available through multidisciplinary, participatory and innovative methods and

[4] 106372-001 (https://www.idrc.ca/en/project/managing-climate-change-coastal-megacities)
[5] See updated report on cities work: CITIES - input for CC for report to BOG updated Jan 2018

technologies. These included remote sensing, modelling and the creation of new information sharing platforms, among others. For instance, in regard to water availability and quality, one project looked at strengthening community-based water supply organizations in Central America. These organisations are generally small, nimble and able to respond to priority needs more effectively than larger utilities. The project created a free access web portal that provides data, information and tools to visualize climate scenarios and climate change impacts on the hydrology of whole Central America region: http://mesomapps.info/.[6] Additionally, in the framework of an initiative that looked into the water security dimension in Central America, key climate change stressors and seasonable vulnerability of water resources were identified in urban areas.[7]

Having improved the understanding of complex water-urbanization relationships, these projects also provided tools to enable increased responsiveness in water governance. Specific tools include strategic agendas for adaptation,[8] a framework guiding urban environmental planning to engage the local community with local governments[9] and a Social Life Cycle Assessment which enables municipal policy makers to measure socio-environmental impacts of climate change when evaluating infrastructure investments in water and sanitation.[10] This last item was provided as part of an initiative that integrated social sciences into the engineering field. It is used to assess different technologies for wastewater treatment plants and how they relate to lowering GHG emissions. Wastewater treatment plants from cities in Brazil, Chile, Colombia, Honduras and Mexico were part of the comparative study.[11] Another project, focused on collaborative governance of risk in informal settlements in Cape Town, South Africa,[12] examined the use of Participatory-GIS to map, discuss and collectively act on areas of particular vulnerability to flooding and solicit more coordinated intervention by various city departments.

In addition to these tools, projects helped to put in place concrete solutions for climate adaptive water management. For instance, improvements in water quality, namely a decrease in coliform levels, were recorded in Tripoli, Lebanon, due to new water storage tanks installed in ten pilot buildings.[13] In addition, pilot test city-specific climate adaptive water management strategies are being developed in four South Asian cities[14] where many local governments have not yet been able to address urban climate challenges. Several adaptation strategies were developed to address groundwater salinization issues in the Eastern Mediterranean region.[15] These strategies were developed at different levels, from specific tools to address water stress in urban areas (i.e., water tanker and reverse osmosis units at the household level) to distinct governance systems (i.e., a conceptual decision support system (DSS) for adaptation). In particular, the latter has provided an innovative means of assessing and prioritizing adaptation measures based on expected changes to salt water intrusion and water demand, as well as on desired outcomes for adaptation.

[6] 107083: Adapting Community-Based Water Supply in Central America to a Changing Climate
[7] 107084: Water Security and Climate Change in Central America and the Caribbean
[8] 105869: Managing Water in the Rural-Urban Interface : the Key to Climate Change Resilient Cities
[9] 104899: Improvement of Water and Sanitation Services : a Comparative Analysis of Tripoli (Lebanon) and Irbid (Jordan)
[10] 105707: Adapting to Climate Change by making better use of Bioenergy Resources (Latin America and the Caribbean)
[11] 105707: Adapting to Climate Change by making better use of Bioenergy Resources (Latin America and the Caribbean)
[12] 105674: Managing the Risk of Flooding and Sea-level Rise in Cape Town : the Power of Collective Governance
[13] 104899: Improvement of Water and Sanitation Services : a Comparative Analysis of Tripoli (Lebanon) and Irbid (Jordan)
[14] 108212: Climate Adaptive Water Management Plans for Cities in South Asia
[15] 106706: Climate Change and Saltwater Intrusion along the Eastern Mediterranean: Socioeconomic Vulnerability

Finally, using case studies in Burkina Faso and Pakistan, it has been demonstrated that, as part of an integrated water management system, adaptable and complementary water storage options (large and small reservoirs and aquifers) create economies and societies with a high responsiveness to local water demands.[16]

