

CONTRIBUTIONS TO CLIMATE ACTION

14 years of adaptation research at IDRC



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Contents

2	Executive summary
7	1. Strengthening climate change adaptation in the Global South
	1.1 An evolving and growing research agenda
	1.2 The collective impact: action and increased capacity
	1.3 Towards a sustainable, resilient, and socially equitable world
12	2. IDRC approaches to adaptation research
	2.1 Investing directly in the Global South
	2.2 Beyond gender: Integrating social equity in climate change research
	2.3 From capacity building to leadership development
23	3. Impacts on the ground
	3.1 Cities and peri-urban areas
	3.2 Agriculture and rural livelihoods
33	4. Moving forward
36	Annex
37	References

Executive summary

The impacts of climate change — from droughts and desertification to storms and floods — are an urgent concern affecting every person on the planet. The climate crisis is real, it is here, and it is leaving marginalized people — disproportionately those living in poverty in the Global South — especially vulnerable.

As part of Canada’s international assistance effort, the International Development Research Centre (IDRC) supports research that builds evidence aimed at breaking cycles of poverty, inequity and vulnerability across the Global South.

IDRC’s investments in climate change research have evolved over the past decade, from smaller-scale, community-based adaptation research to broader regional and global adaptation initiatives. Since 2006, the Centre has managed over CA\$285 million in climate adaptation-related research funding.

Over this time, IDRC’s support for research on climate change adaptation in the Global South has increasingly focused on three major themes, namely:

1. Influencing policy and practice;
2. Ensuring impact at scale; and
3. Integrating gender and social equity considerations.

Enhancing Southern-led agendas, including through capacity-building and supporting research leadership by Southern institutions, has been fundamental to these efforts.

Recognizing that vulnerable populations face a rapidly changing world, the lessons from our work deeply inform our thinking and planning around future investments in climate adaptation research.

IDRC is committed to addressing the current gap in climate action by continuing to support research that helps the world move towards greater sustainability, resilience, and social equality. The Centre is doing so through on-the-ground efforts in both urban and rural contexts. We aim to continually reflect upon and learn from our project work, linking evidence-backed results to decision-making processes at different scales. These lessons and reflections are also helping to strengthen our programming to address the climate challenges of 2020 and beyond.

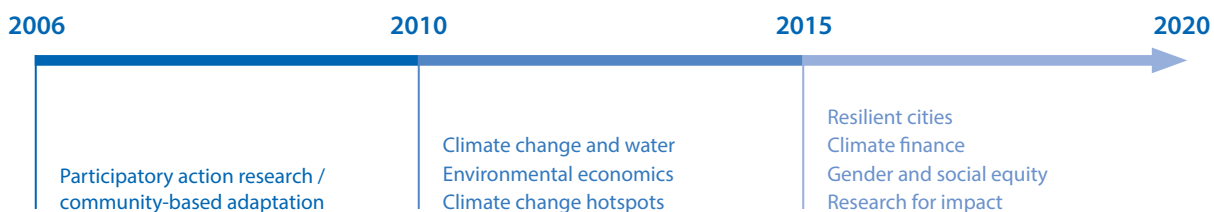
Approaches to adaptation

Through our investments, focused on vulnerable populations, we have garnered and cultivated valuable lessons and insights on how to fund research for impact.

In this report, we highlight four key lessons:

- the importance of direct research investment in the Global South;
- the need to move beyond seeing gender as a vulnerability;
- the value in recognizing multiple dimensions of social inequity; and
- the critical need for capacity building to develop climate leaders.

THE EVOLUTION OF IDRC’S CLIMATE CHANGE PROGRAMMING





Gender is one of many variables that shapes vulnerability to climate change.
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By **investing directly in researchers and institutions in the Global South**, IDRC-supported climate change adaptation projects have helped build a research field focused on improving the climate resilience of the most affected and vulnerable. We have learned that investing in research in the Global South is key to obtaining local, context-specific data to inform development solutions able to meet the needs of vulnerable communities. Other lessons include the following:

- Research led by, or closely engaged with, partners in the Global South can increase resilience for those vulnerable to climate change.
- Knowledge co-production involves collaboration among diverse actors and is necessary for filling existing knowledge gaps and building the relationships needed for climate action.
- Working across scales — from local to regional to international — can promote the uptake of research into policy and practice.

IDRC experience in adaptation research has led us to embrace **intersectional approaches to improve the adaptive capacities of vulnerable groups, including women**. Gender is an essential factor that influences vulnerabilities and adaptive capacities, but it is not the only one. We aim to evolve the understanding of gender as a crosscutting issue toward a more comprehensive understanding of vulnerability and adaptive capacities. Critical learnings in this area include:

- An intersectional framing can reveal nuances in how gender and other factors

intersect to shape vulnerability and influence people's responses to climate change.

- Achieving gender-transformative research and sustainable actions requires going beyond gender-disaggregated data and vulnerability assessments.
- Strengthening the agency of vulnerable groups, while considering the power and social relations that make groups and individuals vulnerable, is vital for social transformation.

IDRC's mandate has evolved beyond building capacity in the Global South to **developing Southern leadership**. Over the last ten years, we have significantly contributed to the Global South's climate research capacity by supporting the development of local climate change experts and leaders, especially women. A critical mass of climate leaders and networks in the Global South has resulted. Valuable lessons have emerged from our capacity-building and leadership-development work:

- Useful climate change research requires building individual and institutional capacities for understanding and communicating climate risk and for evidence-based decision-making.
- Developing leadership capacities, especially among women and people in underrepresented countries, is crucial to local, national and global adaptation efforts.
- Knowledge brokering requires capacity building that connects research, policy, and practice.



Water supply and heat stress are among the challenges facing urban populations.
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ABOUT THIS REPORT

This report presents the key contributions of IDRC to climate action over the past 14 years, highlighting lessons learned and their implications — not only for future programming, but for the research community at large.

The lessons, stories of impact, and examples of influence on policy and practice in this report are drawn primarily from two recent external evaluations of IDRC's climate change programming, undertaken in 2018 and 2019, respectively. Other supporting evidence is drawn from IDRC partners' final reports, peer-reviewed journal articles, briefs, stories, and other knowledge products.

Impacts on the ground

In addition to helping us learn and evolve our climate change programming, IDRC-supported research projects are helping communities across the globe confront climate change impacts. At the local level, IDRC-supported **research has informed some 250 innovative adaptation options** that are now being developed, tested, or scaled up. Research has also shaped policies and plans by informing the development of at least thirty-five national, sectoral, and municipal climate change adaptation or mitigation plans. IDRC-supported researchers have played critical roles in the incorporation of climate considerations into urban planning. This diverse programming has cumulatively enhanced the capacities of individuals and institutions in the Global South.

IDRC has invested roughly CA\$36 million in research involving more than a hundred urban and peri-urban areas in forty countries across Africa, Latin America and the Caribbean, the Middle East, and Asia, to develop and test innovative solutions for reducing climate change risks. Supported research has helped small- and medium-sized cities to strengthen their resilience to the impacts of climate change by identifying how climate change exacerbates urban development challenges: it has generated new knowledge and tested innovations to inform urban planning and policies. For example, IDRC-supported research has increased our understanding of climate-related risks to urban water supply and heat stress. We've also fostered opportunities for exchange between cities and at the global level, facilitating the application of lessons to other urban areas facing similar problems.



Bolivia's Illimani watershed, a vital source of water for local communities, is threatened by the receding glacier.
©AGUA SUSTENTABLE

Over the past decade, **IDRC has invested over CA\$54 million in climate change research in rural areas** in thirty-six countries in Africa, Asia, and South America. Our work has improved the lives and livelihoods of millions of people in the rural Global South. One way we have done so is by delivering innovative, evidence-based, gender-sensitive strategies for improving resilience, agricultural productivity, and food security; another is by reducing malnutrition and climate change-related risks.

IDRC enables the adaptation of coping strategies in the rural Global South by generating new knowledge and developing innovations that benefit local populations.

For instance, by improving the relevance, accuracy, and accessibility of agricultural and climate information, IDRC-supported research programs have helped many people, especially smallholder farmers, better understand climate risks and thus more effectively adapt to climate change. Supported research has improved rural livelihoods by increasing agricultural productivity, food security, and environmental, economic, and social sustainability.

On-the-ground research has further validated some key insights. Urban and rural experiences highlight **the importance of research that produces context-specific data and information**, which is integral to

OUR CONTRIBUTIONS TO CLIMATE CHANGE CAPACITY AND LEADERSHIP DEVELOPMENT

IDRC has supported nearly **200 institutions and 2000 researchers, including:**

700 

post-graduate students
(45% women)

131 

climate leaders
and negotiators
(42% women)

22 

contributors to IPCC
special reports and global
assessments (27% women)



Recurring droughts are a growing concern in semi-arid regions.
©AXEL FASSIO

understanding climate risks in these contexts. Doing so **enables evidence-based policies, planning, and decision-making**. Moreover, we recognize that **strengthening resilience requires the collaboration of diverse actors** and must engage women and other vulnerable groups. Such collaboration helps improve climate resilience while more broadly contributing to development.

Moving forward

By delivering innovative, evidence-based solutions, IDRC has improved the livelihoods and well-being of those in urban, peri-urban and rural areas, and helped vulnerable people anticipate and respond to climate impacts and extreme events. By working with like-minded partners in our programming, we have contributed to recent global climate change assessments and influenced global policy debates.

Current commitments by countries worldwide are insufficient to tackle global climate challenges, which demand innovative and integrated approaches, and simultaneous efforts in adaptation and mitigation. IDRC's 14 years of support for applied research on climate change, and the resulting lessons, provide a strong foundation upon which to build.

Moving forward, we will continue to support both Northern and Southern partners' efforts to generate knowledge and conduct studies and assessments that

inform the latest climate change science. Further, we will continue to invest in facilitating science-based decision-making and commitments to climate action.

If we are to achieve transformative action towards a resilient future, we believe the climate research community must prioritize:

- tackling climate change as a development challenge, with research-based evidence from the Global South;
- creating space for diverse voices and youth empowerment through capacity and leadership strengthening; and
- acting now, based on the existing knowledge that speaks to the urgency of climate change action, to close the gap between knowledge-holders and decision-makers at all scales.

Lastly, in a changing world, we believe it is important to revisit old ideas, including the assumed trade-offs between supporting researchers based in the Global South and North or the choice between investing in research or climate action. Implementing the Paris Agreement means changing the practice of conducting research. Climate research must be embedded into climate action and societies must simultaneously invest in, scale up and learn from their climate plans. IDRC will continue to invest directly in the Global South to propel the world toward action.

1. Strengthening climate change adaptation in the Global South

The impacts of climate change — from droughts and desertification to storms and floods — have become an urgent global concern with implications for every person on earth. The consequences of a warming planet leave the poor and marginalized particularly vulnerable. People and communities facing diminished water availability, food security, and livelihoods experience climate change not as a distant threat, but as an immediate problem. As sea levels rise, extreme weather events increase, and deserts encroach, adaptation has become essential to survival.

As part of Canada's international assistance efforts, the International Development Research Centre (IDRC) supports research that builds evidence to break cycles of poverty and reduce inequalities and vulnerabilities in the Global South. The Centre is a crucial funder supporting investments in knowledge, innovation, and solutions to improve the lives of people in the developing world.

