World Cities Report 2024

# Cities and Climate Action

## Case Study Annex

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# World Cities Report 2024
# Case Study Annex

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# List of acronyms

| | |
|---|---|
| ACTE | Alliance des Communes pour la Transition Energétique |
| ADB | Asian Development Bank |
| ADEME | French Environment and Energy Management Agency |
| AI | Artificial Intelligence |
| Anera | American Near East Refugee Aid |
| ANME | National Energy Agency (Sousse) |
| ARTPARK | Artificial Intelligence & Robotics Technology Park |
| AVSI | Association of Volunteers of Service International |
| BBMP | Bangalore metropolitan area |
| CBD | Central Business District |
| CDIA | Cities Development Initiative for Asia |
| CEFC | Clean Energy Finance Corporation |
| CityRAP | City Resilience Action Planning |
| CLT | Community Land Trust |
| CO2 | Carbon dioxide |
| CSOs | Civil Service Organizations |
| CSP | Community Strategic Plan |
| DHSUD | Department of Human Settlements and Urban Development |
| DiMSUR | The Technical Center for Disaster Risk Management, Sustainability, and Urban Resilience |
| ECLTN | European Community Land Trust Network |
| EEA | European Energy Award |
| EV | Electric Vehicle |
| EWS | Early Warning System |
| GCF | Green Climate Fund |
| GHG | Greenhouse Gas |
| GIS | Geographical Information System |
| GIZ GmbH | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| GPS | Global Positioning System |
| GWh | GigaWatt hour |
| HIMO | High Intensity Labour Approach (Haute Intensité de Main d'œuvre) |
| ICCC | Integrated Control and Command Centre |
| ICLEI | Local Governments for Sustainability |
| IDPs | Internally Displaced Persons |
| IEC | Information, Education and Communication |
| IFRM | Integrated Flood Risk Management |
| IIED-AL | International de Medio Ambiente y Desarrollo |
| IKI | International Climate Initiative |
| IOM | Internation Organization for Migration |
| IVC | Instituto de Vivienda de al Ciudad/The Institute of Housing of the City of Buenos Aires |
| kW(h) | Kilowatt-hour |
| MBR | Membrance BioReactor |
| MCCs | Micro Composting Centres |
| MW(h) | megawatt (hour) |
| MWp | Megawatt peak |
| NAPs | National Adaptation Plans |
| NbS | Nature-based Solutions |
| NDCs | Nationally Determined Contributions |
| NGOs | Non-Governmental Organizations |
| PM | Particulate Matter |
| PPA | Power Purchase Agreement |
| PRISM-H | Platform for Integrated Surveillance and Management of Health Application |
| PSUP | Participatory Slum Upgrading Programme |
| RFA | City Resilience Framework for Action |
| SC China | Save the Children International China Programme |
| SDGs | Sustainable Development Goals |
| SECO | Swiss Secretariat of State for Economic Affairs |
| SEEDS | Sustainable Environment and Ecological Development Society |
| SSC | Sisia Supervisory Committee |
| SWM | Solid Waste Management |
| SWMC | Summer Hill Waste Management |
| tCO2e | tonnes of carbon dioxide (equivalent) |
| TMC | Trivandrum Municipal Corporation |
| TRIDA | Trivandrum Development Authority |
| TUC | Transformative Urban Coalition |
| UNDP | United Nations Development Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WFP | World Food Programme |
| WHO | World Health Organization |
| XES | Xarxa d'Economia Solidaria |

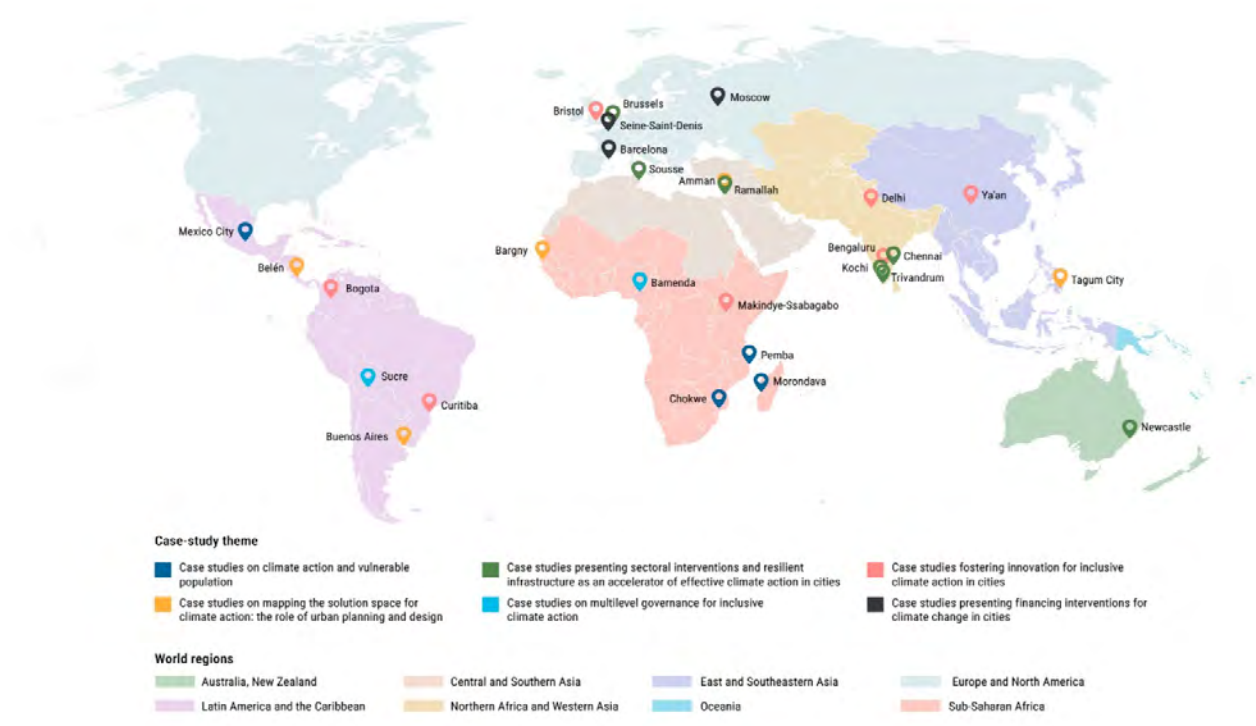
# Introduction

The *World Cities Report* 2024 highlights the critical role cities play in addressing the global climate crisis, both in terms of reversing its impacts (through mitigation) and reducing the vulnerability of at-risk communities, groups and individuals (through adaptation). This annex presents a collection of case studies that showcase the measures and actions taken by local and regional stakeholders worldwide to enhance resilience, reduce greenhouse gas emissions and lower pollution.

UN-Habitat issued a call for proposals in early 2024, inviting urban stakeholders to share the climate mitigation and adaptation solutions implemented in their cities. The response was outstanding, with numerous submissions detailing impactful and innovative actions. This annex compiles some of these case studies, offering an overview of the diversity of approaches and varying contexts for urban climate action. These case studies are organized into six broad categories of climate action, although many cases transcend these categories and apply a combination of tools and approaches (see Figure i.):

- Case studies on climate action and vulnerable populations
- Case studies on the role of urban planning and design for climate action
- Case studies on sectoral interventions and resilient infrastructure as accelerators of climate action in cities
- Case studies on multilevel governance for inclusive climate action
- Case studies fostering innovation for inclusive climate action in cities
- Case studies presenting financing interventions for climate change in cities

**Figure i: The location of the case studies**




*Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by The United Nations. The final boundary between the Republic of Sudan the Republic of South Sudan has not yet been determined. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by both parties.*

## Local action for adaptation, mitigation and co-benefits

The case submissions revealed a significant focus on adaptation measures. This is interesting, given that less than 10 per cent of overall climate investments are directed towards climate adaptation. The case studies demonstrate that a large range of solutions to increase resilience are actively being implemented at the local level, including the development of green infrastructure and nature-based solutions, the implementation of flood management systems, and the promotion of climate-resilient building practices. By showcasing these examples, this annex aims to inspire and guide local actors facing similar challenges, encouraging them to adopt and scale up effective climate solutions. It is also a call to the international community to ensure adequate funding is made available to support these local efforts in adaptation.

Cities also lead mitigation efforts. Actions to reduce greenhouse gas emissions include various strategies, such as transitioning to renewable energy, enhancing energy efficiency (especially in the building sector), and promoting sustainable transport systems. For instance, several cities have successfully implemented digital transport management systems, low-carbon water transports or electric public buses, all contributing to reductions in urban greenhouse gas emissions.

Several of the solutions also highlight the co-benefits that emerge from climate actions. These co-benefits are often social and include increased accessibility to transport, enhanced nutritional capacity of vulnerable households, gender co-benefits, and reduced energy cost for vulnerable groups.

## Triggers, enablers and integration of climate action

The cases in this annex reveal a broad plurality of approaches in how climate action is achieved. Many cases describe specific trigger events, often climate shocks, that demonstrated the urgency of climate action to all stakeholders. In other cases, long-term engagement by various stakeholders led to an enabling environment, such as legal, financial or institutional reforms, that have created the conditions for climate action to occur. Finally, this annex also demonstrates that action does not always need to start with climate—as in many cases climate action was integrated into existing planning and design processes, complementing approaches that already proved themselves in the past.

## Financing gaps and opportunities

While cities are at the forefront of both mitigation and adaptation efforts, securing adequate funding remains a persistent hurdle. The lack of sufficient financial resources often limits the scale and scope of climate initiatives, particularly in low- and middle-income countries where the impacts of climate change are often most severe. The case studies presented here underline the importance of financial support from national governments and international bodies to the local level. However, they also showcase several innovative financing mechanisms that cities have deployed to bridge this gap. Examples include the issuance of green bonds, the development of local currencies and innovative financial schemes. These approaches have enabled cities to mobilize the necessary resources for climate projects, demonstrating the potential for creative financing solutions to overcome funding barriers.

## Cities' contribution to global climate targets

While Nationally Determined Contributions (NDCs) are typically formulated at the national level, the role of cities in achieving these targets cannot be overstated. Activities in urban areas are responsible for a significant proportion of global emissions, and their actions are crucial to meeting national and international climate goals. In this regard, the case studies illustrate how cities are contributing to the achievement of NDCs through local initiatives. For example, several cities have aligned their climate action plans with national targets or with net zero operational emissions, ensuring coherence and synergy between local and national efforts. Furthermore, cities often serve as testbeds for innovative climate solutions that can be scaled up to the national level. The successful implementation of urban projects can provide valuable insights and models for broader application, enhancing the overall effectiveness of national climate strategies.