Solid waste management

Waste management generates carbon dioxide and methane, both of which are greenhouse gases. The adequate treatment and disposal of urban solid waste has a direct influence on the reduction of emissions of these greenhouse gases. Current waste management methods, specifically emissions from landfills, account for almost five per cent of total global greenhouse gas emissions and 12 per cent of the world's emissions of methane (CO_4), a greenhouse gas with an impact more than 20 times that of carbon dioxide (CO_2).[17]

Sustainable waste management includes issues of sustainability, the reduction of waste that ends up in landfills and adequate technologies for waste treatment facilities, all measures that reduce greenhouse gas emissions and mitigate climate change.

Multiple cases of inadequate waste management have led to serious health risks for surrounding communities due to air, land and water contamination. This is a concern for many urban centres, such as Cochabamba, Bolivia, where findings were used to inform an evidence-based integrated municipal solid waste management plan.[18] The plan has helped to enhance the livelihoods of communities that depend on scavenging in the area. Moreover, landfill greenhouse gas emissions from solid waste contribute to climate change. Consequently, research has aimed to develop integrated waste management solutions in urban centres. In collaboration with three NGOs and other donors, one project looked at the carbon market and integrated waste solutions in Indonesia. These research activities resulted in the Indonesian Ministry of Public Works opening 90 new material recovery facilities in 27 provinces.[19] To measure the contributions of solid waste management to climate resilience, another research project looked at the economic analysis of solid waste management and drainage as a means to improve climate resilience in two South Asian cities in Nepal and Bangladesh.[20]

2. BUILDING RESILIENCIES

Resilient cities have the capacity to prepare for, absorb and recover from climate-related natural phenomena and have the ability to address socio-economic challenges. Helping to increase urban resilience has been an important area of work. Through an investment of about CA$17.7 million in 24 countries, 23 projects have addressed the linkages between socio-economic vulnerabilities, risk and strategies to increase city resilience.

Through effective risk preparedness

[16] 107643: Pathways to Resilience in Semi-Arid Economies
[17] https://wastewise.be/2013/08/solid-waste-management-and-climate-change/#.WnMAHvmnGpp
[18] 104395: Focus Cities : Urban Waste Management in the City of Cochabamba (Bolivia)
[19] 105813: Carbon Market and Integrated Waste Solutions : a Case Study of Indonesia
[20] 108382: Economic analysis of solid waste management and drainage for climate resilient cities in South Asia

Increasing understanding of the impacts of climate-related threats to urban communities, such as flooding and excessive heat, has been an important area of research. Flooding, in particular, has been a recurrent and severe risk to urban populations. Several projects have explored how to minimize its impact on households in specific vulnerable cities. A project in the suburbs of Dakar looked at how to improve the flooding adaptation strategies of poor households and communities.[21] In Bangkok, research focused on improving the city's flood management master plan. The project investigated potential institutional arrangements, undertook economic analyses of adaptation options relevant to flood management, and analyzed policy options.[22] In Accra, a research project aimed to improve flood risk management by using evidence to develop an integrated climate smart flood management framework to support policymaking.[23] In Cape Town, rapid expansion has been taking place along the coastline and on inland areas prone to flooding and already vulnerable to climate change. Through individual and institutional capacity building and fostering of partnerships, research has helped to coordinate and strengthen responses to flooding and storm surges in the city.[24] Factors contributing to the flood vulnerability of populations were also better understood in Cotonou, Benin, where the various types of knowledge used in flood prevention and management were mapped and valorized through a participatory process. [25]