Since 2006, IDRC has managed over CA\$285 million in programming on climate change adaptation research, including through partnerships with the Government of Canada, Canada's three leading research funding agencies (the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council (NSERC), and the Social Sciences and Humanities Research Council (SSHRC)), UK's Department for International Development (DFID), and the Ministry of Foreign Affairs of the Netherlands.

Supported researchers are influencing key international public policy debates. For example, more than 22 contributors (6 of them women) to the International Panel on Climate Change (IPCC) reports — including the Fifth and Sixth Assessment Reports and the Special Reports on Global Warming of 1.5 Degrees, the Ocean and Cryosphere, and Climate Change and Land — carried out Centre-supported research. Supported researchers in both anglophone and francophone African countries have joined a group of experts that informs the African Group of Negotiators, which engages in negotiations at the annual Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). Moreover, IDRC-supported research has helped inform over 35 adaptation and development policies and plans, from local to national scales, in more than 14 countries in Asia, Africa, and Latin America (See Annex).

SUMMARY OF OUR INVESTMENTS AND KEY OUTPUTS

Since 2006, IDRC has managed an investment of more than **CA\$285 million** in climate change adaptation research.

- Research has informed more than **35 adaptation and development plans and policies**.
 - More than **200 institutions and 2000 researchers** have been supported in over 80 countries.
 - Researchers have included more than **22 contributors to IPCC reports**.
 - Research partners have published more than **475 articles in peer-reviewed journals and 500 working papers and briefs**.
-

Over more than a decade, IDRC has strengthened the capacity of over 200 institutions involved in researching and testing adaptation solutions and strategies. These solutions have ranged from technological and infrastructure solutions, including heat- and flood-resilient housing and solar-powered irrigation pumps, to “softer” solutions like using social media to communicate flood risks, or extending insurance to farmers, fishers, and municipalities. The Centre has also supported more than 2,000 individual researchers from more than 80 countries across Africa, Asia, and Latin America and the Caribbean.

IDRC's programming approach has evolved significantly, often placing the Centre at the forefront of emerging issues in climate change research, such as uncovering barriers to private sector action or assessing adaptation progress in the context of the Paris Agreement's goals. This report highlights IDRC's unique contributions to climate change adaptation and resilience, its main learnings, examples of on-the-ground impact, and reflections on implications for future directions.



Flooding is a regular occurrence in deltas.
©SAIFUL ALAM

1.1 An evolving and growing research agenda

IDRC worked indirectly on climate-related issues in the early 2000s, through research on solutions addressing rural and urban poverty, natural resource management, and related environmental stressors in low-income communities of the Global South. Some of the solutions developed during this period, such as the restoration of degraded public spaces adjacent to local streams in cities, also helped communities adapt to climate change.

Learning-by-doing

With the joint launch of the Climate Change Adaptation in Africa research and capacity-building program in 2006, IDRC and DFID were among the first bilateral agencies to fund research specifically focused on climate change adaptation. The field of adaptation research has moved beyond earlier stages — focused on defining adaptation and building adaptive capacities — to addressing the implementation of successful adaptation approaches at a global scale.¹ Similarly, IDRC support shifted focus from capacity strengthening towards policy influence and practice, achieving impact at scale, and integrating gender and social equity dimensions into our work. Throughout this evolution, IDRC has maintained consistent support to Southern researchers and Southern-led agendas.

IDRC initially supported research concentrated on participatory action research and community-based adaptation, directly linking vulnerable communities and scientists in “learning-by-doing.” This stream of research first began in 2006, continuing through the

International Research Initiative on Adaptation to Climate Change (2009-2014), co-funded by IDRC, CIHR, NSERC, and SSHRC in 2009. The learning-by-doing approach enables all parties to be involved in testing both local and indigenous knowledge — what people already know and rely on — and new ideas, to create effective strategies and lasting solutions that are specific to local contexts. This work helped better equip local communities to adapt to environmental changes, supported by government policy.

Responding to climate threats

To face threats like increased flooding, waterborne diseases, and water scarcity, IDRC launched its Climate Change and Water program (2010-2015). The program focused not only on improving service delivery and water resource management, but also on strengthening policy and practice. Similarly, IDRC’s support to agriculture and food systems research increasingly considered climate risks and resilience, while work in cities enhanced climate resilience in small and medium-sized cities, through the Climate Change and Cities program (2015-2020) and the Climate Resilient Cities initiative in Latin America (2016-2019) jointly funded with the Climate and Development Knowledge Network (CDKN). In both rural and urban settings, IDRC supported innovation in information and communications technologies (ICTs) to support adaptation. For example, mobile phone and radio-based early warning systems designed by IDRC grantees in Benin, Brazil, Uganda, and the Philippines improved the resilience of nearly three million people to extreme climate events. Another example of ICT use features in Section 2.2, below.

Climate action

As per UNFCCC, climate action involves stepped-up efforts to reduce greenhouse gas emissions and strengthen both resilience and adaptive capacity to climate-induced impacts.²

Gender-transformative research

Gender-transformative research promotes women's empowerment and shared control of resources and decision-making. It breaks down and analyzes social inequality; provides space for women, men, and non-binary genders to learn; and engages with people across the socioeconomic spectrum to change — and challenge — the norms enabling inequality.³

Informing policy across scales

IDRC's investment in Southern-led, collaborative research also grew from the local scale to increasingly connect with national and international agendas. For example, researchers from Canada and the Global South jointly examined common climate-driven issues in their respective countries, such as the impact of rising sea levels on coastal megacities, the allocation of water resources, and the vulnerability of agricultural and indigenous communities to extreme weather events. IDRC also supported transdisciplinary research consortia to examine adaptation in regional climate change "hotspots" — places where high sensitivity to climate change coincides with large vulnerable populations. Along with these shifts in scale came an increasing emphasis on designing research for impact, which continues to inform IDRC programming.

From 2010 to 2015, the Centre supported regional environmental economics research networks in Africa, Asia, and Latin America that fostered and organized local scientific and technological expertise to accelerate policy uptake and environmental problem-solving. To have an impact at scale, these regional networks contributed to two areas: the use of environmental economics concepts such as environmental valuations in public decision-making processes, and the use of environmental economics in education, the media, and public discussion.

Pinpointing business models to support adaptation

Since 2015, IDRC has sought to accelerate climate finance investment, such as by investigating how the private sector can mobilize for adaptation finance. Research has explored new business models for

developing bankable adaptation projects, innovative climate finance instruments to remove barriers for investment in adaptation, and market solutions to reduce the impacts of climate change and contribute to a low-carbon economy.

Refining our focus on gender and social equity

Since 2018, through an initiative focusing on social equity and the empowerment of women and girls to accelerate climate action, IDRC is enabling on-the-ground changes that help women and other vulnerable groups to increase their climate resilience. Moving beyond vulnerability assessments and the collection of gender-disaggregated data, gender-transformative research addresses power structures and encourages leadership by women to enable social transformation. In line with Canada's Feminist International Assistance Policy, this body of work aims to empower the most vulnerable to control how they adapt to a changing climate.

1.2 The collective impact: action and increased capacity

Ultimately, the results of this work reveal themselves through a tangible impact on efforts to adapt to the effects of climate change. Ample evidence points to such impact at a variety of levels and in a range of contexts.

Section 2 of this report outlines IDRC's approaches to adaptation research from over 14 years of climate change programming.

First, our experience investing directly in research driven by, or closely engaging, researchers and institutions in the Global South suggests a natural progression. In



Empowering women and girls can improve their climate resilience and accelerate climate action.
©IDRC/BRENTON BARTAY

essence, adaptation solutions are best defined at the local level, connected to national decision-making, and fed into global dialogues.

Second, our progressively deeper understanding of gendered vulnerabilities highlights the need to consider a range of intersecting factors, such as social class, age, and income level, influencing *who* is vulnerable. It is also important to see gender and social differences as potential sources of resilience.

Third, beyond building capacity, it is vital to have a critical mass of climate leaders. Developing leadership skills, especially among women and other under-represented groups, is crucial to realizing climate action. Section 2.3 outlines specific examples where IDRC built capacity and leadership around climate change adaptation.

Section 3 shares select stories that illustrate on-the-ground impacts and generate further insights into how research has helped communities across the globe to confront the impacts of climate change. Experiences in both urban and rural settings highlight the importance of context-specific data and information to understanding climate risks and enabling evidence-based policies, planning, and decision-making. Innovative approaches to strengthening resilience involve collaboration among diverse actors, including women and other vulnerable groups.

Beyond these stories, there are numerous encouraging indicators of progress made. At the local level, for example, over 250 innovative adaptation options were developed, tested, or scaled.

Research also made a difference to policy-making and planning, informing over 35 national, sectoral, and municipal plans for climate change adaptation, mitigation or development (See Annex). Moreover, researchers played a central role in incorporating climate considerations into urban planning.

Specialized expertise emerged in crucial sub-fields like urban resilience, climate finance for adaptation, climate science and services, gender and climate change, collaborative research, and knowledge co-production and brokering. Between 2005 and 2019, research partners published more than 475 articles in peer-reviewed journals and 500 working papers and briefs.

1.3 Towards a sustainable, resilient, and socially equitable world

The cumulative lessons learned from our investments in climate adaptation research are crucial for the future as we deepen our understandings of how vulnerable populations can face the challenges of rapidly changing environments. IDRC is committed to addressing the current gap in climate action by continuing to support research that helps the world become more sustainable, resilient, and socially equitable. Opportunities to strengthen future research approaches appear in Section 4.

Removing barriers to private investment in adaptation

Although the private sector in developing countries can fund the scaling of climate change adaptation efforts — especially irrigation and flood-control projects that the public sector cannot adequately finance — leveraging private sector investment has been difficult in developing countries. Often, stakeholders see adaptation risks as challenging to measure and lacking a guaranteed market return.

An IDRC-funded project conducted by the Private Financing Advisory Network (PFAN) in sub-Saharan Africa showed that the private sector is usually unaware of the opportunities offered by adaptation investment. The project developed a portfolio of bankable adaptation-funding projects in capital-intensive and risky sectors where private investment was hard to come by, including agriculture, water and sanitation, and forestry. The project then connected project developers with impact investors; the five selected proposals leveraged CA\$9 million in finance. Ultimately, the project demonstrated that innovative financing mechanisms and increased investor awareness of adaptation opportunities could together address adaptation constraints in the Global South.

Find more information about IDRC's work on climate finance [here](#).



Participants in a PFAN investor forum held in Johannesburg, South Africa.

©PFAN



In Brazil's Amazon Delta cities, a risk management mobile app was created to warn the population of flooding.

©CIUDADES RESILIENTES AL CLIMA

2. IDRC approaches to adaptation research

IDRC began supporting applied research on climate change adaptation more than a decade before “climate change” became the “climate crisis.” Together with like-minded donors, we have helped establish strong foundations for climate change adaptation research. In this section, we share details on three sets of approaches and lessons, providing insight into practical questions on achieving impact through adaptation research.

2.1 Investing directly in the Global South

Cumulatively, the climate change adaptation projects supported by IDRC and its partners have helped build a field of research focused on increasing the climate resilience of people in the Global South whose lives and livelihoods are vulnerable to the impacts of global warming. Our contributions to this evolving field have included several common themes: an integrated approach to conduct research informed both by local needs and by the broader range of factors exacerbating vulnerability, connecting with policymakers, and moving away from climate research in favour of climate action.⁴

Work supported by IDRC in the Global South has helped increase understandings of differential and locally specific climate, geographical, and social vulnerabilities, as well as other inter-related factors that affect vulnerabilities. Understanding these multiple vulnerabilities is essential to developing adaptation

solutions and innovations in these specific contexts. This section details some of the ways that the integration of climate-related risks into urban planning can build urban resilience. In rural contexts, agricultural productivity can be enhanced, and climate risks reduced, through improved access to seasonal forecasts and agricultural advisory information tailored to local weather and growing conditions.