## Looking ahead

The actions presented here demonstrate that, despite the challenges, cities possess the creativity, resilience and leadership necessary to drive meaningful climate action. As we face an increasingly uncertain climate future, the lessons learned from these case studies offer hope and ways forward for an increasingly urban world. By continuing to support and invest in urban climate action, we can build more resilient, sustainable and equitable cities for generations to come.

# Case studies on climate action and vulnerable populations

01

## A Community-Centred Strategy for Urban Resilience in Fragile Settings: Lessons from Alto Gingone in Pemba, Mozambique

**City/Locality:** Pemba
**Country:** Mozambique
**Region:** Sub-Saharan Africa
**Theme:** Climate action and vulnerable populations


### Context

Poverty, weak institutional development and exposure to frequent extreme weather events make Mozambique especially vulnerable to climate change. Climate-related hazards, including droughts, floods and cyclones, are having devastating impacts on underprepared populations and overstretched local administrations.

This case study focuses on Pemba, a city in the northern province of Cabo Delgado, characterized by its hilly terrain. An estimated 85 per cent of the land is informally settled, without adequate drainage systems or solid waste collection. These conditions make Pemba's population vulnerable to flooding, erosion, groundwater contamination and the spread of disease, as became apparent when the city was hit by Cyclone Kenneth in 2019. The situation is compounded by high rates of hunger and malnutrition in Cabo Delgado, as well as recurring outbreaks of conflict and violence. According to the International Organization for Migration (IOM), as a result of widespread internal displacement within the country, Pemba's population swelled from 157,000 in 2017 to 260,000 in 2023, placing additional pressure on its already weak urban infrastructure and food systems.

### Solution developed

To enhance Pemba's resilience to climate and interrelated socio-economic challenges, the Association of Volunteers of Service International (AVSI) Foundation, the World Food Programme (WFP) and the municipality of Pemba developed a participatory project targeting the informal neighbourhood of Alto Gingone. This initiative aimed to bolster the city's urban, social, economic and environmental resilience through nature-based solutions, local administrative support and community empowerment.

Infrastructurally, the project transformed 3.2 kilometres of natural water channels into resilient drainage systems (see Figure 1.1), constructed

three rainwater retention basins, and established trenches and infiltration gardens. Additionally, watercourse banks were fortified with erosion-resistant plants, and rainwater storage systems were installed in homes. A pilot waste management system was introduced, equipping 85 families with the means to compost waste on-site, moving away from sewer discharge. The transformation of water channels was complemented with the development of green infrastructure through reforestation, urban gardens and the establishment of public spaces.

**Figure 1.1: Water drainage channel constructed to reduce risk of flooding, disease and pollution**

© Federico Monica (Taxi Brousse)

The transformation of the city's "hard infrastructure" was part of an integrated approach that also incorporated the strengthening of the city's "soft infrastructure" through institutional reform and capacity building. At an organizational level, the project advanced an urban waste management plan that included a household organic waste disposal pilot project, and provided urban drainage maintenance committees with materials and training. In collaboration with the municipality, a set of regulations were developed for better urban drainage management. Community engagement was pivotal in this process, with ongoing door-to-door outreach on waste management and drainage, supported by the active participation of local residents in the cleaning and building of infrastructure. Their proactive involvement ensured the success of the project and activated numerous secondary urban regeneration initiatives.

The construction of the drainage and infrastructure was undertaken by over 600 local residents, who received vocational training to gain the necessary skills for the work. As Pemba had experienced a rapid rise in internally displaced persons (IDPs), half of those trained were IDPs. These skills benefitted the delivery of the project, but also provided local residents and displaced populations residing in the area with future livelihood opportunities, generating long-term benefits to the local economy. The vocational training also focused on the empowerment of women in particular (75 per cent of those trained were women), helping to address some of the structural inequalities they face in Pemba. To motivate the participants and ensure adherence to the work plan, the project provided each of the workers with a monthly voucher that could be redeemed for food products at the local retailer shops in the city.

## Impacts of the solution

Through the combined effort of urban reforestation, the establishment of resilient public spaces and the creation of rainwater infiltration basins, drains and cisterns, the speed and scale of water runoff in the community was significantly reduced. This has helped to reduce erosion along the water banks. It is estimated that the total amount of water runoff has been reduced by approximately 5 per cent as the greening of the community allows more water to be absorbed, while the risk of flooding and erosion has been reduced or eliminated for 85 per cent of the houses considered at risk.

The urban gardens and waste composting that were added as part of the project not only cut waste, but also generated livelihoods and enhanced household nutritional capacity. Waste management initiatives prevent drain clogging, reducing water overflow, pollution and the associated risks of disease. The resilient green infrastructure also doubles as public space in the dry season, providing desperately needed community space and amplifying the regenerative impact of the project. The community's involvement in planning and construction has fostered a profound shift in behaviour, with residents taking ownership of drainage and upkeep of the public spaces.

**Figure 1.2: Community engagement and training with local residents**




## Drivers and enablers of the solution

AVSI Foundation's presence in the area since 2013 was crucial in enabling the development of a participatory urban plan with the municipality and community, identifying priorities and defining roles in implementation. This longstanding engagement established a strong foundation of mutual trust and accountability for the local government and community to lead infrastructure management and waste collection initiatives.

WFP has been providing food assistance in Cabo Delgado since 2018, and has been gradually complementing its life-saving support with early recovery and resilience building activities. The collaboration with the WFP, given its wide operational presence and close ties to the affected communities and AVSI Foundation's implementation capacity, facilitated the involvement of 660 people and 30 artisans in the construction of drainage systems over eight months. This deepened community engagement, enhancing climate change awareness and waste management practices.

Furthermore, integrating physical adaptation with land management improvements, supported by AVSI Foundation and WFP's continuous dialogue with the community and local authorities, enabled holistic and widespread action. This synergized approach transformed the neighbourhood's urban and management framework, sparking further urban regeneration. Additionally, the high proportion of female workers on the project empowered family managers and strengthened women's roles in neighbourhood development. The recruitment of both local residents and IDPs also helped to promote social cohesion between host communities and displaced populations.

## Lessons learnt and prospects

The project's design aims for scalability across other Pemba neighbourhoods and Mozambican cities, utilizing affordable, local materials and construction techniques that promote community involvement without reliance on external construction companies. It demonstrates that substantial, complex infrastructure can be developed with limited budgets, community participation and sustainable practices. City technicians and administrators engaged in designing, implementing and maintaining drainage systems, gaining skills for future projects. The local community, trained by 30 local craftsmen under AVSI Foundation's guidance, is now prepared to replicate similar projects in future. The project's technological solutions vary to suit different terrains, ensuring adaptability. A comprehensive manual detailing these elements aids future projects' replication, reinforcing the model's sustainability and impact.

*This case study was submitted by AVSI Foundation and the WFP.*

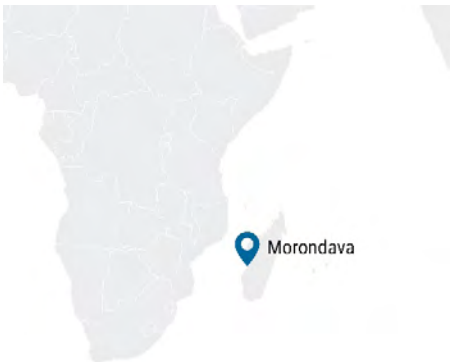
### More information

IOM. (2023, May 26). Mozambique. IOM Displacement Tracking Matrix. https://dtm.iom.int/mozambique#producttabs

02

## Building Urban Climate Resilience in Morondava, Madagascar

**City/Locality:** Morondava
**Country:** Madagascar
**Region:** Sub-Saharan Africa
**Theme:** Climate action and vulnerable populations




### Context

Morondava is a city on the south-western coast of Madagascar. Like many other cities in Africa, the city is urbanizing rapidly, with 45 per cent of the neighbourhoods considered informal, and 25 per cent of the population living under the poverty line. Morondava is situated in the middle of a delta and crossed by two rivers, thus surrounded by water on all sides. This context makes the city vulnerable to storm surges, riverine and swell floodings, coastal erosion, sea level rise and water stress.

This vulnerability is exacerbated by informal urban expansion into low-lying areas, inadequate drainage conditions and inefficient solid waste management. Flooding during high tides has already caused the coastline to retreat by a kilometre over the past decades, resulting in the submersion of city infrastructure and buildings. Mangroves were historically one of the main protections for coastal communities in Madagascar, but as a result of economic stress many mangroves have been deforested as wood for fuel in vulnerable communities. This deforestation reduces flood resilience and has knock-on effects on the local fishing economy, as lowered biodiversity in the mangroves has affected fish stocks.

### Solution developed

Tropical cyclones pose a significant threat to Morondava, exemplified by the impact of Cyclone Chendeza in 2015, which affected 16,000 individuals and led to the displacement of around 3,200 people. In response to these shocks, in 2017 the city of Morondava developed an Integrated Flood Risk Management (IFRM) system that aims to build local capacities and create conditions for communities to live with floods while reducing flood disaster risks.

The first step was the identification of the interventions based on the priority actions of Morondova's City Resilience Framework for Action (RFA) through the application of the Climate Resilience Action Planning (CityRAP) tool (discussed in more detail in case study 8 on Bargny, Senegal). This participatory planning tool helped identify eight key actions to enhance the city's flood risks and disaster response: these included rehabilitation of the mangroves that the city had lost, but also urban greening, strengthening of an early warning system (EWS) for floods, safe haven construction, flood-proof roads to facilitate emergency evacuation, reconstruction of three bridges, increased drainage capacity and improved solid waste management. Four of these actions are highlighted below:

- To enhance flood resilience, the project focused on nature-based solutions (NbS), primarily through the rehabilitation of 182 hectares of mangroves along the coast, in addition to 89 hectares down and upstream of the rivers. For those parts of the water system that ran through the settlement, the project carried out interventions to improve buffer areas and soil stabilization in critical areas prone to flooding. Green buffer areas were developed along a main avenue linking the two sides of the city, which absorbed additional run-off and was also used as the principal evacuation route in case of floods.