More recently, projects have been investigating heat stress cities and peri-urban areas. Heat waves are exacerbated by climate change and the urban heat island effect. One research project is aiming to improve the management of heat stress risks in India by supporting the development of heat stress action plans in Delhi, Bhubaneswar and Rajkot.[26] The work of the project "Five-City Network to pioneer climate change adaptation in sub-Saharan Africa" has also designed frameworks for managing flooding, heat stress and landslides. This has laid the groundwork for a local climate change adaptation strategy and action plan for Cape Town, Dar es Salaam, Maputo, Windhoek and Port Louis.[27] A more concrete product is the "Green Book" which selects locally appropriate adaptation options for small and medium-sized urban South African settlements, according to climate risk profiles.[28] Finally, work is currently being done in the Filipino coastal cities of Metro Manila, Iloilo and Naga to prepare disaster risk reduction and management plans. Called "Resilience 2022", this effort will increase the resilience of the most vulnerable populations in these cities to climate-related disaster risks.[29]

In the last few years, the Climate Resilient Cities (CRC) initiative in Latin America[30] has been promoting innovative solutions for the design and implementation of climate compatible development. This forward looking activity will ultimately improving the quality of life for the people most affected by climate change in the world's most urbanized region. The initiative provides a total of CA$1.5 million funding for the implementation of projects that explore how the rapid growth of small and medium-sized cities can be exploited to achieve climate-resilient and transforming urban development.

[21] 107026: Flooding in Dakar suburbs: towards adaptation by improving buildings, infrastructure and local governance
[22] 107094: Improving Flood Management Planning in Thailand
[23] 108262: Integrated Climate Smart Flood Management for Accra, Ghana
[24] 105674: Managing the Risk of Flooding and Sea-level Rise in Cape Town : the Power of Collective Governance
[25] 105815: Protecting the Urban Community of Cotonou from the effects of Climate Change (Bénin)
[26] 108453: Climate adaptive action plans to manage heat stress in Indian cities
[27] 105868: Five-City Network to Pioneer Climate Change Adaptation in sub-Saharan Africa
[28] 108230: Adapting South African Settlements to the Impacts of Climate Change
[29] 108688: Coastal cities at risk in the Philippines: Investing in climate and disaster resilience
[30] 108193: Resilient Cities Initiative on Climate Change in Latin America and the Caribbean

Through reducing the vulnerability of the urban poor

Vulnerability studies are an essential component of most city projects. Using an integrated and multidisciplinary approach, urban vulnerabilities were mapped considering both the biophysical and socio-economic dimensions of vulnerability. This was mapping was carried out with an understanding that the capacity of populations to adapt to the impacts of climate change depend on socio-economic factors.

Socio-economic factors must also be taken into account in order to reduce urban population vulnerabilities. Research has looked at how the impacts of climate change on water resources is affecting the vulnerability of populations. For instance, it was noted that in four South Asian cities in India, Nepal and Bangladesh, gender differentiated vulnerabilities intersect with caste and other relations of power. These divisions determine access to the resources, information and institutions that shape adaptation and adaptive capacity.[31] Socio-economic vulnerabilities were also tackled through the lens of sustainable urban planning, which addresses deep-rooted socio-economic stresses. In post-war Angola, an analytical framework aided in measuring the impact of poverty reduction strategies and contributed to the production of socio-economic profiles of several urban municipalities.[32] In the Left Bank of Rimac River, Peru, a strategic plan for the reduction of vulnerability was developed and led to a risk management approach that was adopted in the city of Lima's master plan.[33] As vulnerable populations often lack suitable housing, one project explored bamboo housing for the urban poor. It turned out that a large potential market exists for bamboo panels in Addis Ababa, where the Housing Authority recommends the use of bamboo for its low income urban buildings.[34] As these projects indicate, taking into account socio-economic vulnerability factors has helped in the design of more effective and equitable adaptation policies. A main outcome has therefore been informing municipal authorities and other key actors in the field about additional avenues for better coping with climate change.