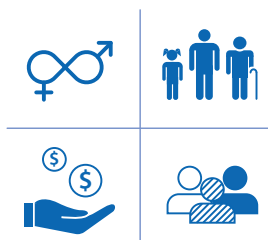
IDRC-supported research has helped strengthen the links between research, policy, and practice — an outcome that required working at different scales to bridge local, national, and global levels of policymaking. While many projects improved understanding of climate change impacts and developed adaptation solutions at more local or regional levels, others worked across regions. The Collaborative Adaptation Research Initiative in Africa and Asia (CARIIA), for example, was a seven-year, CA\$70 million program supporting collaborative research to strengthen resilience in hotspot regions highly vulnerable to climate change (such as deltas, semi-arid lands, and glacier-dependent river basins in Africa and Asia) by informing policy and practice. This partnership with the UK’s Department for International Development brought together more than 450 researchers across 15 countries through four consortia, with selected study areas based on geographic and social similarities. Together, the consortia would share knowledge and experiences across disciplines, sectors, and regions.

OUR APPROACHES

Investing in research driven by partners in the Global South



Integrating gender and social equity within research



Building capacity and leadership on climate action





Researchers share satellite imagery with community members in Angola affected by flooding.
©DEVELOPMENT WORKSHOP ANGOLA

Research supported by IDRC and its partners has also helped enable the transition from climate research to climate action.⁵ Climate resilience and other development goals are interwoven and interdependent. Through long experience investing and working directly in the Global South, IDRC emphasized the intersection of climate adaptation efforts with other development objectives and challenges.

What we learned

Investing in research in the Global South is key to obtaining local context-specific data. Such data informs development solutions that meet the needs of vulnerable communities. IDRC's long-term investment in climate change adaptation has yielded the following understandings:

- **Research led by, or closely engaged with, partners in the Global South can increase resilience for those vulnerable to climate change.** Direct engagement of local institutions and researchers throughout projects is critical. It may be preferable to heavy reliance on external experts and can foster local agency and the uptake of local knowledge into solutions.⁶
- **Knowledge co-production involves collaboration among diverse actors and is necessary for filling existing knowledge gaps and building the relationships needed for climate action.** To mobilize different kinds of knowledge and ability, research teams must involve local officials and communities, the private sector, and civil society.⁷ Collaboration among diverse actors engenders innovative approaches for increasing resilience.⁸

Strengthening the links between research, policy, and practice required working at different scales to bridge local, national, and global levels of policymaking.

- **Working across scales — from local to regional to international — can promote the uptake of research into policy and practice.** Locally implemented research should ideally tie into national decision-making and global dialogue where it may support improved outcomes.⁹ For example, the African Group of Negotiators Expert Support (AGNES) and LatinoAdapta initiatives generate scientific evidence in Africa and Latin America, respectively, to inform policy and ensure Southern voices are heard in global fora.

2.2 Beyond gender: Integrating social equity in climate change research

One of IDRC's main contributions to the field of adaptation research has been to shed light on how gender interacts with other factors to shape vulnerabilities and adaptive capacities. Many earlier and current IDRC-supported research initiatives collected gender-disaggregated data and used vulnerability assessments to differentiate the impacts of climate change along gender lines; many also used a variety of strategies to engage both women and men in research and decision-making.¹⁰

IDRC makes two unique contributions concerning the gender components of the projects it supports. Firstly, it views gender and social differences not just as vulnerabilities, but also as sources of resilience. This outlook is central to a project in Malaysia and Cambodia launched in 2019, for example, that seeks to empower young female social entrepreneurs as a source of long-term community climate resilience.¹¹

Secondly, IDRC looks beyond gender, and towards more broadly-defined social equity, based on the understanding that a range of complex and interrelated factors will impact not only vulnerabilities to climate change but also the achievement of a more comprehensive set of development goals.

Supported research has taken an intersectional approach that reveals how multiple overlapping factors — such as age, gender, ethnicity, or social class —

can shape the vulnerabilities and adaptive capacities of groups and individuals whose livelihoods depend on climate-sensitive natural resources. Some recent research has also highlighted the potential for climate change adaptation to be gender-transformative, by carving out new opportunities for both men and women to exercise their agency in ways that go beyond traditional roles.

An intersectional approach shows how multiple overlapping factors — such as age, gender, ethnicity, or social class — can shape both vulnerabilities and adaptive capacities.

In Northern Kenya: Exploring the gender-differentiated impacts of climate change^{12,13}

Earlier research supported through the Climate Change Adaptation in Africa program on the impacts of climate change on pastoralist communities in Northern Kenya increased understanding of the role of gender in determining how men and women are vulnerable in different ways. The project's goal was to enhance adaptation among pastoralist communities in this arid- and semi-arid area, where drought had caused the Kenyan government to declare a national disaster six times between 1993 and 2009.

Facing more erratic and intense rainfall, and more frequent and severe droughts, pastoralists found it more challenging to move because of increased agricultural settlement and reduced vegetative cover. This reduced mobility, which reduced grazing for cattle, increased soil erosion and promoted conflict over access to scarce water and pasture lands.

Research among Turkana and Mandera communities found that cultural norms and gender roles shaped the different ways in which men and women are vulnerable to the impacts of drought. In Turkana, for example, women are excluded from decision-making, have lower earning power, and are the last to eat in times of drought. They must also care for the sick and the young. Men, on the other hand, are at direct risk from occasionally-violent conflicts over water and pasture land, while elderly men are left alone to cope when families form households.



Cultural norms and gender roles shape the vulnerabilities of men and women to the impacts of drought in Northern Kenya.
©AXEL FASSIO

In Asian cities: Involving women in decision-making¹⁴

Meanwhile, a project focused on women's rights to access water and sanitation in Asian cities showed that involving women in decision-making processes can be useful in reducing the heightened vulnerability of women and girls.

The project addressed an increasingly-frequent problem: as water supplies become uncertain in the face of climate change, providing access to sustainable sanitation systems in urban settings is a priority. Despite the importance of this issue to women — not only for their health and hygiene but for that of their families as well — they are commonly excluded from local planning discussions. These include those dealing with the operation of community toilet complexes.

In this case, however, the project facilitated dialogue between local governments and key stakeholders, including poor women and girls. By employing a methodology that enabled women to analyze safety from their perspective, understanding of the water and sanitation needs of poor urban women and girls was vastly improved. As a result, there was also an improvement in the quality and maintenance of these facilities, helping to ensure the privacy and dignity of the women and girls using them. Active community participation, community organizing, and capacity building to address gender gaps in water and sanitation services also reduced the level of harassment experienced by women and girls while using community toilets.

By giving a voice to the women and girls affected by gaps in essential services such as water, sanitation, drainage, and solid waste management, the project ensured that women's and girls' resilience is at the forefront of local urban planning and governance discussions.

Informing policy change to address gender and social equality

Gender and other social factors are often not taken into consideration in plans and policies to address climate change. Thanks to the concerted efforts of consortia partners to engage with government officials and others involved in shaping adaptation and development plans and policies, CARIIAA-produced evidence had an impact on policy at several different levels. Two examples presented on the next page — one from India's Odisha state, and another from Botswana — illustrate how IDRC research partners informed and influenced climate change action plans at regional and national levels to make them more socially inclusive.

Deepening social and gender equity through climate action

A series of research projects launched in 2018-2019 explicitly focuses on social and gender equity.¹⁵ The six projects, respectively, aim to:

- scale up locally tested adaptation technologies in Bangladesh;
- address gaps in the management planning of water-induced disaster risks in Nepal;
- promote women-led, community-based initiatives on climate change adaptation and disaster risk reduction in the Niger Delta region;
- address water- and climate-driven migration in the Congo Basin;
- strengthen resilience among woman migrants to the Reconquista River Basin in Argentina; and
- develop inclusive resilience to climate change and disasters in Benin.

As these initiatives produce results, IDRC will tap and share the emerging lessons to increase its internal capacity to manage and support socially-inclusive and gender-transformative research more effectively.

In Odisha State, India: Addressing gender in adaptation planning

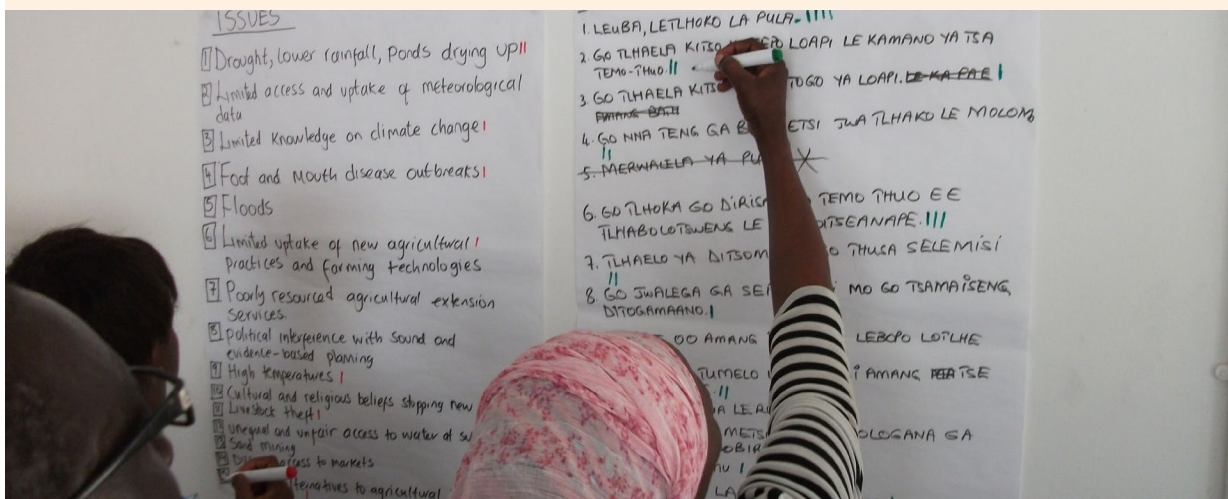
As a coastal state in India which has frequently experienced cyclones and other tropical storm surges, Odisha is considered one of the areas most vulnerable to climate change in the region.¹⁶ CARIIA's India-based research team actively engaged stakeholders in the Odisha state government in their research on hotspots and migration, barriers to policy implementation, and the criteria for successful adaptation in the Mahanadi delta.

In particular, the team's 2016 review of existing Odisha State adaptation policies in the Mahanadi Delta included a gender analysis, and their active engagement in the consultations around the drafting of the subsequent action plan proved productive. While gender had been minimally considered in the original plan, as a result of CARIIA engagement and research findings, the Odisha State Action Plan on Climate Change 2018-2023 contains a separate chapter on gender.¹⁷

In Botswana: Concern for the most vulnerable moves to the national level

CARIIA research on adaptation in arid and semi-arid regions consistently searched for valid entry points to support systemic responses to climate risk that prioritize the most vulnerable. In Botswana, which has endured increasingly severe and recurring droughts, district-level planning provides a crucial opening for communities to provide input on development policy, practical action, and government investment plans. CARIIA partners facilitated such community input through its participatory vulnerability and risk assessment (VRA) method, which gives communities a voice in articulating how they see themselves as affected by climate risks and hazards.¹⁸

After using VRA to inform Botswana's Central District development plan, the consortium was invited by the Office of the President to scale out this approach nationwide. Now, all 16 districts across the country have trained district development officers and economic planners in using the method to work with their communities to manage climate risks and reach the most vulnerable, including women and girls. The United Nations has highlighted this success as a best practice in inclusive adaptation.