- For emergency response, an EWS for floods was strengthened through training of local residents and the deployment of technological solutions. Equipment for rapid emergency evacuation was provided to communities such as canoes, life jackets, flashlights, mobile phones and megaphones. Meanwhile, the project provided computer equipment towards the EWS at the monitoring centre at the University of Morondava.

- The project established a multi-purpose safe haven capable of hosting up to 200 people during emergencies. The haven is powered by solar panels, supplied with pumped water, and furnished with a sheltered outdoor kitchen and laundry area. The haven, the first of its kind in Madagascar, serves as an alternative to schools which were previously relied on, resulting in disrupted learning schedules. The safe haven also functions as a training centre, contributes to reducing carbon emissions through its solar power system, and is accessible for individuals with reduced mobility.

- Lastly, the project constructed flood-proof elevated roads, complemented with drainage channels to divert stormwater and provide a safe passage for citizens during emergency situations. To further ensure the proper functioning, networks of drainage ditches were cleaned and rehabilitated by the community and City of Morondava, ultimately improving the durability of the roads and bridges as well as the waste management system.

## Impacts of the solution

The mangrove rehabilitation enhanced local biodiversity, mitigated flooding and strengthened community engagement. The rehabilitation of mangroves, implemented in 11 communities, generated flood protection benefits for more than 39,000 people. As the residents were involved in the planting of new seedlings, the project also acted as an income-generating opportunity for many families. This urban greening initiative also had social co-benefits, as it integrated two new green public spaces for Mondrova's inhabitants: a children's park and an urban oasis. Besides facilitating emergency evacuation in case of floods, the rehabilitated bridges also had economic co-benefits, fostering development through improved accessibility and mobility.

The rehabilitation of mangroves, implemented in 11 communities, generated flood protection benefits for more than 39,000 people.

The most directly felt city-wide impact has been the strengthening of EWS for floods, which has benefitted the entire population by minimizing and reducing damage. During the passage of Cyclone Cheneso in January 2023, the constructed safe haven was fully occupied and offered shelter to 95 families, composed of 80 per cent women and children. Moreover, the city's improved drainage systems managed to clear water from the streets within one hour.

**Figure 2.1: Community and youth planting mangroves in Lovobe, downstream of Morondava**

**Figure 2.2: Inauguration of one of Morondova's three rehabilitated bridges, improving accessibility within the city and to the rest of the country**

© UN-Habitat/Sandrine Andriantsimietry, 2023

One of the project's most noticeable impacts was the strong involvement of civil society, with residents actively participating in the construction works themselves. This resulted in greater local ownership of the project, enhanced infrastructure sustainability and stronger ties with vulnerable communities.

## Drivers and enablers of the solution

Engagement from the regional Menabe government and the Municipality of Morondava, along with the active involvement of local communities (including vulnerable groups, such as women, elderly persons, youth and persons with disabilities), played a pivotal role in enhancing the resilience of Morondava. Community associations were represented in committees established by the municipality and OXFAM, overseeing infrastructure management and ensuring sustainability.

Resources and support were facilitated by both UN-Habitat and Oxfam, in addition to the Adaptation Fund as the primary donor of the project. This project was also endorsed in both the United Nations Sustainable Development Cooperation Framework 2021-2023 and included in the 2024-2028 cycle in Madagascar, which has acted as a significant enabler to generate support from the local and national governments.

## Lessons learnt and development prospects

The restoration of mangroves in Morondava positions the city as an example of realistic and cost-effective urban climate resilience building in Madagascar. While the focus of the project was on enhancing resilience to climate disaster events, there was greater buy-in from the community through the very tangible co-benefits on livelihood improvement that were generated through the project.

Replication of the project may be challenging due to the unique resources and support provided by UN-Habitat and Oxfam, alongside significant financial backing from the Adaptation Fund. Future development prospects will likely require securing similar partnerships and funding sources to achieve comparable success and impact. Without such support, replication efforts may face substantial obstacles.

*This case study was submitted by UN-Habitat Regional Office for Africa.*

### More information

City of Morondava, UN-Habitat, & DiMSUR. (n.d.). *Plan d'action pour la résilience urbaine: Commune urbaine de Morondava 2017 -2027*. http://dimsur.org/wp-content/uploads/2023/04/MAD_Morondava-RFA.pdf

Gomes, A. (2023, May 10). Building urban climate resilience in south-eastern Africa (Madagascar, Malawi, Mozambique, Union of Comoros)—Adaptation Fund. Adaptation Fund. https://www.adaptation-fund.org/project/building-urban-climate-resilience-south-eastern-africa-madagascar-malawi-mozambique-union-comoros-2/

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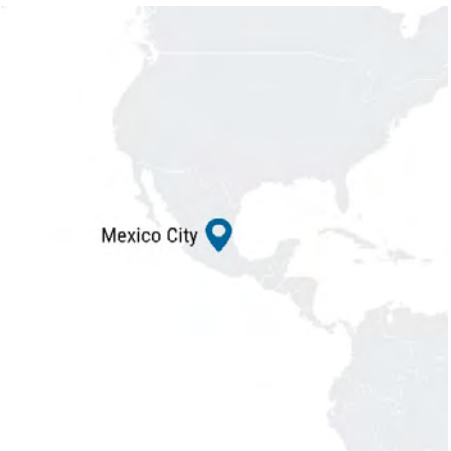
03

## Combating Water Scarcity through Mexico City's Rainwater Harvesting Programme

**City/Locality:** Mexico City
**Country:** Mexico
**Region:** Latin America and the Caribbean
**Theme:** Climate action and vulnerable populations




### Context

Mexico City's water system is supposed to cater to a population of 9.2 million residents, yet almost a third (32 per cent) of residents lack sufficient water for basic necessities. A key factor that makes it difficult to close this gap is the fact that over 50 per cent of the city water must be pumped from external sources, using approximately 570 million kWh of energy, subsequently producing a carbon footprint of 1.16 million t CO2eq annually.

The city currently extracts twice the amount of water from local aquifers that it can naturally replenish, leading to overexploitation and increasing the long-term risk of severe water scarcity. The effects of climate change further exacerbate this situation, as future projections predict a decreased volume of available water for Mexico City.

However, estimates show that the city would have the potential to capture around 443,000$m^3$ and 1,444,000$m^3$ of rainwater annually, representing between 43 to 143 per cent of the city's total water consumption. The Mexico City government realized that if this potential could be leveraged, the city would be in a much better position to address its water scarcity.

### Solution developed

The "Cosecha de Lluvia" (Rainwater Harvesting) programme initiated by the Mexico City government focuses on improving water supply in areas grappling with economic challenges and water shortages by equipping homes with rainwater harvesting systems. In addition to offering greater access to water for families, these provide households with water for residential use between four to seven months of the year, depending on the length of the rainy season and the storage capacity of each system. The programme has placed great importance on the training of residents to use and operate their system by instructing families on optimal water collection and maintenance of the rainwater harvesting system. The system maintenance training is a critical component of the programme, as it can guarantee families continue to receive the benefits of the system for up to 20 years.

The programme commenced in 2019 with the aim of installing 10,000 rainwater harvesting systems annually. In 2022, the programme doubled its annual budget and installed 20,000 systems, and as of May 2024 a total of 68,817 systems had been set up, making the city a global leader in rainwater harvesting. To make this possible, the Mexico City Government allocated 1,418 million pesos (US$7.3 million) between 2019 and May 2024, with an additional budget of 200 million pesos made available in June 2024 to install an estimated 10,000 more rainwater harvesters, bringing the total of the programme to around 80,000.

### Impacts of the solution

A key benefit of the harvesting programme is its contribution to water autonomy. This gives users a sense of ownership and security, while also contributing to the recovery and sustainable consumption of local aquifers as urban demand is reduced. With an installed rain collection system, each household can collect on average 10,000 litres of rainwater annually, though the amount collected is highly dependent on local rainfall, household roof size and frequency of use.

**With an installed rain collection system, each household can collect on average 10,000 litres of rainwater annually**

In addition, the programme has proven gender co-benefits. Generally, women are primarily responsible for carrying and storing water, spending an average of 5.3 hours per week on the task. Post-installation figures indicate that the time they spent on this task reduced by one hour (to 4.3 hours per week). Rainwater harvesting also generates additional environmental and social co-benefits. First, the capture of rainwater by the system acts as a flood control measure as less water enters the storm water drains. Another benefit is that the amount of energy required to pump and transport water to homes is significantly lower as demand from external sources is reduced. Furthermore, the systems actively involve community members in different aspects of water management, including cleaning, care and maintenance of the systems. The systems have also led to improved water quality, helping to lower the incidence of water-borne diseases.

**Figure 3.1: Rainwater harvesting tank, capable of storing almost 1,000 litres of water at a time**


© The social communication unit of the Secretary of Environment of Mexico City

## Drivers and enablers of the solution

The Cosecha de Lluvia programme has put Mexico City at the global forefront of water harvesting. Sustained political support from the Government of Mexico City and the Secretary of the Environment of Mexico City has aided the continuous development of the programme.

The significant upfront capital investment by the Mexico City government has meant the programme could be brought to scale and demonstrates how institutional funding can endorse large-scale applications of ecotechnology. The programme's free training and installation is a significant driver of its uptake among the residents. Furthermore, the rain harvesting programme has been implemented as a public policy to tackle water scarcity, while simultaneously seeking to promote the creation of a culture of sustainable water management that reconnects communities with the water cycle. The involvement of the public ensures that knowledge of the systems is passed through the community and ultimately increases participation.

**Figure 3.2: The time-saving benefits of the rainwater harvesting system**

© The social communication unit of the Secretary of Environment of Mexico City

## Lessons learnt and development prospects

Internal evaluations were conducted among the post-installation households to assess future opportunities. The evaluations emphasized that a maintenance activities list should be implemented for the purpose of equally distributing responsibilities to members of the family to shift the burden of this work away from women. The programme also exemplifies how local governments can lead in climate action.

High installation rates since the creation of the Cosecha de Lluvia programme have proven that government involvement at both the local and national levels, along with public investments, are significant drivers of urban development and resilience. Under the right conditions, other nations can learn from and implement similar strategies.