Through leadership support

IDRC has contributed to increased urban resilience by supporting emerging leaders, especially researchers and graduate students, allowing them to build their individual capacities and work toward inclusive, climate resilient economic development. Global award programs such as Adaptation H_2O[35] contributed to strengthening the capacity of 16 graduate students (PhD and MSc) by deepening their knowledge and expertise in both theoretical and applied adaptation research. Grants supported their field work which resulted in peer-reviewed research (Nguimalet, 2018). Another example is the Ecopolis Graduate Research and Design competition[36], through which 27 post-graduate students were supported to conduct a mix of academic research and design projects[37] in fields such as architecture, environmental science and urban planning in 11 countries.[38] The project resulted in the publication of the book *Sustainable Cities: Local*

[31] 106248: Water Security in Periurban South Asia : Adapting to Climate Change and Urbanization
[32] 105673 and Cain, A. (2018). Informal water markets and community management in peri-urban Luanda, Angola. Water International, 43(2), 205-216.
[33] 104397: Focus Cities : Reducing the Vulnerability, Poverty and Environmental Load in Centretown Lima (Peru)
[34] 105191: Prefabricated Engineered Bamboo Housing for East Africa
[35] 106299: Cain, A. (2018). Informal water markets and community management in peri-urban Luanda, Angola. Water International, 43(2), 205-216.
[36] 103710: ECOPOLIS Graduate Research and Design Competition
[37] Highlights of research published in the Ecopolis book: Sustainable Cities: Local solutions in the Global South (Robertson 2011)
[38] Ethiopia, Senegal, Congo, Kenya, Botswana, Bangladesh, Thailand, Philippines, China, Argentina and Peru.

Solutions in the Global South.[39] Quality of research, teaching and learning in climate change science at the University of Ghana was improved through a capacity development project, generating knowledge on how poor urban coastal populations in the Ga Machie area adapt to climate change.[40] Likewise, a 48-month postgraduate diploma course has been established to develop leadership and multiple technical capacities among at least 75 young leaders in Latin American and Caribbean cities. The program combines theoretical and practical modules providing young leaders with practical knowledge and skills related to climate risk and urban management, accompanied by participatory planning and negotiation skills.[41] Another modality for supporting leaders consists of specific trainings offered to small-scale private water providers across 257 drinking water supply organizations in Costa Rica, Guatemala and Nicaragua. Participants benefited from training to improve management practices.[42]

The South Asian Water (SAWA)[43] project awarded 60 fellowships to master's students (48 women and 12 men) enrolled in Integrated Water Resources Management (IWRM) programs at one of four partner institutions in Bangladesh, India, Nepal and Sri Lanka. The project was structured in three cohorts focused on different themes: i) Food security and climate change (2013–2015 cohort); ii) Water security and climate change (2014–2016 cohort) and iii) Livelihood adaptation and climate change (2015–2017). The project sought to establish a gender balance in water-related research, the work place and policy in the region; hence 80 per cent of the total fellowships were awarded to women. The remainder was awarded to male students from socio-economically underprivileged backgrounds. In addition, the project provided training, mentoring and networking opportunities. It also supported the organization of three regional training workshops on interdisciplinary research methods and two review workshops where experts provided feedback to the students. These opportunities increased capacity among the fellows and supervisors in the host universities and created stronger linkages among participating institutions in research, teaching and learning in IWRM.

The new SAWA Leadership Program on Climate Change[44] will be awarding fellowships to 36 women enrolled in master's-level IWRM programs in Bangladesh, India, Nepal and Sri Lanka, providing these women with opportunities to access decision-making environments through internships. The program will have two main emphases, one being intensive training in the application of research methods that include gender and social approaches. The second is the development of leadership skills through activities such as team-building sessions, communication skills training, participation in negotiations and conflict resolution, and mentorship and networking opportunities.