Participants at a VRA workshop identifying hazards and issues that affect communities in the Bobirwa sub-district, Botswana.

©HILLARY MASUNDIRE

What we learned

IDRC's approach to understanding the gendered implications of climate change evolved over successive programming initiatives, moving from exploring gender-differentiated impacts and vulnerabilities to examining how gender intersects with other social dimensions to influence risks, vulnerabilities, and options, and how adaptation may allow — and sometimes compel — women and men to take on new roles. The progressive evolution over years of examining gender as a factor in climate change adaptation suggests that:

- **An intersectional framing can reveal nuances in how gender and other factors intersect to shape vulnerability and influence people's responses to climate change.**^{19,20,21,22} Research shows that multiple factors (such as age, ethnicity, marital status, household composition, education, socio-economic status, and physical ability) are essential to understanding vulnerabilities²³. Questioning and challenging the conditions that create vulnerabilities is essential to informed risk-reduction and adaptation strategies. Climate resilience strategies must address structural power relations at different scales. The resilience and adaptive capacities of the most vulnerable can be increased by addressing the interrelated factors leading to different climate change impacts.
- **Achieving gender-transformative research and sustainable actions requires going beyond gender-disaggregated data and vulnerability assessments.** Although gender is a significant factor influencing vulnerabilities and adaptive capacities, IDRC-supported research demonstrates that realities are much more complicated.²⁴ Therefore, gender-differentiated data and vulnerability assessment are only two tools among many for integrating social equity concerns into climate change research and reaching gender-transformative research. Climate change affects everyone, but peoples experience and adapt to climate change effects differently.^{25,26}
- **Strengthening the agency of vulnerable groups, while considering the power and social relations that make groups and individuals vulnerable, is vital for social transformation.** The research revealed that vulnerable groups, including women, cannot be seen as homogeneously weak and powerless victims of natural hazards and climate change. In essence, we must consider interlinked factors like diverse identities, agency, resource access,

power relations, livelihood choices, and cultural norms.^{27,28,29,30} Research also shows how, while some responses to climate change may be adding to the burden on some women, adaptation also has the potential to transform social relations and propel new roles and opportunities for both men and women.

2.3 From capacity building to leadership development

IDRC has contributed significantly to building climate research capacity in the Global South, by supporting the development of local climate change experts and leaders, including women, who can shape our understanding of the extent and severity of climate-related stressors on economies and ecosystems. Our investments in building Southern research capacity — among individuals and institutions — enable countries in the Global South to build resilience to these challenges, informed by locally-relevant evidence.

In addition to providing education, training, and career opportunities for these experts, IDRC-supported initiatives have fostered research networks and communities of practice. The cumulative result of these efforts is the building of a critical mass of climate leaders within governments and the research community in the Global South.

The degree of success that has been achieved in this area can be seen in the following indicators:



Over 700 students (45% of them women) have obtained post-graduate degrees.



IDRC has contributed to the training of 131 climate action leaders and negotiators.



At least 22 contributors (27% women) to IPCC reports, including the Fifth and Sixth Assessment Reports and the Special Reports on Global Warming of 1.5 Degrees, Ocean and Cryosphere, Climate Change and Land, have been supported by IDRC.



83 research networks and communities of practice have been built in 18 countries.



Researchers from the Ashoka Trust for Research in Ecology and the Environment being trained in geo-spatial analysis.
©IDRC/ATUL LOKE

Our efforts have helped build a critical mass of climate leaders within governments and the research community in the Global South.

A regional approach to education and training

IDRC's contribution to educating and training climate leaders includes supporting graduate students and postdocs, awarding fellowships, and holding training sessions to provide skills. Those skills include implementing action research, climate modelling, engaging communities, innovating in climate finance, and using scientific evidence for decision-making.

Some training and education programs have had a regional focus. Several programs have dramatically strengthened Africa's expertise and capacity for advancing climate change adaptation strategies: the African Climate Change Fellowship Program, research grants for Innovative Application of ICTs in Addressing Water-related Impacts of Climate Change, and the Africa Climate Leadership Program. Since 2007, these programs have involved at least 179 fellows, 176 institutions in Africa and elsewhere, and 270 senior scientists.

Another regionally-focused initiative is the South Asia Water Leadership program. Under this program, 37 fellows (29 of them women) have completed their Master's training in Integrated Water Resource

Management at four institutions in India, Sri Lanka, Bangladesh, and Nepal. A tracer study reveals that all of them have been employed as water engineers with government, NGOs, or academia, except for two who are pursuing Ph.D. studies abroad.

The initiative has significantly contributed to knowledge in the field through the publication of 37 master's theses, 16 peer-reviewed journal articles, and 31 national and international conference proceedings. One notable academic contribution was the advancement of the scientific methodology for analyzing food security in accordance with agro-ecosystems — a methodology that compares irrigated and dry systems and assesses changes in land-use dynamics in India.

Strengthening thematic capacities, networks, and communities of practice

IDRC has also played a key role in building capacities based on themes, and in creating and supporting networks and communities of practice. The multiple benefits of this approach include enhancing South-South exchanges and sharing, promoting transdisciplinary research, and strengthening the connections between science, policy, and practice.

The IDRC-supported Adaptation Finance Fellowship Program, hosted by the Frankfurt School of Finance & Management, has trained about 36 emerging leaders from research, policy, and the private sector who aspire to become climate ambassadors, equipped with state-of-the-art knowledge on adaptation finance, in their respective home countries and beyond.



Regional meetings enabled researchers to network and share knowledge on climate change adaptation in Asia.
©SaciWATERS

To build a critical mass of scientists in Africa, the African Institute for Mathematical Sciences' Next Einstein Initiative (AIMS-NEI) supports training, internship placements in government, industry, and intergovernmental organizations, and research grants, with a particular emphasis on women mathematical scientists. Established in 2017 with funding from IDRC and Global Affairs Canada, AIMS-NEI Fellowships for Women in Climate Change Science aim to support 20 outstanding women by the end of 2021. Their work will focus on revealing climate change triggers, mapping climate patterns, increasing knowledge of climate change impacts, and recommending solutions on how best to adapt, mitigate or increase resilience.

Another example is the Africa Climate Change Network, which brings together the alumni of IDRC-supported African climate leadership programs. This network aims to draw on its expert base to undertake collaborative research, bid for joint projects, and inform climate policy, implementation, and on-the-ground action.

Regional environmental economics research networks, meanwhile, are focused on using research findings on the crucial links between economics and the environment to inform policy and practice. IDRC supported four regional environmental networks: the Economy and Environment Program for Southeast Asia; the South Asian Network for Development and Environmental Economics; the Latin America and Caribbean Environmental Economics Program; and

the Centre for Environmental Economics and Policy in Africa. Each of these networks generated locally relevant knowledge and built capacity for disseminating knowledge to policymakers. The networks worked on a variety of topics, each in response to local environmental issues, and strengthened local capacity for the economic analysis of environmental and climate change-related problems.

Developing Southern climate action leaders

With an increased emphasis on ensuring the equal representation of women, IDRC has made significant investments in building the capacities of climate action leaders. It has contributed to the training of over 1,000 fellows at the masters, doctoral, and post-doctoral levels; over 2,000 researchers; more than 130 climate leaders; and over 22 IPCC authors. At least ten people trained in IDRC-supported programs have won prestigious awards, including a 2015 UN Momentum for Change award, a Women in Science award, and a Yara prize for contributions to African agriculture. Many more have seen that investment contributing significantly to their career development, as illustrated by Dr. Arame Tall.

IDRC has also provided expert support to climate change negotiators, such as the African Group of Negotiators (see text boxes). These climate leaders are making outstanding contributions to climate change adaptation efforts at the global, national, and local levels.



Dr. Arame Tall (Senegal)

Senior Climate Specialist at the World Bank, leading expert on global climate services

In 2008, Dr. Arame Tall received CA\$11,000 through the African Climate Change Fellowship Program to implement research and communication activities that would influence policy change in Africa. Based at the Université Cheikh Anta Diop in Dakar, she focused on designing a training workshop to bring together scientists from the university with a targeted group of potential users of the forecasts, such as Red Cross volunteers serving in Senegalese communities. Most of these scientists were climate modelers producing longer-term, downscaled climate projections for West Africa. The 2009 Dakar workshop concluded with a pledge, by both participating communities, that “we will never again act without knowing; nor know without acting.”

That workshop inspired the development of a methodology — “Bridging the Gap” — for facilitating similar activities, currently being used by community groups in West Africa and beyond. Dr. Tall also designed pilot workshops to establish frameworks for climate services at the national level in Mali, Burkina Faso, and Niger, as a way of communicating climate science to policymakers and vulnerable communities. In 2015, she helped establish the first regional office of the World Meteorological Organization’s Global Framework for Climate Services, which provides policy guidance to all 54 African governments on how to mainstream adaptation and establish effective national/ regional frameworks for climate services.

What we learned

IDRC’s work on climate adaptation has garnered lessons on capacity-building and leadership-development. We now understand the following:

- **Useful climate change research requires building individual and institutional capacities for understanding and communicating climate risk and for evidence-based decision-making.** By supporting individuals and institutions and by building capacities for regional and thematic approaches, IDRC has helped create communities of practice that enhance South-South exchanges, promoted transdisciplinary research, and improved the effectiveness of the interface between science, policy, and practice.³¹
- **Developing leadership capacities, especially of women and those in underrepresented countries, is crucial to global, national, and local adaptation efforts.** IDRC has increasingly emphasized the need for equal representation of women.³² At the same time, it has invested significantly in building the capacities of climate leaders. At least ten people trained in IDRC-supported programs have won prestigious awards, including a 2015 UN Momentum for Change award, a Women in Science award, and a Yara prize for contributions to African agriculture. These climate leaders are making significant contributions to global, national, and local climate change adaptation efforts.
- **Knowledge brokering requires capacity building that connects research, policy, and practice.** IDRC has learned that capacity building is needed among all actors involved in climate action, from researchers to research users.^{33,34} Successful knowledge brokering is often about connecting actors with similar challenges to share practice-based experiences. For example, IDRC supports the Climate and Development Knowledge Network (CDKN), which brokers climate knowledge to and between decision-makers, sometimes through peer-to-peer learning opportunities for actors within different government ministries.

Rethinking capacity building: Peer-to-peer learning as a vehicle for evidence-informed climate action

The Climate and Development Knowledge Network (CDKN) works to enhance the quality of life for the poorest and most vulnerable to climate change. Part of its work involves brokering climate knowledge and evidence to decision-makers, sometimes through peer-to-peer learning opportunities that use the knowledge that already exists within government ministries.

In Latin America, this approach has been used to strengthen government ministries' capacities to implement gender-responsive climate policy and action. Peru, Chile and Ecuador are all developing implementation plans for their Nationally Determined Contributions and have appointed gender specialists to mainstream the issue through all sectors. This is a complex task, given the large number of mitigation and adaptation measures that must be considered through a gender lens.