*This case study was submitted by the Secretary of the Environment of Mexico City.*

### More information

BBC. (n.d.). Mexico City's rain catchers. (n.d.). https://www.bbc.com/storyworks/transforming-cities/mexico-city

04

## Building Climate Resilience through the City Resilience Action Planning Tool in Chókwè, Mozambique

**City/Locality:** Chókwè
**Country:** Mozambique
**Region:** Sub-Saharan Africa
**Theme:** Climate action and vulnerable populations


### Context

Chókwè, a city of approximately 68,000 residents, in Mozambique's Gaza Province, lies along the lower Limpopo River. This location subjects the city to frequent droughts, cyclones, storms and particularly flooding due to its low-lying, flat terrain. The exposure to flooding is compounded by rapid urban expansion, with 60 per cent of the population living below the poverty line. Marginalized and vulnerable groups in unplanned neighbourhoods are the most affected by flooding, with significant impacts on income generation, food security, education and health.

Vulnerability to flooding in Chókwè results from several intersecting urban issues. A poorly functioning drainage system leads to water clogging and overflow of storm water drains. The inadequate disposal of solid waste exacerbates the problem, as refuse dumped in landfills overflows into housing areas and drainage channels during rains and floods, posing significant health and safety risks as well as obstruction to the water drains. Furthermore, the lack of an effective early warning system (EWS), lack of access to safe havens and limited disaster risk management capacities complicate disaster response efforts.

### Solution developed

To address these challenges, which are common to other countries in the Southern African region, an integrated resilience building project was launched by UN-Habitat in partnership with OXFAM International and the governments of Mozambique, Malawi, Madagascar and Comoros to enhance local resilience development with a component of community engagement. The project develops a set of integrated and complementary interventions at the regional, national and local levels. At the local level, the city of Chókwè was selected to benefit from interventions aimed at improving drainage, establishing a local EWS, enhancing solid waste management, and constructing a multi-purpose haven. The project targeted the four most vulnerable neighbourhoods in Chókwè, comprising 46,000 people, selected due to their high exposure to natural hazards and socio-economic vulnerabilities.

The interventions were based on the City Resilience Framework for Action (RFA) for Chókwè developed in 2017 through the implementation of the City Resilience Action Planning (CityRAP) tool, a participatory planning tool designed to facilitate community participation building urban resilience. The planning process involved a wide range of stakeholders, including the municipality, public institutions, community members and the private sector. To mitigate recurrent flooding, the project strengthened the capacity of the city's drainage system by constructing a new hydraulic passage and maintaining the drainage channels in critical neighbourhoods, which was carried out in collaboration with local communities. The construction of two solid waste treatment centres, coupled with the community's adoption of improved waste management practices, significantly enhance the city's ability to manage solid waste efficiently. To enhance disaster response capacity, a local EWS was developed. The core component of this system was the installation of a climate-resilient community radio station to bolster local authorities' ability to anticipate extreme events, with the additional support of megaphones and cell phones.

The rehabilitation of the infrastructure where the radio is located aimed at quickly reclaiming the radio's broadcasting services, especially in times of flood emergency. Taking into consideration resilience-building codes based on ministerial Guidelines on Resilience to Natural Threats, Environmental and Social Safeguards for School Buildings, the roof and its structure were engineered to resist the impact of anticyclones and strong winds. Currently, the building also serves the dual-purpose of a safe haven. As part of the EWS, a multi-purpose safe haven capable of housing 200 people, is being constructed to provide shelter during flood emergencies and serve as a community centre to a secondary school, while an emergency situation is not activated.

**Figure 4.1: Radio Municipal Khindlimuka, the radio station constructed to strengthen Chókwè's EWS**

© Lourenço Nhandoro

## Impacts of the solution

The main impact of the project has been the reduction of damage caused by floods and the overall enhanced resilience of the city. The construction of a hydraulic passage and the purchase of a bulldozer for the continuous maintenance of the drainage channels have reduced the severity of flooding, while the EWS ensures readiness and a better response from the local population when an emergency occurs.

The construction of the two waste management centres, aside from overall wellbeing and benefits to the environment, also generated co-benefits, as they provided job opportunities for women's groups, who manage them and sell separated plastic waste to support local livelihoods.

The construction of a hydraulic passage and the purchase of a bulldozer for the continuous maintenance of the drainage channels have reduced the severity of flooding, while the EWS ensures readiness and a better response from the local population when an emergency occurs.

In total, 68,000 inhabitants, from eight different neighbourhoods, are direct beneficiaries of the waste management and safe haven components.

**Figure 4.2: Chókwè's solid waste management centre**

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## Drivers and enablers of the solution

The project's approach emphasized local and community-owned interventions. A key enabler of the project was the engagement and ownership of local communities. Community members participated in every component of the project, from the CityRAP tool process to the maintenance of drainage systems. The government and UN-Habitat's "Living with Floods" strategy also played a significant role in the project's development, as it paved the way for a more adaptive approach to flood management.

The success of the participatory approach in Chókwè was also supported by institutional actors. The active involvement of the Municipality of Chókwè, the national government and the Technical Center for Disaster Risk Management, Sustainability and Urban Resilience (DiMSUR) enabled strong coordination and knowledge sharing, ensuring effective delivery of the programme at a regional level.

The actions implemented in Chókwè are a sub-component of the project "Building urban climate resilience in south-eastern Africa" (2020-2024), funded by the Adaptation Fund. The Adaptation Fund finances projects and programs designed to help vulnerable communities in developing countries adapt to climate change. This funding opportunity was crucial for the project's implementation as each initiative is tailored to the specific needs, perspectives, and priorities of the participating countries.

A key enabler of climate action in Chókwè was the deployment of the CityRAP tool, which was used in 2017 to identify actions for enhanced urban resilience and helped foster local stakeholder ownership. The tool enables communities to understand and plan actions aimed at reducing risk and building resilience through the development of a Resilience Framework for Action. It offers a step-by-step participatory resilience planning methodology that includes a set of training exercises and activities targeting municipal authorities, communities and local stakeholders.

## Lessons learnt and prospects

Mozambique's vulnerability to climate change and natural hazards, such as recurrent cyclones and flooding, underscores the importance of community involvement in climate adaptation measures to ensure sustainability. The project demonstrated the use of the CityRAP tool, which has the potential to be used for training city managers and municipal technicians in small- to intermediate-sized cities across Sub-Saharan Africa. Its step-by-step methodology allows it to be replicated in a diverse range of contexts and be adapted to local circumstances.

The strong involvement of national counterparts in Chókwè's interventions helped leverage lessons learned. By facilitating knowledge exchange, DiMSUR promoted cross-fertilization between cities and countries. This project has also encouraged the development of nationwide regulations to enhance climate resilience and climate change adaptation. The people-centred approach and the implementation of an EWS have the potential for nationwide expansion and enhancement, setting a model for other regions facing similar challenges.

*This case study was submitted by UN-Habitat Regional Office for Africa.*

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# Case studies on the role of urban planning and design for climate action

05

## Belén: Costa Rica's First "Sponge City"

**City/Locality:** Belén
**Country:** Costa Rica
**Region:** Latin American and the Caribbean
**Theme:** The role of urban planning and design for climate action


### Context

Belén is a small city within the Greater Metropolitan Area of Costa Rica, located at the lowest altitude of the regional basin. During Costa Rica's rainy season, Belén becomes vulnerable to flooding from overflowing rivers, a situation exacerbated by the runoff that comes from other counties at higher altitudes and unplanned urbanization. Hundreds of houses, commercial and service establishments, as well as road infrastructure, have been lost over the past 20 years as a result of flooding. These challenges have pushed Belén's local government to plan for an integrated, comprehensive solution that addresses climate impacts while adapting the city's public spaces and networks through nature-based solutions (NbS).

### Solution developed

To address Belén's flooding issues, the city developed a Municipal Risk Management Plan, which modelled geospatial, hydrological and geotechnical risk to enable robust and comprehensive decision-making. To implement the plan, in 2020, the Municipality of Belén opened a public bid to develop data-driven studies and project design and implementation. The winning proposal centred on transforming Belén into Costa Rica's first Sponge City, through the integration of the city's hydrological cycle with a myriad of NbS that provide ecosystem services to the city.

The resulting NbS are focused on restoring the hydrological functioning of the region by creating a network of blue-green spaces for hydrological management that promote better infiltration and evaporation of water. This network is composed of a larger linear or fluvial park and four smaller interventions called satellites: these are located in public spaces with a high share of impervious surfaces that exacerbated floods, overflows and runoffs.

The approach to NbS in Belén illustrates an example of urban acupuncture, an approach to urbanism in which small and targeted interventions are leveraged for larger impact as part of a network of interventions, with the explicit aim of catalyzing further transformations within and beyond the network. In the case of Belén, these work together to provide ecosystem services for the community, while catalyzing improvements in the social fabric of the neighbourhood though additional public space.

## Impacts of the solution

The various acupuncture NbS have together enabled the management of 35 per cent of the entire city's surface water runoff, which has reduced the impact of floods on. houses and other private properties. This offers significant co-benefits in terms of higher property values. Furthermore, the enhancement of public spaces through improved material conditions led to a significant decrease in the need for investment in the maintenance and repair of public spaces.

Overall, a greater sense of ownership was evident among local residents, leading them to respond better to climate conditions and the needs of the population. Additionally, an improvement in people's perception of the aesthetics and general integrity of the public spaces was also noted. The interventions further improved awareness among residents, the local government and the private sector regarding the value of investing in green infrastructure to support public safety, the integrity of ecosystems and the protection of heritage.

**The interventions improved awareness among residents, the local government and the private sector regarding the value of investing in green infrastructure to support public safety, the integrity of ecosystems and the protection of heritage.**

**Figure 5.1: Detail of permeable surface for hydrological control in local park, Belén**

© Blackwaters

## Drivers and enablers of the solution

Repeated flooding, particularly during 2007 and 2015, was an important call to action for the Municipality of Belén. The local government and residents saw with their own eyes the importance of developing the right solutions on the ground. They also became convinced that solutions to flooding had to be thoroughly data-based and technically robust. An extensive hydrological analysis and modelling exercise was carried out before the NbS solutions were designed and ultimately implemented. Such detailed analysis and modelling helped build credibility and public trust in the local government and implementing partners.

The transformation in Belén can be traced back to a much broader, country-wide commitment to environmental stewardship in Costa Rica. Leadership at the national level, demonstrated through the country's vast protected areas and widespread deployment of renewable energies, has helped to encourage local actors to take climate action too. Belén's new approach to flooding is centred around the country's main asset: its nature.