3. PROMOTING DIALOGUE FOR FRUITFUL PARTNERSHIPS AND GOVERNANCE

In order to positively influence climate change decision-making and local adaptation plans, dialogue among key actors was further encouraged. Increased cooperation and knowledge sharing platforms allowed players to engage in joint efforts to reduce climate change impacts. A central component in most of the built environment projects has been to build on or reinforce a multi-stakeholder approach. A recent project on

[39] https://www.idrc.ca/en/book/sustainable-cities-local-solutions-global-south
[40] 106548: Climate Change Adaptation Research and Capacity Development in Ghana
[41] 108443: Building leadership for LAC cities in a changing climate
[42] 107083: Adapting Community-Based Water Supply in Central America to a Changing Climate
[43] 107240: IDRC - South Asian Water (SAWA) Fellowships
[44] 108441: South Asian Water (SAWA) Leadership Program on Climate Change

"Improved Municipal Planning in African CiTies (IMPACT) for a climate resilient future"[45] has been investigating what and how IMPACT mechanisms contribute to building climate resilience via inclusive municipal planning, action and collaboration between diverse sets of stakeholders. Teams have worked in partnership to test innovative solutions in the context of improving water, sanitation and solid waste services in Jakarta,[46] or to understand how different multi-stakeholder partnerships can be tailored to respond to the need for water and sanitation services in urban Latin America.[47] While these projects were focused not on climate change-related issues but on urban environmental issues in general, the results have helped to build the resilience of the communities living in these cities. The need to establish multi-stakeholder environmental governance models to address the risks and impacts of climate change on vulnerable coastal systems is a recurrent research topic in many projects. One example is an initiative in Colombia, in the bay of Cartagena, that promotes a governance model to engage the environmental authority, private sector actors, and small holders (mostly fishermen). The initiative empowers these stakeholders with science on water quality and mitigation strategies for reducing coastal pollution and associated impacts on human health and ecosystems.[48]

Another focus for collaboration has been the rural-urban interface. Rural-urban relationships are an important component in reinforcing cooperation because urban spaces are part of a bigger picture that points to significant rural-urban interdependencies. Several of the projects have specifically focused on exploring options to reinforce cooperation between cities and rural areas in order to better cope with climate change and variability. This is especially important in the case of enhancing water availability and quality where a multitude of actors are involved in water governance. In Burkina Faso, specific collaboration mechanisms were assessed.[49] Likewise, in India, Ghana and Ethiopia, IDRC projects have contributed to integrated rural-urban water management for climate, increasing cities' resilience and adaptation capacities.[50] One project in Aba, Nigeria, promoted the sharing of knowledge generated through a participatory adaptation experiment and demonstrated mechanisms for rural-urban interaction that can be adopted to increase the coping capacity.[51] Within the agriculture and food innovation systems, the project connected rural and urban communities in Tanzania and Malawi. Through individual and organizational capacity strengthening, the project facilitated adaptation to the challenges and opportunities arising from climate change.[52] Recent work in Solapur, Maharashtra State, Vijayawada and Andhra Pradesh in India will help establish platforms that bring together rural-urban and upstream-downstream stakeholders and enable information exchange, priority and needs sharing, and collaboration in planning for improved water management.[53]

4. Fostering Gender Equity in the Built Environment

[45] 108665: Improved municipal planning in African CiTies – IMPACT for a climate resilient future
[46] 103796: Focus Cities : Economic Incentives for Improving Water, Sanitation and Solid Waste Services in Jakarta (Indonesia)
[47] 105185: Multistakeholder Partnerships in the Water and Sanitation Sector within Urban Policies in Latin America and the Caribbean
[48] 107756: Reducing the Risk of Water Pollution in Vulnerable Coastal Communities of Cartagena, Colombia: Responding to Climate Change
[49] 104683: Rural Urban Cooperation on Water Management in the Context of Climate Change in Burkina Faso
[50] 108224, 105869
[51] 105839: Rural Urban Interaction to Cope with Climate Change (Nigeria)
[52] 105836: Urban-Rural Interdependence and the Impact of Climate Change in Malawi and Tanzania
[53] 108224: Integrated Rural-Urban Water Management for Climate Based Adaptation in Indian Cities (iAdapt)