In 2019, CDKN recognized that Peru, Chile, and Ecuador confronted the same challenges and hosted a peer-to-peer learning event so that gender specialists from each country could learn what approaches had worked elsewhere. This simplified the work of specialists in each country. At the same time, this event has built relationships that continue to pay dividends, with specialists continuing to share information as new issues emerge in each of their national contexts. This experience hints at the possibilities of connecting gender experts embedded within government ministries.

For example, in December 2019, gender and climate change specialists from Peru and Ecuador deepened their interaction and shared their experiences of inclusive climate policy and planning at a COP25 event hosted by Peru's Ministry of Environment and CDKN.

Peer-to-peer learning is one approach to capacity building that can support gender-responsive climate action in an era where no textbooks outline how to accomplish this.



Ministry of Environment gender and climate change specialists from Peru and Ecuador with the director of the International and Ibero-American Foundation for Administration and Public Policies at COP25.
©CDKN

AGNES: Supporting African climate negotiators

Since 2015, the African Group of Negotiators Expert Support (AGNES) initiative has been providing scientific expertise and evidence-based information to African climate negotiators. AGNES' support has been crucial to the African negotiators' most significant successes:

Its technical and scientific inputs helped negotiators move the UNFCCC towards a heightened focus on agriculture, a sector upon which Africa is highly dependent. AGNES also played a critical role in the adoption by the twenty-third Conference of the Parties (COP23) of a Gender Action Plan, the first plan of its kind adopted under the UNFCCC.

AGNES is also developing strategies to help African countries implement the Nationally Determined Contributions, which set objectives for implementing climate adaptation and mitigation actions.

Since 2016, AGNES has been working on a long-term strategy to institutionalize its activities in all five sub-regions of Africa. As well, expert support provided through AGNES will expand beyond gender and agriculture into areas including adaptation, finance, technology development and transfer, and global stocktaking.

More recently, IDRC has committed to enhancing its support for the francophone sub-group of AGNES. IDRC support will contribute to enhancing the capacity of francophone African climate change negotiators, increasing their representation and participation in critical global negotiation sessions, and boosting their contribution to research results informing common negotiating positions. Together, these outcomes are expected to contribute to more responsive climate policy and action, building greater climate resilience for Africa's francophone countries.



Members of the African Group of Negotiators Expert Support (AGNES) at COP 25 in Madrid.
©AGNES

3. Impacts on the ground

IDRC has been advancing climate change adaptation research in both urban and rural settings in the Global South. By focusing on small- and medium-sized cities, for example, IDRC-supported research increases the adaptation capacities in urban and peri-urban areas that face more intense climate shocks and stresses while budgets remain limited and populations rise. In rural areas that depend upon agriculture, one of our contributions has been to support the development and delivery of solutions to improve resilience, agricultural productivity, food security, and nutrition, and to reduce climate-related risks. The ultimate impact of these solutions is enhanced livelihoods in areas that are highly vulnerable to the impacts of climate change.

This section describes IDRC's contribution to adaptation research as well as specific lessons applicable to these areas, featuring stories illustrating how research has had an impact in both urban and rural areas at risk. These stories illustrate how local, on-the-ground circumstances affect communities' needs, the approach of the research, and the results and impacts achieved.

3.1 Cities and peri-urban areas

IDRC has funded climate change research involving more than 100 urban and peri-urban areas in 40 countries across Africa, Latin America and the Caribbean, the Middle East, and Asia. Since 2006, we have invested roughly CA\$36 million to develop and test innovative solutions to reduce the risks associated with climate change in those areas.

Why small- and medium-sized cities, and why now?

More than half the world's population lives in cities, where most infrastructure, assets, and economic activity are concentrated. This proportion is expected to rise to two-thirds of the world's population by 2050. City-dwellers consume 78% of the world's energy, and they are responsible for more than 60% of greenhouse gas emissions, yet they account for only 2% of land globally. In the Global South, most new urban residents will live in small- and medium-sized cities.³⁵

These cities are already struggling to manage water supplies, wastewater, and solid waste, and cope with the health impacts of heatwaves and air

pollution. Migration from rural areas has concentrated populations in informal settlements often located on marginal land, lacking adequate water, sanitation, drainage, healthcare, and emergency services. These conditions make the estimated one billion people now living in informal settlements worldwide (a population expected to increase further) especially exposed to impacts of climate change. Increases in climate-related hazards such as cyclones, intense rainfall, and droughts will exacerbate the vulnerability of city residents. Small- and medium-sized cities, in particular, lack the resources and capacity to deal with problems of this scale and complexity.³⁶

In response to these challenges, IDRC-supported research helped small- and medium-sized cities in the Global South strengthen their resilience to the impacts of climate change by identifying how climate change exacerbates urban development challenges, by generating new knowledge, and by testing innovations to inform urban planning and policies. Supported research has increased our understanding of the climate-related risks to urban water supply, and it has developed and tested feasible strategies that enhance the availability and quality of water to improve urban livelihoods and support economic activities within cities. We have also fostered opportunities for exchange between cities and at the global level so that lessons can be applied by cities elsewhere facing similar challenges.

Two impact stories — one from Angola, the other from India — illustrate how research has led to innovations with impacts on policy at the local, national, and global levels. Other examples illustrate the type of adaptation options and impacts generated.

Learning from research on urban resilience

Although the climate-risk challenges in Angola's coastal cities and India's urban centres differ, both clearly illustrate how climate change can make cities' existing problems much worse, and how the most damaging effects fall disproportionately on the shoulders of the urban poor. More positively, research supported by IDRC in both these locations has contributed significantly to the lessons that we have learned about the necessary ingredients for building resilience in the Global South.



Cities of the Global South already struggle to manage water and waste, along with heatwaves and air pollution.
©IDRC/ATUL LOKE

RESEARCH ON CITY-SPECIFIC CLIMATE RISKS IS ESSENTIAL TO URBAN PLANNING PROCESSES

The first lesson is that it is necessary to integrate climate-related risks into urban planning using city-specific evidence. This lesson is proven not just by the Indian and Angolan experiences, but by a wide range of IDRC-supported projects around the globe. Two specific areas where there is convincing evidence of the role of research in ensuring effective policy-making are the development of adaptation plans and tools and improved water management. The contribution of city-specific data to inform urban adaptation plans and local actions, such as South Africa's Green Book online tool (see text box), has been of practical use to municipalities and other actors working to build urban resilience.

Research has also generated new knowledge to help us better understand the complex links between urbanization and water security in the face of climate variability. Different cities have co-developed and tested adaptive strategies related to water that can make an immediate difference in the lives and health of urban citizens.

Many climate change adaptation solutions in urban areas are simple, inexpensive, and nature-based. In the hill towns of Nepal, for example, researchers from the Southasia Institute for Advanced Studies are working with multiple stakeholders to pilot the use of water recharge ponds to replenish water flow in springs that are critical water sources for residents and businesses in these rapidly urbanizing areas. Also, in the small town of Yumbo, Colombia, green infrastructure was used to mitigate flooding in informal settlements. Paved roads were replaced with porous "green" roads that allow water

Supported research increased our understanding on climate risks to urban water supply, and tested strategies to improve urban livelihoods and economic activities.

percolation and reduce the urban heat island effect. Results have shown that these roads significantly reduce the risk of localized flooding. That initiative is overseen by researchers from Oeuvre Durable, who are working on a project focusing on informal settlements in Latin America and the Caribbean.

COLLABORATION IS KEY TO DRIVING INNOVATIONS THAT INCREASE URBAN RESILIENCE

A second essential lesson is that innovative approaches to increasing urban resilience are more likely to arise from collaborations among diverse actors. When research engages directly with city dwellers — to understand their experiences and hear their needs and ideas — and when it involves local governments, civil society organizations, urban planners, health providers, and others, it can catalyze close communication between actors and contribute locally specific data and evidence to inform relevant climate action. Collaboration is also essential because the scale of action involved with developing and instituting solutions to the urban effects of climate change requires the skills, insight, and efforts of many actors.

Improving water security and reducing climate risk in Angola's coastal cities

Angola once benefited from a rich record of climate data, but almost three decades of civil war destroyed 98% of the country's meteorological stations and data. The war also led many Angolans to flee the countryside, with most settling in coastal urban settlements vulnerable to climatic events such as flooding and landslides. Municipal officials face the challenges of providing adequate water supplies and safe housing to war-displaced populations while facing more frequent and intense climate-related events even as they lack reliable information about these hazards.

Between 2012 and 2014, research took place in four coastal cities — Luanda, Cabinda, Benguela, and Lobito — to better understand past weather patterns, as well as present and future climate risks. The NGO Development Workshop Angola led the following activities:

- Building a National Climate Database, which reconstructed close to 30 years of meteorological data through archives and oral histories;
- Creating of a climate-risk map of the four cities, using a combination of participatory research methods (household surveys and focus groups) and satellite images, in close cooperation with civil society, municipal and national governments;
- Establishing with the National Environment Directorate of an early warning system in southwest Angola, utilizing the risk assessments and risk maps; and
- Developing a community water management model, including the creation of legally constituted water associations to directly serve Angola's vulnerable urban populations.

Through close collaboration with city planners, policymakers, and vulnerable populations, the project has achieved the following key outcomes:

- Risk maps are being used by municipal officials to guide urban planning, such as restricting new developments in high-risk areas and identifying where actions need to be taken to safeguard communities.
- The early warning system was used ahead of major storms to warn communities and alert authorities to the need for the evacuation of hundreds of families before widespread flooding and damage.
- The new water management model significantly improved household water availability and affordability in urban populations, with a 90% reduction in cost to consumers. The model has since been incorporated into a national "Water for All" policy and is being replicated across the country.

Development Workshop Angola has now received funding to repeat their efforts in other coastal cities and to help the national government develop a new climate change strategy and action plan.

More information can be found [here](#).



Participatory mapping with local residents in Angola.
©DEVELOPMENT WORKSHOP ANGOLA



Water associations were created to distribute water to households in Angola.
©DEVELOPMENT WORKSHOP ANGOLA

Keeping cool in India's warming cities

Indian cities are seeing unprecedented high temperatures, exacerbated by the heat island effect with considerable impacts on vulnerable communities. Between 2004 and 2013, India recorded a 61% increase in heat-related mortality, and the frequency of heatwaves is projected to increase by 30 times by the end of this century.

Since 2017, IDRC has been supporting research led by Integrated Research and Action for Development, which aims to develop spatially-differentiated and gender-sensitive Heat Stress Action Plans (HSAPs) in the cities of Delhi, Bhubaneswar, and Rajkot. Researchers are quantifying how climate events like extreme heat affect human health, work productivity and livelihoods, to inform measures to address these risks. The primary outcomes of this research are:

- The identification and mapping of heat 'hotspots' — scorching locations with significant vulnerable populations. These maps have already proven valuable in guiding targeted actions such as the delivery of water to established access points during extreme heat events.
- The specialized training of medical practitioners to better diagnose and manage heat-related illnesses. This includes raising their awareness of the HSAPs for their respective cities.
- The establishment of early warning heat advisory systems as well as specific hotspot warnings for identified high-risk areas and populations. This involves direct communication to the public and relevant authorities such as health, water and fire services.
- Adjustments to heat stress thresholds based on analysis of climatology and mortality data. For example, the Rajkot Municipal Corporation now declares heatwave alerts at 40.5°C instead of 41°C, as the research showed the 0.5-degree difference led to increases in morbidity and mortality.