## Lessons learnt and development prospects

Belén is only one of the 31 local governments that compose Costa Rica's Greater Metropolitan Area, and therefore there is the need to extend the logic of hydrologically centred NbS to the broader metropolitan region. In this sense, the approach of urban acupuncture applied in Belén can be scaled up to multiple satellites and larger fluvial or linear interventions along the region's rivers, creeks and springs. As steps forward, several mayors from Belén's neighbouring counties have met to explore intermunicipal solutions for NbS on a larger scale. The nearby counties of Heredia, Flores and San Pablo have already designed similar types of solutions, which are expected to be implemented soon.

Furthermore, the impact of NbS is dependent on several complementary actions that should be considered in Belén and other cities. First, mandating zoning ordinances (*plan regulador*) that define land use regulations consistently across all of Costa Rica's jurisdictions can help to ensure compatible land uses in areas that are adjacent or proximate to ecologically sensitive places, as well as to enable complementary blue-green infrastructures. Second, environmental stewardship relies on access to environmental education tools and programs that provide skills and knowledge for the support and sustainability of NbS solutions. Third, as hydrological processes cross different jurisdictions, effective regional NbS relies in local governments to create alliances with each other to consolidate an intermunicipal, basin-scale approach to planning.

*This case study was submitted by the Municipality of Belén and Blackwaters.*

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06

## Using Urban Labs to Integrate Climate Action with Informal Settlement Upgrading in Buenos Aires, Argentina

**City/Locality:** Buenos Aires
**Country:** Argentina
**Region:** Latin American and the Caribbean
**Theme:** The role of urban planning and design for climate action


### Context

In cities with a large proportion of informal settlements, a central element in reducing climate risk is community upgrading. Many climate-related hazards such as heatwaves and flooding tend to lead to significantly greater impacts in informal settlements compared to the rest of the city, particularly in contexts where housing is poorly constructed and basic services such as water, sanitation and solid waste management are lacking. In Argentina, approximately 5 million people live in these settings, characterized by overcrowded forms of housing, with a lack of basic services, deficient thermal insulation, and insufficient ventilation and/or lighting.

A case in point is Villa 20, a settlement with roughly 30,000 inhabitants, located in the city of Buenos Aires. While the links between informal settlements and climate vulnerability are increasingly recognized, upgrading still often takes place without a climate resilience lens, and there remains a lack of accessible examples available to local practitioners on how to integrate climate action within urban upgrading processes. Until recently this was also the case in Villa 20, as the settlement was increasingly dependent on conventional grey infrastructure, and at the same time had missed opportunities to achieve a just and sustainable transformation.

### Solution developed

In 2021, as part of the Transformative Urban Coalition (TJC), funded by the International Climate Initiative (IKI), an urban lab was set up in Villa 20 to promote behavioural shifts among local actors. The Urban Lab explores practical examples of how climate action can be integrated in contexts of urban informality. A wide variety of actors participated in the Urban Lab, co-designing ideas for interventions that were then carried out by community organizations and local cooperatives. These activities generated income opportunities and training while strengthening the TUC.

The solution developed through the Urban Lab consisted of several interlinked components. First, a temperature and humidity monitoring system was installed to generate accurate data to compare Villa 20 with other neighbourhoods.

The data was then collected and analyzed in partnership with trained residents and informed four pilot interventions, including vertical gardens and vegetated pergolas using native plants, rain gardens, tree planting, and retrofitting paved surfaces with permeable materials. Through community engagement, a manual was developed aiming to help residents to retrofit their houses to adapt them better to extreme temperatures.

Cross-city exchanges and a variety of training and awareness raising activities have supported the Urban Lab and the implementation of the four pilot projects.

**Figure 6.1: View of Villa 20 and new housing**



## Impacts of the solution

The interventions have contributed to reducing $CO_2$ emissions as a result of the increase in vegetation coverage in two distinct ways. The new vegetation (trees, climbing plants, shrubs and herbaceous plants) directly captures $CO_2$, but the newly shaded public spaces and replacement of impermeable surfaces also produce a cooling effect that reduces the demand for thermal conditioning in summer, resulting in improved health, energy savings and avoided emissions. A pedestrian survey undertaken after implementation showed that 75 per cent respond positively to interventions, indicating they walk more slowly and appreciate the greening of the local environment.

The new vegetation directly captures $CO_2$, but the newly shaded public spaces and replacement of impermeable surfaces also produce a cooling effect that reduces the demand for thermal conditioning in summer, resulting in improved health, energy savings and avoided emissions.

Significantly, community organizations have taken ownership of interventions and the four pilot projects have sparked further interventions by residents. The Institute of Housing of the City of Buenos Aires (Instituto de Vivienda de la Ciudad—IVC), which had been working in the neighbourhood since the early 2000s, has started to integrate the greening interventions within their overall approach to informal settlement upgrading.

## Drivers and enablers of the solution

The Urban Lab in Villa 20 benefitted from an ongoing participatory process between the residents and IVC), which had been working in the neighbourhood since the early 2000s. Most recently, from 2016 onwards, the IVC established a multi-stakeholder decision-making space called the Participatory Management Table to overcome scepticism within the community—stemming from a lack of response from the local government in the past—and ensure greater involvement in the decision-making processes. With these structures already in place, it was easier to incorporate the additional climate change lens into these participatory processes.

**Figure 6.2: Vegetated pergolas, flower beds and benches in schoolyard**

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The integration of climate considerations into informal settlement upgrading was enabled by a broader commitment by the city government to create a resilient, inclusive and carbon-neutral city by 2050. Different city offices are looking more closely into the impacts and potential solutions of climate change on informal settlements. Buenos Aires has had a Climate Change Action Plan in place since 2009, and the activities in Villa 20 fitted well into this vision. While funds were provided by the IKI, they were managed by a local NGO and the community, which has been critical to generating buy-in and enhancing capacities within the community.The integration of the TUC and its Urban Lab into the ongoing slum upgrading process helped to generate synergies and innovative solutions, enhancing the participatory process and its outcomes. Constant dialogues and Urban Lab meetings throughout the process helped develop capacities among all members of the Lab (including community leaders, city teams, professionals participating and the TUC team). The process encouraged flexibility and openness in the co-designed solutions.

## Lessons learnt and development prospects

Embracing public space interventions that increase vegetation coverage, as well as low-carbon building practices, can allow low-income neighbourhoods to "leapfrog" less efficient development trajectories. The integration of climate action in lower-income urban contexts and urban upgrading processes should become the norm, not the exception.

**Figure 6.3: Vertical gardens and planters in a recently opened alleyway in Villa 20**

© IIED—America Latina, 2024

Several key lessons were learnt through the Urban Lab. First, when working in local communities, it is important to prioritize local needs when planning climate initiatives. Access to data and information for all actors, in appropriate languages and formats to enhance participation, is key in this regard to enable informed decision making. It can help to unpack complex social and environmental problems into smaller packages that are more easily approachable by the community.

There is a wealth of experiences across informal settlements, but in practice this knowledge is still not widely shared. Applying climate action in informal settlements necessitates acknowledging the time, resources (human and financial), training and commitment needed to ensure participation and build a diverse coalition of actors that can sustain transformative processes over an extended timeframe.

Solutions need to address climate adaptation and mitigation while simultaneously alleviating the urgent everyday needs informal settlements face. The projects should also be co-designed and implemented by the community themselves to ensure they are locally appropriate, affordable, easily replicable, and generate immediate impacts to ensure the buy-in of all those involved in the project.

*This case study was submitted by the Instituto Internacional de Medio Ambiente y Desarrollo, IIED—América Latina.*

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07

## Improving Living Conditions in Marginalized Neighbourhoods in Amman

**City/Locality:** Amman
**Country:** Jordan
**Region:** Northern Africa and Western Asia
**Theme:** The role of urban planning and design for climate action


### Context

East Amman faces an acute shortage of urban infrastructure and inadequate public open spaces. Often, locals are faced with challenges in accessing essential urban services, such as waste management or healthcare, due to these services being far away or non-existent. The lack of infrastructure makes the population more vulnerable to climate impacts, including heat waves, air pollution and flooding. This results in negative socio-economic impacts such as decreased social interactions, environmental risks and further difficulty in accessing urban services and facilities. Additionally, the absence of greenery or well-connected sidewalks in East Amman undermines residents' quality of life and health.

### Solution developed

The project "Improving Living Conditions in Disadvantaged Areas" focuses on the creation and revitalization of public open spaces, increasing connectivity to public transport systems as well as sensitizing people about the significance of green infrastructure in climate change adaptation. During implementation, the project strengthened community engagement by addressing gender-specific needs, with the aim of reducing the social costs of global warming hazards while fostering social cohesion, thereby enhancing overall urban welfare through capacity building.

One of the components in this project is the Urban Micro-Lungs initiative, a green infrastructure intervention that helps to enhance the standard of living in underprivileged neighbourhoods while combatting habitat loss. The restoration of natural ecosystems in East Amman was undertaken through the Miyawaki approach: this method entails the reforesting of an area using native vegetation, mixing topsoil with organic materials for soil recovery, to hasten the growth processes required for the development of self-sustaining forests. Through this method two native, hyper-dense, biodiverse and multi-layered urban forests were established, which have been designed to reduce heatwaves, lower air pollution linked with carbon emissions, promote diversity in plants and animals, as well as strengthen resilience against droughts.

The project is grounded in community involvement, with a special emphasis on gender-responsive planning. To this end, capacity building programs enable local authorities to sustainably manage green spaces over the long term. The activities have also contributed to improved awareness among policy makers and the general public of the role of green infrastructure in promoting climate resilience, social inclusion as well as the attainment of national and international development objectives.

**Figure 7.1: Participatory workshop with community members in East Amman**




## Impacts of the solution

The participatory planning approach has empowered local residents and municipal staff with a sense of ownership and involvement in urban planning, enhancing social cohesion and community engagement. Together with the implementation of green infrastructure, quality of life and mobility in the targeted neighbourhoods have also improved, thereby increasing accessibility and creating places for communities to connect.

Urban forest restoration, applying the Miyawaki method, provides a model of scaling up that is relevant for boosting biodiversity conservation and mitigating environmental hazards while encouraging sustainable urban development. During the implementation, a guidebook for plant species selection was developed as an offshoot from the project, facilitating knowledge sharing and capacity building beyond the scope of the project. Several other cities have expressed interest in the project, raising the possibility of replication in other urban areas, further amplifying its impact.