Because women are often impacted differently by climate change in urban areas, examining gender is an important aspect of the work discussed above. While most projects have a gender component, 10 are specifically dedicated to gender related concerns. CA$8.7 million was invested in these projects. In the context of solid waste management, researchers examined the gender dimension in terms of income, social inequities, environmental improvements, and cultural factors in the cities of Latin America and the Caribbean. In these regions, the number of people living off solid waste is growing rapidly.[54] Likewise, a gender gap persists in water and sanitation. This was specifically addressed by a project that looked into women's rights and access to water and sanitation in cities in Asia. The initiative tested and adapted the safety audit methodology for meeting the water and sanitation needs of poor urban women and girls.[55] Addressing the role of gender in adaptation to extreme climate events, some projects had advanced knowledge on the capacity of local governments to design more effective and equitable adaptation plans. This work conducted in Southeast Asia[56] allowed researchers to offer guidance on how to integrate gender practices into climate resilient plans for five Latin American cities.[57] Women also occupy a key role in grassroots adaptation strategies. A recent project in five small and medium-sized cities in Latin America and the Caribbean is looking into how these strategies can be further integrated into public policy.[58]

CONCLUSION

IDRC's Climate Change program and its predecessors have supported more than 40 research projects on urban and peri-urban areas and invested more than CA$35 million to address climate change-related risks. These efforts have improved the adaptive capacity of the communities and institutions active in these areas. The supported research has provided solutions for improved access to basic urban services, better population and infrastructure resilience, and effective dialogues and partnerships. It has also supported gender equality and advanced grassroots and local government capacities to integrate gender dimensions in urban planning.

Although discussions on urban adaptive capacity in international spheres have evolved, several gaps remain, especially with regard to collaboration and cooperation within various contexts and frameworks to address urban resilience challenges. Future research in this field will aim to better align urban adaptation solutions with urban resilience building practices and planning. This synergy will be key in creating resilient, equitable and sustainable cities.

[54] 105183: Gender Dimension in Solid Waste Management in Urban and Periurban Areas (Latin America and the Caribbean)
[55] 105524: Women's Rights and Access to Water and Sanitation in Asian Cities
[56] 106960: Adapting to Climate Change in Peri-Urban Southeast Asia
[57] 108193: Resilient Cities Initiative on Climate Change in Latin America and the Caribbean
[58] 108501: Climate change adaptation in informal settings: Understanding and reinforcing bottom-up initiatives in Latin America and the Caribbean

Annex 1 – List of Cities in Climate Change Projects since 2015

Project #	City	Country
108212	Dharan	Nepal
	Dhulikhel	Nepal
	Haldwani	India
	Gurgaon	India
108224	Solapur	India
	Vijayawada	India
108262	Accra	Ghana
108382	Bharatpur	Nepal
	Kawasoti	Nepal
	Sylhet	Bangladesh
108193	Iquitos	Peru
	Santa Ana	El Salvador
	Santo Tomé	Argentina
	Dosquebradas	Colombia
	Puerto Iguazú	Argentina
	Foz de Iguacu	Brazil
	Ciudad del Este	Paraguay
	Tarapoto	Peru
	Coyuca	Mexico
	Abaetetuba	Pará (Brazil)
	Punta de Piedra	Pará (Brazil)
	Santana	Amapá (Brazil)
	Mazagon	Amapá (Brazil)
108213	La Villa	Panamá
	Chitre	Panamá
108453	Delhi	India
	Rajshahi	Bangladesh
	Hyderabad	Pakistan
108501	Yumbo	Colombia
	Salgar	Colombia
	Concepción	Chile
	Canaan	Haiti
	Villa Clara province	Cuba
108665	Blantyre	Malawi
	Lilongwe	Malawi
	Harare	Zimbabwe
	Bulawayo	Zimbabwe
108688	Metro Manila	Philippines
	Iloilo	Philippines
	Naga	Philippines