Researchers are quantifying how extreme heat affects human health, productivity, and livelihoods.
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Policymakers are making active use of the evidence gathered through this project, and they are driving the integration of HSAPs into broader urban disaster risk reduction strategies in the pilot cities and beyond.

More information can be found [here](#).

A short video titled [“I had no idea hot summers could kill’: how ‘climate apartheid’ divides Delhi,”](#) produced by The Guardian in 2020, and part of the Divided Cities film series, features IDRC-funded research on heat stress in Delhi.

Some of the most innovative approaches supported by IDRC have involved the collaboration of residents — most notably women and vulnerable communities, such as residents of informal settlements. The Climate Resilient Cities in Latin America initiative illustrates this collaborative innovation (see text box). Such collaboration can be at the city-scale or beyond: in Nepal, Brazil, and other countries, researchers have worked beyond city boundaries to engage actors in the surrounding peri-urban and rural areas on interrelated climate challenges. Several solutions identified through IDRC-supported research represent climate actions that provide adaptation, mitigation, and development benefits for both urban and rural communities.

THERE IS MUCH MORE WORK TO BE DONE

In addition to pointing towards successful strategies, the research has also helped to identify numerous gaps in building urban resilience. These include securing financing for city-level climate action, encouraging private sector support for local adaptation action, building municipal-level capacity to address climate change challenges, scaling local solutions, and linking local solutions to international policy processes. If we are to “leave no one behind,” we must tackle the multiple dimensions contributing to urban poverty and vulnerability. This points to the need for research that unpacks the gendered and social dimensions of vulnerability at the level of individuals and seeks to transform the structures, institutions, and policies that perpetuate inequality.

3.2 Agriculture and rural livelihoods

Over the past decade, IDRC has invested over CA\$54 million in climate change research in rural areas across 36 countries in Africa, Asia, and South America. Our work has improved the lives and livelihoods of millions of people living in the rural Global South by delivering innovative, evidence-based, gender-sensitive solutions that improve resilience, agricultural productivity, and food security and reduce malnutrition and climate change-related risks.

Agricultural vulnerability to climate change effects

Nearly half of the world lives in rural areas, and 90% of those people live in the Global South.³⁷ Agriculture, a primary economic sector in these countries, is highly vulnerable to weather and climate. For example, since much agricultural land in the Global South lacks adequate access to modern irrigation, agriculture

is susceptible to rainfall variability.³⁸ Irrigation-infrastructure improvements, water-storage structures, and more recently, climate-information provision all minimize climate change risks. Additionally, much of the world’s rural populations have adapted their livelihoods to cope with climate variability, through means such as the use of Indigenous knowledge, livelihood diversification, and the use of informal institutions that share and manage risk.

IDRC supports these adaptation and coping strategies by generating new knowledge and by developing innovations that benefit local populations. For instance, by improving the relevance and accuracy of — and access to — agricultural and climate information, IDRC-supported research projects have enabled many people, especially smallholder farmers, to understand climate risks and to adapt to climate change. That research also improved rural livelihoods by increasing agricultural productivity, food security, and environmental, economic, and social sustainability.

Two impact stories highlight how IDRC-supported initiatives addressed climate resilience and livelihood protection, two interrelated rural needs in the Global South. In Uganda, farmers gained access to information and communications technologies to manage climate-related risks, while in Colombia, adaptive technologies helped coffee farmers sustain their endangered crops.

Learning from research with producers

Rural community experiences in Uganda and Colombia demonstrate how IDRC research investments have improved the capacities and incomes of small-scale farmers and their families. IDRC’s goal in these projects was to support more efficient and sustainable agricultural production innovations that enhance food security and improve the incomes of small-scale farmers. Both projects provide critical lessons on methods mitigating rural climate risks.

ACCURATE, TIMELY, AND LOCALIZED INFORMATION AND GUIDANCE IS VITAL TO RURAL PRODUCERS

The first key lesson is that access to localized climatic, weather, and agricultural information can enhance agricultural productivity and reduce climate risk.

The CHAI research in Uganda demonstrates the role of accurate weather and climate information in building local climate risk understanding and guiding multi-scale decision making, both of which are key to improving rural farming lives in vulnerable regions. Despite the growing provision of climate services across the Global South, available information often does not support

on-the-ground decision-making. The Uganda research demonstrated that reliable and relevant weather and climate information could be made readily available and accessible. Integrating weather and climate information into decision-making is crucial to addressing current, and future, climate risks — provided information is disseminated in forms and languages that are useable at the local level.

CHAI also showed that uptake initiatives for weather and climate information could help farmers strategize on how to deal with short-term climate risks. Some agricultural sectors in some regions have incorporated monthly-to-seasonal climate information because that time scale is essential to farming decisions. The research also suggests that the current use of short-term information is a precursor to better management of future climate risks.

Coffee production, the focus of the Colombia research, supports the livelihoods of millions of small-scale producers in more than 60 tropical countries in Africa, Asia, and Latin America. Climate-related impacts on cultivation can be devastating to communities that depend on this commodity: for example, during the last coffee price crash of 2000 to 2003, poverty in producing regions like Colombia increased drastically. During the El Niño-associated 2005 drought, coffee productivity fell to between a third and half of normal levels, severely reducing small producers' incomes.

The coffee-farming vulnerability index developed in Colombia guided agricultural practices. Surprisingly, the data showed that coffee-production vulnerability was relatively low, and that coffee farming is more resilient than initially assumed. It also demonstrated that cost-effective adaptation strategies could increase coffee-farming resilience, productivity, and income.

Climate Resilient Cities in Latin America

The Climate Resilient Cities in Latin America initiative was developed as part of a strategic alliance between IDRC, CDKN, and the Fundación Futuro Latinoamericano. Results from research carried out in 13 small- and medium-sized cities in seven Latin American countries highlight the complex interactions between social, economic, and environmental drivers of urban vulnerability, and how impacts related to climate change can deepen vulnerability.³⁹ The projects demonstrate that local authorities, working with partners and communities, can innovate using their limited resources. For example, research carried out in four cities in the Amazon delta in northeastern Brazil took on the health and water access problems exacerbated by climate change in these informal settlements. The project team worked with stakeholders to develop and pilot a simple, cost-effective rainwater collection system to ensure access to clean and safe water for families in ecologically-sensitive, flood-prone areas lacking infrastructure or other services.⁴⁰

The Climate Resilient Cities initiative has taught us that small- and medium-sized cities can be essential engines of change.

More information can be found [here](#).



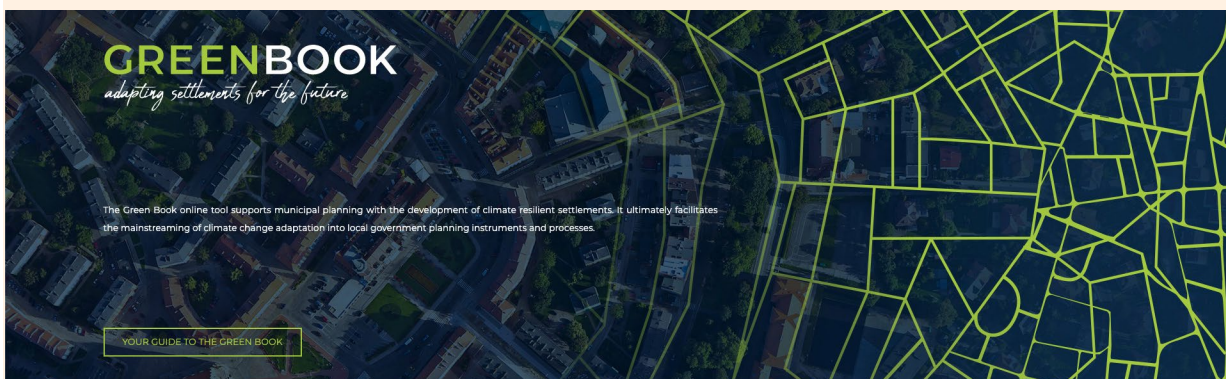
Community-led rainwater management system in the Peruvian Amazon.
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Green infrastructure in Yumbo, Colombia.
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Green Book to help South African communities plan urban resilience

The Green Book provides city-specific projections for changes in climate and population, outlining the dynamic nature of climate-risk to aid South African towns and cities in planning for urban resilience. The [Green Book online tool](#) was developed by the Council for Scientific and Industrial Research (CSIR) in South Africa. From its launch in March 2019 to September 2019, it had been consulted by over 4,900 people. Researchers from CSIR have received a formal request to accompany the city of Tshwane in its efforts to address climate-related risks, and they have been asked to support all eight of the metropolitan cities of South Africa in integrating climate-related risks and adaptation consideration into their planning. An insurance company has also appointed CSIR to use the Green Book planning tool to train officials in two pilot municipalities.



| www.greenbook.co.za

Using ICTs to help Ugandan farmers adapt to climate change

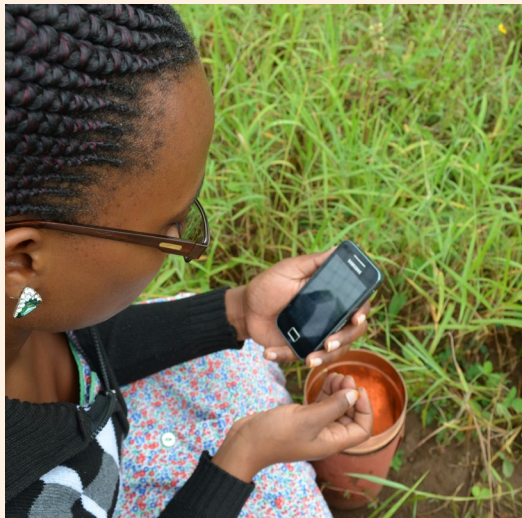
Uganda's "cattle corridor," covering 40% of the nation's land, has been severely affected by climate change, mostly due to recurrent droughts and unpredictable weather. Combined with poor weather and climate information, agricultural risk management has become increasingly difficult.

From 2012 to 2018, IDRC funded research on weather and climate information as well as communication tools available to farmers in three intervention districts (Nakasongola, Sembabule, and Soroti) and one control district (Rakai). The Climate Change Adaptation and ICT (CHAI) project was co-led by Uganda HealthNet and FHI 360, in partnership with government and academic institutions.

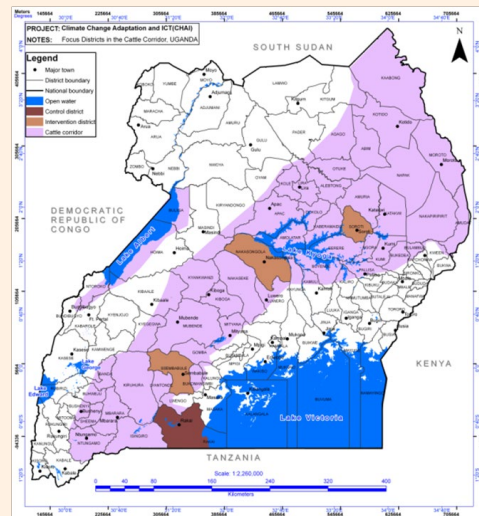
Weather and market information was collected and analyzed by rehabilitating weather stations and training community development officers to collect rainfall and price information on local crops and livestock using mobile phones. This allowed researchers to disseminate advisories to 250,000 farmers, using a variety of methods to reach their broad audience. The research found that advance weather forecasts, repeated daily in all local languages, were critical to managing climate change risks: more than 83% of households reported the climate and agricultural information was 'very effective' in minimizing crop losses.