Urban forest restoration, applying the Miyawaki method, provides a model of scaling up that is relevant for boosting biodiversity conservation and mitigating environmental hazards while encouraging sustainable urban development.

## Drivers and enablers of the solution

This pilot project was enabled by a partnership between the German Federal Ministry for Economic Cooperation and Development, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the Ministry of Environment and the Greater Amman Municipality. This collaborative framework ensured that each organization's goals were aligned with one another, experiences were shared and resources used effectively. The collaborations allowed for funding to support the initiative, supplying US$2.2 million in initial investments. Additionally, the project's approach to policy support is aided by favourable policies at both the national and local levels to encourage the integration of green infrastructure into urban planning strategies. This is primarily due to the alignment of the project with national development goals such as the Sustainable Development Goals and Nationally Determined Contributions, allowing for replication in different cities. The inclusion of the public through community participation and capacity building, particularly women, has also been fundamental in securing acceptance of the initiatives implemented in pilot sites.

**Figure 7.2: Improved mobility infrastructure, activity pods and greenery in Mahmoud Al-Qudah Park**



## Lessons learnt and development prospects

From the project, some factors contributing to the initiative's scalability and replicability were identified. As the project strongly relies on public participation, when replicating similar projects in other contexts, the solutions implemented in their city must be tailored to meet the inhabitants' specific requirements there. These are likely to vary significantly in different cultures and geographical locations.

The development of the guidebook on plant species selection provides a practical resource for city officials, landscape architects and designers, aiding the replication of green infrastructure projects in other cities. In addition, the adoption of the Miyawaki method for the urban forest restoration provides a scalable solution to enhance native biodiversity as well as address environmental challenges within compact urban areas. Lastly, capacity building programs assist partners in developing similar initiatives on greening cities by incorporating these activities into comprehensive urban design and planning strategies.

*This case study was submitted by the Greater Amman Municipality.*

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08

## Development of a City Resilience Framework for Action in Bargny, Senegal

**City/Locality:** Bargny
**Country:** Senegal
**Region:** Sub-Saharan Africa
**Theme:** The role of urban planning and design for climate action


### Context

Bargny, Senegal, exemplifies the intersection of environmental degradation and socio-economic vulnerability in coastal cities. Located just southeast of Dakar, Bargny's 51,000 residents are increasingly exposed to severe risks exacerbated by both natural and human-induced factors. One of the most pressing concerns for Bargny is coastal erosion, which has accelerated in recent years, with the coastline retreating by 3 to 4 metres annually. The erosion not only displaces communities but also threatens their primary source of livelihood—fishing. With almost three-quarters (73 per cent) of the working population engaged in the fishing sector, the physical loss of coastal land and the decline in fish stocks due to environmental changes have had devastating impacts on the local economy and food security.

Flooding is another significant issue, exacerbated by inadequate infrastructure, such as poor waste management systems and underdeveloped sewage facilities. These shortcomings lead to frequent inundations that not only displace residents but also contaminate groundwater, making access to clean water increasingly difficult.In addition to natural environmental challenges, the presence of highly polluting industries within Bargny further threatens the health and well-being of its inhabitants. This in turn exacerbates the city's already precarious living conditions, particularly for the most vulnerable groups who often have the least capacity to adapt.

### Solution developed

The lack of comprehensive urban planning and infrastructure development has left Bargny ill-equipped to handle these growing challenges, further entrenching poverty and vulnerability. Bargny, like many cities in Africa, faces a multitude of climate-related issues and it can be difficult to identify the most pressing issues to address first, especially in a context of scarce technical, financial and human resources. In response, Bargny has taken significant steps toward enhancing its urban resilience through the implementation of the City Resilience Action Planning (CityRAP) tool, a participatory methodology developed by UN-Habitat. The municipality utilized this tool to create a City Resilience Framework for Action (RFA), which outlines a series of priority actions designed to strengthen urban resilience over short-, medium- and long-term horizons, with a specific focus on participation of the population and of all actors of the city, from the conception to the implementation of the RFA. This inclusive process involved 192 key stakeholders including representatives from vulnerable communities, municipal staff, non-governmental organizations, civil society organizations, students, the military and intergovernmental organizations.

The CityRAP methodology was implemented in four phases:

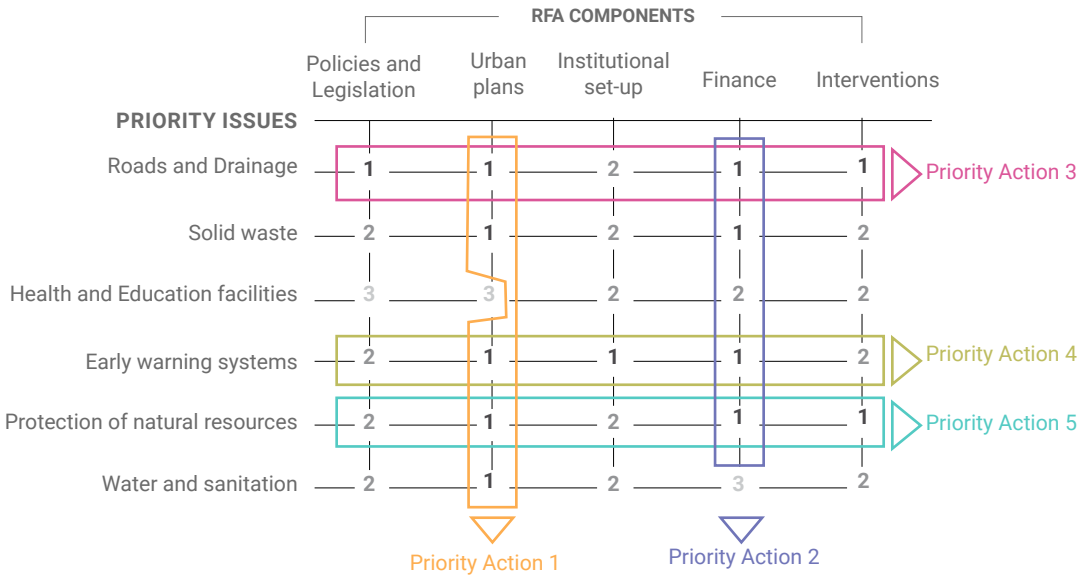
- *Crash course on urban resilience and risk mapping:* The process began with a one-week workshop that provided participants with training on urban resilience concepts and disaster risk management. Participants also engaged in risk mapping exercises to identify significant urban risks in Bargny, including issues related to water access, sanitation, waste management, the presence of heavy industries and climate-related hazards.

- *Data collection, municipal self-assessment and participatory mapping:* This phase involved gathering data to create a comprehensive city risk profile. Through municipal self-assessment and participatory mapping exercises, the gaps in the municipality's current capacities were identified, along with the priorities for enhancing urban resilience at the neighbourhood level.

- *Data analysis and prioritization:* In this phase, stakeholders engaged in in-depth focus group discussions and a participatory prioritization workshop. The collected data were analyzed to identify and prioritize actions that would be most effective in enhancing urban resilience.

- *Development and validation of the RFA:* Based on the data and insights gathered an action plan was developed that included six priority actions and detailed, feasible activities. The RFA was then validated in January 2024 during a workshop that played a crucial role in the endorsement and dissemination of the consolidated strategy, with local, national and international stakeholders.

**Figure 8.1: Proposed priority actions identified through the CityRAP methodology**




Source: UN-Habitat & DiMSUR, 2020

## Impacts of the solution

The City Resilience Framework for Action in Bargny represents a significant stride towards urban resilience. While the framework has not yet resulted in action on the ground, this climate-smart and cross-sectoral planning document serves as a foundation for community engagement and resource mobilization. By fostering a sense of ownership among local authorities and civil society, the process has also enhanced their capacity to implement urban resilience and climate adaptation measures effectively, as four municipal focal points were trained and led the CityRAP process, and are now equipped to train other people.

The inclusive and participatory nature of the CityRAP process ensures that the resulting strategies are well-aligned with the needs and priorities of the most vulnerable communities in Bargny, making it a model for similar urban resilience efforts in other cities facing climate-related challenges. The resulting action plan also serves as a robust base for the municipality's technical commission's annual work plans and budget, as well as an essential fundraising instrument, helping to secure financing for the prioritized actions to enhance the city's resilience. The CityRAP tool has led to the development of actionable strategies that address the unique vulnerabilities of each city while enhancing the capacity of local governments and communities (see Figure 8.2).

The resulting action plan serves as a robust base for the municipality's technical commission's annual work plans and budget, as well as an essential fundraising instrument, helping to secure financing for the prioritized actions to enhance the city's resilience.

**Figure 8.2: Priority actions and proposed activities for Bargny that emerged from the application of the CityRAP tool**