CHAI also showed that the generation and dissemination of information and technology alone were not sufficient to achieve these results — farmers also required resources to implement the acquired knowledge. This was achieved, for example, by connecting farming households to community support organizations. By engaging government and community officials from various levels, the project also created local ownership and strengthened local capacities and systems to produce necessary weather data. The results informed technology-focused adaptive actions and policy processes.

More information can be found [here](#).



A farmer receiving weather forecast on her cellphone.
©FHI 360



CHAI intervention and control districts.
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Enhancing the livelihoods of small-scale coffee farmers in Colombia

Coffee production supports the livelihoods of millions of small-scale producers in more than 60 tropical countries in Africa, Asia, and Latin America. Climate-related impacts on cultivation can be devastating to communities that depend on this commodity: for example, during the last coffee price crash of 2000 to 2003, poverty in producing regions like Colombia increased drastically. During the El Niño-associated 2005 drought, coffee productivity fell to between a third and half of normal levels, severely reducing small producers' incomes.

Colombia is the world's third-largest coffee producer, with coffee grown by more than half a million small-scale family farms and 2.5 million Colombians dependent on coffee for their livelihoods. In recent years, less predictable rainfall and increased temperatures have led to declines in Colombian coffee production. The proliferation of pests and diseases has forced some farmers to abandon their crops.

From 2016 to 2018, IDRC worked jointly with Tim Hortons and Cenicafé to reduce small-scale Colombian coffee growers' vulnerability to climate change, aiming to improve farmer productivity in the Caldas and Risaralda provinces. By analyzing growers' practices and perceptions of climate variability, researchers developed an exhaustive vulnerability index for coffee farmers. This index is a novel means of assessing coffee-farm vulnerability to diverse climate factors, enabling specific recommendations to be made either to individual farmers or the region. It has also informed the use of farming methods that improve climate adaptation, production resilience, and profitability.

Six farms were chosen to test the use of the index and, later, the recommended management strategy. To verify the effectiveness of the strategies, agronomic and economic indicators were established and measured before, during, and after implementation of the intervention. This was complemented by interviews with each farming family to assess the environmental, social and economic changes.

Results showed that the coffee-cultivation practices implemented by the six selected farms significantly improved farmers' livelihoods, their quality of life, and the sustainability of their coffee production systems.

The project further trained 260 coffee growers, who used their training to better manage harvests, soil fertilization, and agronomy. The growers displayed their plots as examples to their communities and other producers, encouraging others to adopt these approaches.

The research results and coffee-farming vulnerability index developed by the project are now used nationwide in Colombia to improve the resilience of cropping systems.

More information can be found [here](#).



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Smallholders in their field in Haranahalli village, India.
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MULTIPLE FACTORS BEYOND CLIMATE RISKS INFLUENCE AGRICULTURAL DECISION-MAKING

The second key lesson is that enhancing rural livelihoods requires a better understanding of a range of factors — beyond the climate and environment — that impact livelihood-related decision-making. For instance, the Colombian research showed that coffee is more resilient than previously believed and helped disprove assumptions frequently made about the impact of extreme climatic events on land-use change. Among farms that opted out of coffee growing, the study found no correlation between climate signals and land-use changes. In contrast, others began coffee production, with no clear trend or concentration, suggests farmers make decisions based on many factors, including but not limited to climate considerations, cost of harvest labour, increased land prices near urban centres, incentive programs to join other agricultural sectors (e.g., livestock or poultry), and the migration of youth to cities. Further research is needed to understand these forces better.

The Ugandan research similarly shows that farmers' decision-making is a complex process of iterative adjustments influenced by assets, aspirations, sociocultural and perceptual environments, and market regimes. Additionally, agricultural decisions, especially by smallholders, typically focus on short-time horizons, such as seasons and years, rather than decades.

By tailoring agricultural and climate information, research helped smallholder farmers better understand climate risks and adapt their practices.

ENHANCING THE UPTAKE OF SOLUTIONS DEMANDS TAILORING INFORMATION AND INNOVATIONS TO USERS

The third key lesson concerns the methodological requirements of research for improving rural livelihoods. Teams need the capacity to not only collect information and develop innovations but also to ensure they are delivered in a timely way and through means that meet the needs and preferences of multiple groups, including women. The Uganda research, for example, showed that participatory approaches to climate information design and interpretation could promote decision-making uptake. It also demonstrated that farmers were willing to pay for information and innovations that significantly reduce loss and damage. Factors that increased farmers' willingness to use climate information included their use of tools and systems that built mutual trust and provided climate information relevant to their specific, local working environment.

4. Moving forward

More ambitious, robust action is required to reduce the impacts of rapid climate change and to help communities adapt. International commitments enshrined in the Paris Agreement and the United Nations Sustainable Development Goals, and the scientific evidence articulated in recent IPCC reports,^{41,42} all underscore the increased urgency of this need.

In September 2019, UN Secretary-General António Guterres called on world leaders to come to the Climate Action Summit in New York with concrete, realistic plans to enhance their nationally determined contributions by 2020. Regrettably, the post-Summit consensus is that commitments made, such as the pledge to reach net-zero carbon emissions by 2050 and support for the Green Climate Fund, do not amount to the fundamental transformation required to tackle the climate challenge facing the world today.^{43,44}

The demand for climate change research that can have a direct impact is higher now than ever before. Efforts on the ground in Africa, Asia, and the Americas by IDRC-supported researchers have helped the most vulnerable people living in cities and rural areas anticipate and respond to climate impacts and extreme events, thereby increasing the world's resilience. IDRC-supported research has helped economies, food systems, and communities to thrive. By delivering innovative, evidence-based solutions, we have improved livelihoods and enhanced well-being in rural areas and enabled cities to start transitioning towards a carbon-neutral future. Our climate change programming, which emphasizes working with like-minded partners, has contributed significant data and evidence to reports from the IPCC and other bodies and has influenced global policy debates.

We are currently living in a world where, as a speaker at a Climate Week event in September 2019 expressed it, we need to “live resiliently while decarbonizing.” This calls for innovative, integrated approaches that focus simultaneously on adaptation and mitigation. Such approaches build on IDRC's contributions to climate action over the past 14 years of applied research.

Past experience here can inform and guide future work. For example, by investing directly in researchers and institutions in the Global South to generate local,

context-specific knowledge, we have learned that knowledge needs to be translated into adaptation solutions at the local level; it then needs to be connected to national decision-making and fed into global dialogues.

Additionally, by deepening our understanding of the gendered vulnerabilities to climate change, IDRC-supported researchers have highlighted the need for a change of outlook in the field of research on climate change and gender. Researchers and others now understand the need to consider a much more extensive range of factors affecting climate vulnerability, and they are also more likely to view gender and social differences as sources of resilience, rather than merely indicators of vulnerability.

While providing support to individuals, institutions, and networks to develop capacities, we have learned that Southern countries' abilities to strengthen climate resilience and transition to a low-carbon economy depend upon having a critical mass of climate researchers and leaders. Developing leadership skills, especially of women and those in under-represented countries, is now a crucial component in this process.

Those are the key contributions and learnings that have emerged from IDRC's support for climate adaptation research since 2006. Our focus on research uptake — working at multiple scales for impact, and towards gender transformation through research and leadership development — places the Centre in an important strategic position to continue supporting climate change research that will make a meaningful difference in the coming decades. As cooperation increases with Canadian agencies and other government bodies committed to climate action, IDRC's programming illustrates Canada's values and strengthens its leadership role in addressing the urgent need for global climate action.

The demand for climate change research that can make a real difference is greater now than ever.



A creative temporary adaptation measure to cope with floods in Bangladesh.
©SAIFUL ALAM

Looking forward, we will continue to support our Southern partners' efforts to generate knowledge and contribute to studies and assessments that inform the latest science on climate change. Further, IDRC investments will continue to facilitate science-based decision-making and commitments towards climate action. Key priorities for the climate research community to propel the world towards transformational action for a sustainable, resilient future include:

- *Tackling climate change as a development challenge, using research-based evidence in the Global South for decision-making:* The IPCC has concluded with a high level of confidence that “differences in vulnerability and exposure arise from non-climatic factors and multidimensional inequalities often produced by uneven development processes.”⁴⁵ Differentiated impacts of climate change arise from complex and interrelated factors that go beyond the climate or the environment. As we saw in the stories of impact, climate change is an urban planning issue, it leads to health problems, and it compromises key livelihood activities. Our experience since 2006 demonstrates the value of bringing together various actors to develop a more holistic understanding of the factors at play and to develop locally-driven strategies that integrate the climate change piece into ongoing development challenges. We will continue to build resilience in the Global South with a holistic approach that integrates climate change in development efforts, most important of which are sustainable urban planning, resilient food systems, and disaster risk reduction.

We will continue to build resilience with a holistic approach that integrates climate change in development efforts.

- *Ensuring space for the diverse voices and youth:* the recent emergence of the youth climate movement has helped bring questions of climate justice to the fore and highlights the need for governments to engage excluded groups in finding solutions.⁴⁶ As demonstrated above, innovative approaches arising from IDRC-supported research have involved and empowered marginalized and vulnerable communities. Such research has also benefitted from the contributions of a new generation of young researchers, trained and equipped through IDRC-supported research. The increasingly prominent role youth are taking on the frontlines of climate action highlights the need to build platforms and create networks that integrate them into research and decision-making. Building on our gender-transformative research and focus on social equity, we will strengthen our work to inform climate justice, including its intergenerational dimensions.
- *Acting now, based on existing knowledge:* the global climate change research agenda is now focused on implementing climate action.⁴⁷ Although new knowledge and evidence are needed, we already know that the time to act is now. In addition to creating new knowledge, we need to close the



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gap between existing knowledge and decision-makers, and at all scales. To achieve this, we need to invest in improving effective communication and building long-term relationships between the producers and users of knowledge. This paper has underscored the vital need for capacity-building and leadership development to this end. Our experience with peer-to-peer learning illustrates its value in strengthening the capacities of governments and individuals, and in brokering existing knowledge between countries to support climate action directly.

It is also timely, in a changing world, to revisit old ideas, such as the assumed trade-offs in supporting researchers based in the Global South and North, or the choice between investing in research and climate action. For example, it was once assumed that Northern academics had a comparative advantage in contributing to global scholarship and that Southern participants had an advantage in applying knowledge to policy and practice. IDRC's recent experience shows that often the reverse was true. While Northern-based participants have been keen to ensure that research is understandable to decision-makers and positioned to make a positive impact in Africa and Asia, Southern-based participants have demonstrated their ability to contribute to global science, publishing in essential journals and becoming authors in the IPCC assessments.

To act now, we need to close the gap between existing knowledge and decision-makers.

We need to revisit old assumptions — Southern-based participants have demonstrated their ability to contribute to global science.

Moving to implement the Paris Agreement means doing research differently, shifting from an approach of “study-then-disseminate” towards one that ensures research is embedded into climate action and learning *while* societies invest in — and scale up — their climate plans. We will continue to invest directly in the Global South to propel the world towards action.

In 2018, Kristalina Georgieva, then-CEO of the World Bank, stated: “We are clearly the last generation that can change the course of climate change, but we are also the first generation with its consequences.” Building on IDRC's contributions and lessons on climate action, in the years ahead, we aim to achieve a sustainable, resilient future by investing further in research that directly translates into enhanced climate action. This will be done, in part, by consolidating our work in this field with three outcomes: sustainable and resilient food systems, enhanced climate resilience, and low-carbon economies.

We thereby envision a sustainable, socially equitable world where economies have transitioned to net zero-emissions, cities and food systems are resilient and sustainable, and people are thriving regardless of where they live.

Annex. Examples of adaptation and development policies and plans informed by IDRC-funded research

Country	Adaptation and development policies and plans informed by IDRC-funded research
Bangladesh	Climate Change Strategy Action Plan
Bangladesh	National Adaptation Plan
Bangladesh	Refugees and remittances policy of the Ministry of Labour and Employment
Bangladesh	UN Global Compact on Migration (2017-2018)
Bolivia	Strategic Action Plans for adaptation to climate change in 36 municipalities and departmental governments.
Botswana	District Development Plan for Botswana's Central District.
Dominican Republic	National Water Security Plan 2015-2020.
Egypt	National Climate Change Adaptation Strategy
Ghana	Coastal Development Authority Bill
India	Orissa State Action Plan on Climate Change 2018-2023
Kenya	Integrated development plans of Kajiado, Narok, Laikipia, and Makueni counties.
Kenya	National Climate Change Action Plan and the National Wildlife Strategy.
Namibia	Windhoek Declaration for Enhancing Resilience to Drought in Africa.
Nepal	National Adaptation Plan.
Nepal	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
Pakistan	Climate Change Strategy and Action Plan of Gilgit-Baltistan.
Panama	National Water Security Plan 2015-2020.
Senegal	Guide to local planning piloted by the National Local Development Program
Thailand	Local action plans on adaptation, in collaboration with researchers, farmers and the Department of Fisheries.
Thailand	Master Plan for Inland Aquaculture Development of Thailand 2017-2021
Thailand	Flood Management Master Plan

References

- ¹ Blane, H, Cochrane, L., Czunyi, S. & Huang, Y.S. 2019. *Learning, landscape and opportunities for IDRC climate programming*. Report commissioned by IDRC. <http://hdl.handle.net/10625/57623>
- ² UNFCCC (United Nations Framework Convention on Climate Change). 2020. Marrakech Partnership for Global Climate Action. <https://unfccc.int/climate-action/marrakech-partnership-for-global-climate-action>
- ³ IDRC (International Development Research Centre). 2019. *It's about time: Research that tackles gender inequality at its roots*. <https://www.idrc.ca/en/research-in-action/its-about-time-research-tackles-gender-inequality-its-roots>
- ⁴ Alain Lafontaine, Sarah Lebel, Cecilia Moreno & Claudio Volonté. 2019. Climate Change Program External Evaluation: Final Report. Le Groupe-conseil baastel Itée. Available at: <http://hdl.handle.net/10625/58263>
- ⁵ Ibid.
- ⁶ Ibid.
- ⁷ Ibid and Alain Lafontaine, Claudio Volonté, Carine Pionetti & Cecilia Moreno. 2018. *Collaborative Adaptation Research Initiative in Africa and Asia, Summative Evaluation: Final Report*. Le Groupe-conseil baastel Itée. <http://hdl.handle.net/10625/57296>
- ⁸ Lafontaine et al., 2019
- ⁹ Lafontaine et al., 2018
- ¹⁰ Nordehn, C. & Rubin, D. 2018. *Gender and Climate Change—Synthesis of IDRC's Support to Climate Change Research*. International Development Research Centre. <http://hdl.handle.net/10625/57515>
- ¹¹ See: <https://www.idrc.ca/en/project/promoting-social-entrepreneurship-disaster-risk-reduction-build-community-resilience-pilots>
- ¹² IDRC. 2010. "Stories from the field: Reducing vulnerability among pastoralists in Northern Kenya". *Climate Change Adaptation in Africa Program 2009-10 Annual Report*. Available at <https://www.idrc.ca/sites/default/files/sp/Documents%20EN/reducing-vulnerability-among-pastoralists-in-northern-Kenya.pdf>
- ¹³ Omolo, N.A. 2010. "Gender and climate change-induced conflict in pastoral communities: Case study of Turkana in northwestern Kenya". *African Journal on Conflict Resolution*, 10(2): 81-102 <http://dx.doi.org/10.4314/ajcr.v10i2.63312>
- ¹⁴ Women in Cities International. 2011. *Gender and essential services in low-income communities: Report on the findings of the action research project "Women's Rights and Access to Water and Sanitation in Asian Cities"*. Montréal: WCI. <http://hdl.handle.net/10625/47973>
- ¹⁵ For more information on the projects, see <https://www.idrc.ca/en/news/new-projects-will-drive-social-and-gender-transformative-climate-research>
- ¹⁶ Hazra, S. 2016. *Review of Odisha State Adaptation Policies, Mahanadi Delta*. DECCMA Working Paper, Deltas, Vulnerability and Climate Change: Migration and Adaptation. http://generic.wordpress.soton.ac.uk/deccma/wp-content/uploads/sites/181/2017/07/Final_IN-Mahanadi-policy-review.pdf
- ¹⁷ Vincent, K. 2018. *Story of change: DECCMA's inputs to the Odisha State Action Plan on Climate Change 2018-23*. <https://generic.wordpress.soton.ac.uk/deccma/2018/08/13/story-of-change-deccmas-inputs-to-the-odisha-state-action-plan-on-climate-change-2018-23/>
- ¹⁸ ASSAR. 2015. *Heat, heat and more heat: a fitting climate for our Vulnerability and Risk Assessment workshop in Bobonong, Botswana*. Event report. <http://www.assar.uct.ac.za/VRA%20workshop>
- ¹⁹ Rao, N., Singh, C., Solomon, D., Camfield, L., Sidiki, R., Angula, M., Poonacha, P., Sidibé, A. & Lawson, E.T. 2020. "Managing risk, changing aspirations and household dynamics: Implications for wellbeing and adaptation in semi-arid Africa and India." *World Development*, Volume 125. <https://doi.org/10.1016/j.worlddev.2019.104667>
- ²⁰ Goodrich, C.G., Udas, P.B. & Prakash, A. 2019. "Gendered vulnerability and adaptation in Hindu-Kush Himalayas: Research insights." *Environmental Development*, Vol. 31. Pages 1-8. www.sciencedirect.com/science/article/pii/S2211464518304433
- ²¹ CARIAA. 2018. *Gender and Social equity*. Novel Insights Brief. Collaborative Adaptation Research Initiative in Africa and Asia. IDRC: Ottawa, Canada and UK Aid: London. <http://hdl.handle.net/10625/57369>
- ²² ASSAR, n.d. *Gender is one of many social factors influencing responses to climate change: An ASSAR cross-regional insight*. http://www.assar.uct.ac.za/sites/default/files/image_tool/images/138/Legacy_chapters/ASSARs%20work%20on%20gender%20and%20social%20differentiation.pdf
- ²³ Ibid.

- ²⁴ Ibid.
- ²⁵ CARIAA. 2018.
- ²⁶ Goodrich, C.G., Udas, P.B. & Prakash, A. 2019. "Gendered vulnerability and adaptation in Hindu-Kush Himalayas: Research insights" in *Environmental Development*, Vol. 31. Pages 1-8.
- ²⁷ ASSAR, n.d.
- ²⁸ Lafontaine et al., 2019.
- ²⁹ Rao, N., Lawson, E.T., Wapula, N.R., Solomon, D., & Angula, M.N. 2017. "Gendered vulnerabilities to climate change: insights from the semi-arid regions of Africa and Asia" in *Climate and Development*. <https://doi.org/10.1080/17565529.2017.1372266>
- ³⁰ Goodrich et al., 2019
- ³¹ Lafontaine et al., 2019
- ³² Ibid.
- ³³ CARIAA. 2018b. *Research for impact*. Novel insights brief. Collaborative Adaptation Research Initiative in Africa and Asia. IDRC: Ottawa, Canada and UK Aid: London. <http://hdl.handle.net/10625/57289>
- ³⁴ Prakash, A., Cundill, G., Scodanibbio, L., Vincent, K., Nathe, N., Morchain, D., DeMaria-Kinney, J., Soumelong Ehode, L., Sukla, D., Mishra, A., & Piryani, A. 2019 *Climate Change Adaptation Research for Impact*. CARIAA Working Paper no. 23. IDRC: Ottawa, Canada and UK Aid: London. <http://hdl.handle.net/10625/57489>
- ³⁵ United Nations, Department of Economic and Social Affairs, Population Division. 2018. *World Urbanization Prospects: The 2018 Revision, Online Edition*. Available from <https://esa.un.org/unpd/wup/Publications>
- ³⁶ Rosenzweig, C., Solecki, W., Romero-Lankao, P., Mehrotra, S., Dhakal, S., & Ali Ibrahim, S. (Eds.). 2018. *Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network*. Cambridge University Press.
- ³⁷ United Nations Department of Economic and Social Affairs, Population Division. 2018. *2018 Revision of World Urbanization Prospects*. <https://www.un.org/development/desa/publications/2018-revision-of-world-urbanization-prospects.html>
- ³⁸ Global Commission on Adaptation. 2019. *Adapt now: A global call for leadership on climate resilience*. https://cdn.gca.org/assets/2019-09/GlobalCommission_Report_FINAL.pdf
- ³⁹ Villamarin et al. 2019. *Synthesis Report: Contributions of the Climate-Resilient Cities in Latin America Initiative*. <https://cdkn.org/wp-content/uploads/2019/08/Documento-Sintesis-INGLES-FINAL-para-web.pdf>
- ⁴⁰ Lima, A.B., Almeida, O., Furtado O., C., Mercado, J. 2018. *Dois exemplos de estratégias de resiliência para ocupações de risco em cidades da Amazônia*. Informativo para políticas públicas. <https://crclatam.net/documentos/publicaciones/70-informativo-para-politicas-dois-exemplos-de-estrategias-de-resiliencia-para-ocupacoes-de-risco-em-cidades-da-amazonia/file.html>
- ⁴¹ Inter-governmental Panel on Climate Change. 2018. *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. <https://www.ipcc.ch/sr15/>
- ⁴² Inter-governmental Panel on Climate Change. 2019. *IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*. <https://www.ipcc.ch/report/srccl/>
- ⁴³ International Institute for Sustainable Development. 2019. "Climate Action Summit." *Earth Negotiations Bulletin*. IISD Reporting Services. <http://enb.iisd.org/download/pdf/enb12762e.pdf>
- ⁴⁴ Sengupta, S. and Friedman, L. 2019. "At U.N. Climate Summit, Few Commitments and U.S. Silence." *The New York Times*. Published on September 23, 2019. <https://www.nytimes.com/2019/09/23/climate/climate-summit-global-warming.html>
- ⁴⁵ IPCC. 2014. *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp. <https://www.ipcc.ch/report/ar5/wg2/>
- ⁴⁶ *The Guardian*. 2019. The Guardian view on the climate youth movement: we have been warned. Published on September 24, 2019. <https://www.theguardian.com/commentisfree/2019/sep/24/the-guardian-view-on-the-climate-youth-movement-we-have-been-warned>
- ⁴⁷ AdaptationWatch. 2017. *Toward Implementation: The 2017 AdaptationWatch Report*. Eds. Kevin Adams and Danielle Falzon. White Paper. www.adaptationwatch.org