| Priority actions | Activities |
|---|---|
| **Priority Action 1: Urban Plans**<br><br>Elaborate integrated urban plans for the most vulnerable areas of the city that focus on the identified priority issues and are coherent with existing plans. | Activity 1.1: Conduct road condition surveys in the district and identify roads and drainage systems to be improved/constructed (in collaboration with the department responsible for solid waste management because of obstructions caused by solid waste accumulation in the drainage channels) (linked to Action 3).<br>Activity 1.2: Draft a comprehensive road and drainage plan, with a specific focus on local development plans for vulnerable areas. Ensure the overall plan complies and is in line with the master plan (linked to Action 3).<br>Activity 1.3: Identify and locate key solutions, e.g., design escape ways for emergencies, adapt green infrastructure design, etc. (linked to Actions 4 and 5). |
| **Priority Action 2: Finance**<br><br>Improve the coordination of finance among different concerned departments in order to increase the budget available for roads and drainage, solid waste, early warning systems (EWS) and protection of natural resources. | Activity 2.1: Establish an improved coordination mechanism among different municipal departments for better budget allocation.<br>Activity 2.2: Set up a finance plan to collect revenues from the use of the dump site (to support costs related to solid waste management).<br>Activity 2.3: Introduce local parking fees to support the costs for the improvement of roads and drainage (linked to Action 3).<br>Activity 2.4: Introduce penalties for non-compliance in building plans and disposal of solid waste.<br>Activity 2.5: Improve the market and bus station infrastructure to increase the municipal revenue base. |
| **Priority Action 3: Roads and Drainage**<br><br>Formulate municipal policies, by-laws and local development plans that allow better management of roads and drainage. | Activity 3.1: Conduct a review of road and drainage policies and legislation to identify relevant gaps and barriers.<br>Activity 3.2: Draft the implementation of higher-level roads and drainage policies at local level and, in collaboration with relevant departments, formulate additional policies (if needed) that support implementation of related plans and local development plans.<br>Activity 3.3: Ensure that road and drainage plans are included in the master plan and prepare at least two local development plans to improve roads and drainage within informal settlements (linked to Action 1).<br>Activity 3.4: Construct/improve roads and drainage in a resilient manner, prioritizing the implementation of at least two local development plans within informal settlements. |
| **Priority Action 4: Early Warning Systems**<br><br>In collaboration with the relevant municipal departments, and in coordination with responsible national and sub-national entities, elaborate an EWS plan for the city. | Activity 4.1: Consultations with the responsible entities at national and sub-national levels to design a EWS at city level.<br>Activity 4.2: Establish a municipal committee on EWS, including community representatives.<br>Activity 4.3: Set up a unit within an existing municipal department to deal with early warning and disaster response issues.<br>Activity 4.4: Include early warning and disaster response in the municipal budget (linked to Action 2).<br>Activity 4.5: Carry out sensitization and training on disaster risk and response, also related to EWS.<br>Activity 4.6: Identify and establish safe havens (linked to Action 1). |
| **Priority Action 5: Protection of Natural Resources**<br><br>Identify sensitive natural ecosystems that need to be protected and design locally adapted solutions that reduce the risk of disaster. | Activity 5.1: Sensitize communities on the importance of natural ecosystems and the need to protect them.<br>Activity 5.2: Review existing municipal bylaws for protecting sensitive natural ecosystems.<br>Activity 5.3: Empower communities to better manage these ecosystems and facilitate the identification of income generation.<br>Activity 5.4: Implement reforestation and afforestation programs with the communities (linked to Action 1). |

Source: UN-Habitat & DiMSUR, 2020

## Drivers and enablers of the solution

The application of the CityRAP tool in Bargny was enabled through long-term engagement on issues on urban resilience by the Sahel Resilience project, which operates in seven countries in the Sahel region. This initiative, supported by UN-Habitat, UNDP and the Government of Sweden, highlights the importance of cross-regional collaboration and adaptability in enhancing urban resilience across diverse contexts. It has been instrumental in advancing the agenda of urban resilience in the Sahel region, particularly through the implementation of the City Resilience Action Planning (CityRAP) tool in cities like Bargny, but also in other countries like Burkina Faso. By selecting cities of appropriate size and securing government support, the Sahel Resilience project was able to establish a solid foundation for successful implementation.

An important component of the CityRAP tool is the dissemination of knowledge through the Training-of-Trainers model. This approach built local capacity by ensuring that the knowledge and skills acquired could be further shared, amplifying the project's impact.

To enable inclusive and relevant participation, all stakeholder groups needed to be represented. It is critical especially during the city-wide risk mapping that community representatives are present as the inclusion of diverse voices, from different genders and age groups, enriched the planning process, leading to more comprehensive and inclusive outcomes.

The political support garnered by the initiative was also critical in mobilizing resources and ensuring the successful implementation of CityRAP in these cities. The presence of focal points within the municipality of Bargny was crucial for the effective coordination and implementation of the CityRAP initiatives.

## Lessons learnt and development prospects

The successful engagement of the municipality and communities in Bargny has been a pivotal factor in the effective implementation of the City Resilience Action Planning (CityRAP) tool. The active participation of key stakeholders, especially the most vulnerable communities, allowed local knowledge and perspectives to be integrated into planning activities, resulting in tailored, feasible solutions to enhance Bargny's urban resilience.

The CityRAP tool is designed to be adaptable, making it suitable for implementation in small- to medium-sized cities or in districts with populations under 250,000 inhabitants. Its flexibility allows it to be tailored to various local contexts and climate vulnerabilities. By fostering inter-municipal cooperation and leveraging the capacity built through the Training-of-Trainers, the CityRAP tool can be effectively expanded to other municipalities in the Petite Côte and beyond. Additionally, CityRAP can focus on specific lenses, such as climate adaptation, and can be integrated into larger national projects, including data collection or planning for National Adaptation Plans.

*This case study was submitted by UN-Habitat Regional Office for Africa.*

### More information

DiMSUR. (n.d.). CityRAP Tool. https://dimsur.org/3-cityrap-tool/

UN-Habitat & DiMSUR. (2020). CityRAP tool: City Resilience Adaptation Planning Tool. https://unhabitat.org/sites/default/files/2020/05/cityrap_tool_booklet_2020.pdf

09

## Tagum CityWalk: Increasing the Climate Resilience of Tagum City

**City/Locality:** Tagum City
**Country:** Philippines
**Region:** East and South-Eastern Asia
**Theme:** The role of urban planning and design for climate action


### Context

Tagum City is located in the Davao del Norte Province and is an important centre for regional trade, business opportunities as well as government services. Against a backdrop of continuous economic development and growing demand for space, the city has undergone rapid urban development. This has resulted in the widespread prevalence of concrete and asphalt, a lack of tree cover within the city core and limited public spaces for residents to use.

As a result of these overlapping issues of urban development and climate change, people living in or using the Central Business District (CBD) are experiencing high levels of urban heat stress and are at increased risk of flooding. Based on climate change projections, temperatures in Tagum City are projected to increase by as much as 2.3 to 4.2 degrees Celsius by the mid- and late-21st century, respectively. Conventional urban design practices may trigger a further warming of the CBD, leading to a number of negative impacts on human health, greater dependence on motorized transportation and increased use of electricity for cooling.

To mitigate the adverse effects of climate change and urban development, the city developed a broad city-wide climate adaptation strategy. Guided by an ecosystems-based approach to urban planning and strong stakeholder participation, this strategy generated the interest, knowledge and skills required for implementation of climate-resilient solutions on the ground. Following the revisions of the city's policy framework to support climate-resilient development, the city spearheaded the development of the Tagum CityWalk project as an urban design pilot project to demonstrate the impact on mitigating extreme temperatures and pluvial flooding.

### Solution developed

The main objective of the Tagum CityWalk is to introduce holistic and integrated urban design solutions to enable vulnerable communities and businesses to be climate resilient and sustainable. While the project involves various components, ranging from flood adaptation to cycle infrastructure and housing, they are all part of the same integrated plan and are mutually reinforcing.

Within the CBD, such as in the Trade Center Area, flood management strategies included increasing the water permeability of built areas and improving drainage design through green roofs, urban gardens, shading devices and permeable grounds. Further measures included wet floodproofing of critical structures by redirecting floodwater to unoccupied and uninhabited parts of the urban fabric. Key social infrastructure, like the Rizal Elementary School, were identified as ideal places to add green spaces and urban agriculture for the many children that use these spaces. Not only were these adaptations for flood management, but also played a role in enhancing Tagum's rainwater harvesting and reducing the urban heat island effect.

The Magugpo Creek is an important part of the city water network, and therefore a central component of the city's response to flooding. Many people live alongside its banks in informal settlements. The approach to the rehabilitation of Magugpo Creek combined a redesign of the creek into a tree-lined corridor and adaptive parks, so that it could better serve its role as a natural flood management system, with in-situ housing improvements using climate-resilient materials for communities situated there.

These interventions are thus not only adaptive, but also transformative: setting the city on a course to become low-carbon while addressing structural inequalities. Another transformative component is the extensive improvement of the city's network of pedestrian walkways and cycle infrastructure, which have now been lined with trees to provide shade and evaporation for the people using them. The integration of these non-motorized means of transport helps generate the conditions for a modal shift towards more sustainable means of transportation, while improving the mobility of residents and their access to these newly developed and enhanced green spaces.

**Figure 9.1: Map highlighting key components of the Tagum City Adaptation Strategy**


Source: City Government of Tagum, in UN-Habitat et al., 2022

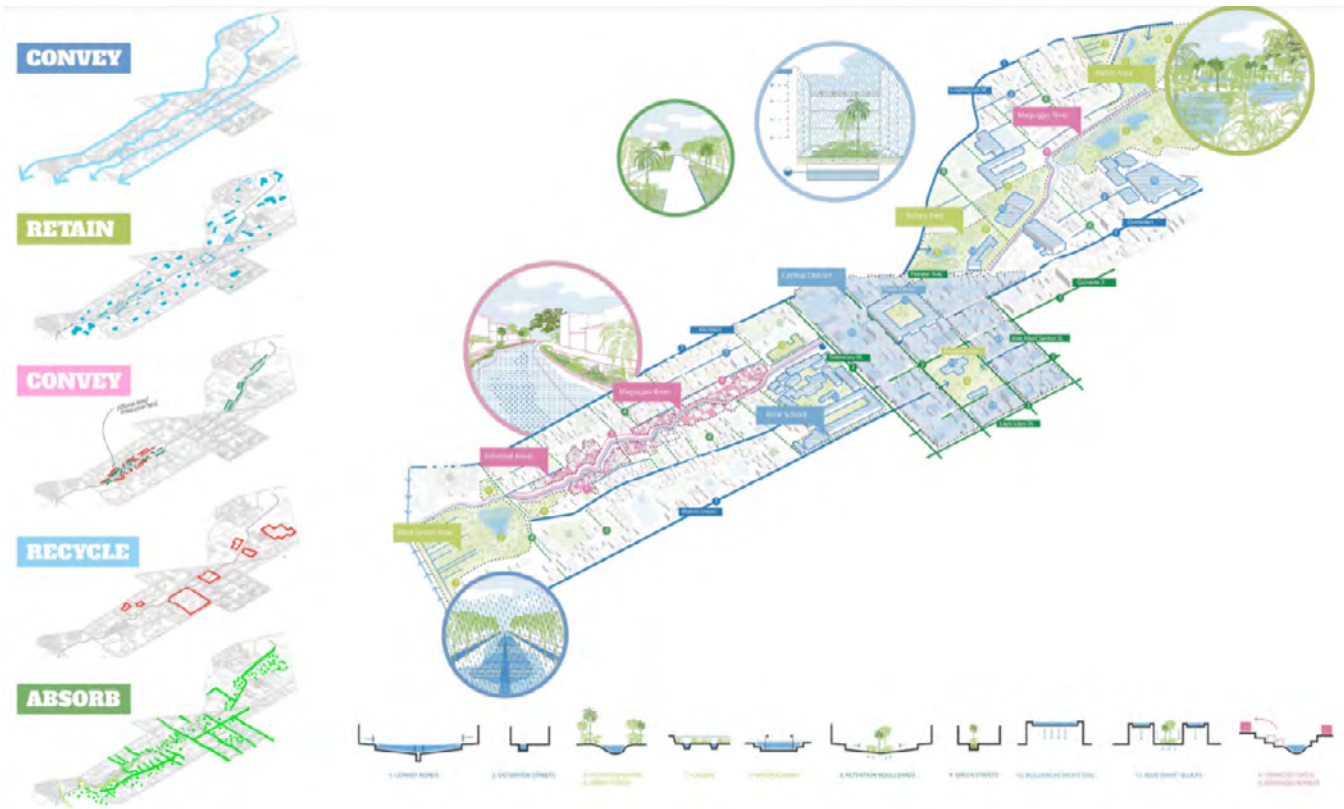
## Impacts of the solution

The Tagum CityWalk has generated significant impact, particularly in enhancing the micro-climate of the city through alleviated heat stress and reducing flooding during periods of heavy rainfall. The implemented solutions also improved infrastructure for pedestrians and cyclists, which in turn promoted enhanced mobility. Furthermore, the creation of green spaces improved public health and overall well-being by promoting physical activity, as well as assisting in the capture of greenhouse gas emissions.

Additional co-benefits included the encouragement of small businesses, a rise in land value and increased social mix. It is estimated that the project directly benefitted 739 families living in informal settlements including 1,823 youth, 1,034 elderly persons, 113 persons with disabilities and 3,278 mobile vendors. The climate resilience actions contributed to the city's post-COVID-19 green recovery, further enhancing the project's impacts.

The Tagum CityWalk has generated significant impact, particularly in enhancing the micro-climate of the city through alleviated heat stress and reducing flooding during periods of heavy rainfall. The implemented solutions also improved infrastructure for pedestrians and cyclists, which in turn promoted enhanced mobility.

**Figure 9.2: Axonometry of Tagum CityWalk**




Source: City Government of Tagum, in UN-Habitat et al., 2022

## Drivers and enablers of the solution

The main enabler of the project was access to finance through city and national government funding support. An amount of 3.4 million USD was initially accessed and utilized by the city to start the phased implementation of the CityWalk Project. The city pursued internal budget allocation and financing from various streams to complete the implementation of the project.

Aside from funding, the project's successful implementation was also enabled through climate and disaster risk assessments, which allowed for data-driven processes and decision-making. Additionally, multi-stakeholder participation during the capacity needs assessment and the subsequent community-based monitoring system ensured inclusivity during the design process, ultimately bringing a sense of responsibility to the local population. Moreover, alignment with broader city land use and sectoral plans and investment programming further enabled the success of the project.

## Lessons learnt and development prospects

The initiative is part of the broader long-term development of the city. As the Tagum CityWalk involved many complementary components, the project applied a phased approach to its implementation. The project was carried out by breaking it down into stages, with timings based on urgency, the practicality of securing necessary financing and the required order of implementation, ensuring that each phase built upon the previous one. This approach allowed for efficient resource allocation and the seamless progression of people involved in the project.The project has potential to be scaled up in other areas of Tagum City and to be replicated in other cities in the Philippines. To capture some of the lessons and insights, a "Climate Resilient Urban Planning and Design Guide" was developed, which is currently being promoted by the Philippine Department of Human Settlements and Urban Development (DHSUD).

*This case study was submitted by UN-Habitat Philippines.*

## More information:

UN-Habitat, Department of Human Settlements and Urban Development Philippines & Climate Change Commission Philippines. (2022). Path to climate resiliency: Case studies of cities in the Philippines. UN-Habitat. https://unhabitat.org.ph/wp-content/uploads/2022/06/Path-to-Climate-Resiliency-Case-Studies-of-Cities-in-the-Philippines.pdf

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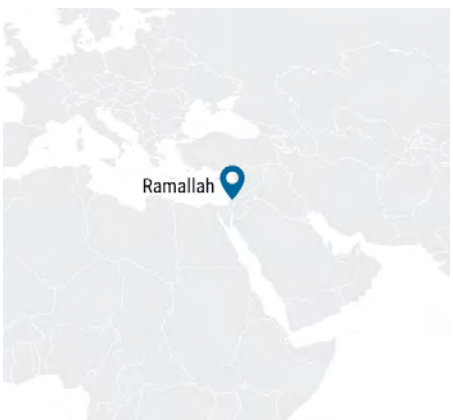
# Case studies on sectoral interventions and resilient infrastructure as accelerators of climate action in cities

10

## Greener Ramallah Future: Transforming Wastewater to Address Water Scarcity

**City/Locality:** Ramallah
**Country:** State of Palestine
**Region:** Northern Africa and Western Asia
**Theme:** Sectoral interventions and resilient infrastructure as accelerators of climate action in cities




### Context

The city of Ramallah boasts a moderate climate with hot summers and mild winters, but is experiencing a shift due to climate change, marked by rising temperatures, diminished precipitation, more frequent droughts and heightened evaporation rates. Ramallah also has a very high number of internally displaced persons and other migrants, resulting in a greater demand for water resources for drinking and daily activities.

This high number of habitants, alongside climatic changes, have significantly impacted the water sector, leading to reduced groundwater recharge, declining water quality, diminished stream flow and increased water demand. These stresses on the water sector impact in turn on the local agriculture sector as yields are reduced, growth cycles are altered and the chance of loss and damage to harvests and livestock increases, affecting farmers, food industries and consumers alike.

Ramallah's water scarcity is exacerbated by ongoing disputes over the control and utilization of Palestinian water resources. This scarcity, coupled with the changing climate, has intensified droughts and exacerbated shortages of potable water, particularly during the increasingly common extreme heat of summer. Those living in the area reportedly experience water cuts three or four days a week during the summer. Alongside the water shortages, extreme heat as well as careless visitors have increased wildfires, leading to the destruction of many of the areas' oldest olive trees.

### Solution developed

Ramallah's innovative approach to addressing water scarcity in these challenging conditions involves the utilization of reclaimed wastewater, using Membrane BioReactor (MBR) technology. It is estimated that the

project provides up to 1,000 cubic metres per day of additional water. This endeavour, partially supported by the organization American Near East Refugee Aid (Anera), entails pumping reclaimed wastewater from the Ramallah city wastewater treatment plant to six tanks strategically positioned at elevated points within the city, thereby enabling gravity-fed irrigation networks to operate effectively and reduce operational costs. This also reduces the amount of greenhouse gas emissions that would have been needed to transport water by trucks. Furthermore, the project incorporates an environmental awareness campaign aimed at promoting the safe and responsible use of reclaimed water. This initiative includes specific guidelines on public health safety measures associated with wastewater reuse.

## Impacts of the solution

On average, the project facilitates the reuse of 240,000 cubic metres of wastewater annually, effectively conserving precious potable water resources. This contributes significantly to addressing the frequent water cuts endured by the Ramallah community, particularly during the summer months and times of increased conflict. This use of reclaimed water irrigation has transformed public parks, privately owned farms and gardens, municipal facilities and median islands along streets in Ramallah into lush, green areas, enhancing the quality of life for residents and visitors. The integration of privately owned farms and gardens into the reuse water network enables irrigation at lower costs compared to traditional water sources, ultimately supporting agricultural production and food security while mitigating desertification.

On average, the reclaimed wastewater project facilitates the reuse of 240,000 cubic metres of wastewater annually, effectively conserving precious potable water resources.

**Figure 10.1: One of six water tanks responsible for storing and distributing 240,000 cubic metres of reclaimed water annually**

© Ramallah Municipality media team

Beyond irrigation, reclaimed water is also utilized for activities such as civil construction projects and firefighting. By ensuring roads are better paved, firefighters can optimize their duties as well as obtain enough water for their jobs, all while reducing reliance on scarce freshwater resources.

The accompanying environmental awareness raising campaign in the community also fosters a culture of responsible water management and promotes sustainable practices among residents. Overall, Ramallah's reclaimed wastewater initiative showcases tangible impacts in water conservation, enhanced green spaces, agricultural support as well as further diverse applications, all through state-wide tensions. The project also has strong partnerships aligning with Sustainable Development Goals 11, 13 and 17.

## Drivers and enablers of the solution

Overall, the combination of advanced technology, tactical infrastructure development, collaborative efforts and community engagement through targeted information campaigns collectively drive the success of Ramallah's innovative approach to addressing water scarcity.

The central enabler for this project is identified as the presence of the Anera organization in the West Bank. The organization began its work in Palestine in 1968, later expanding its work into Lebanon and Jordan. This exposure over the years provides the organization with extensive knowledge and expertise on the local areas, with the added benefit of the close relationship built between their donors and partners over the years.

**Figure 10.2: Enhanced urban green spaces utilizing gravity-fed irrigation**

© Ramallah Municipality media team

## Lessons learnt and development prospects

The project in Ramallah is one of many similar projects that have been implemented in Palestine over the years, which has enabled the leveraging of experience and knowledge to scale climate action and bring about increased efficiency. To further enhance the impact of these wastewater facilities, regulatory frameworks and guidelines for wastewater reuse can be established, which can improve compliance with safety and health standards, while also facilitating the adoption of similar initiatives in other jurisdictions.

*This case study was submitted by the City of Ramallah.*

### More information

Anera. (2019). Construction is underway on the Ramallah Wastewater Reuse Project. Anera. https://www.anera.org/stories/construction-ramallah-wastewater-reuse-palestine/

11

## "Sanmathi": Where Good Sense Triumphs in the War against Waste

**City/Locality:** Trivandrum
**Country:** India
**Region:** Central and Southern Asia
**Theme:** Sectoral interventions and resilient infrastructure as accelerators of climate action


### Context

Trivandrum (Thiruvananthapuram) is the capital of the state of Kerala, located in the south of India. It is one of the most populous cities in the state, producing an average of 325.2 tonnes of waste per day. In 2011, the Trivandrum Municipal Corporation (TMC) had to shut down its centralized waste management plant at Vilappilsala following a severe backlash from locals due to the informal management of the city's waste and the associated environmental, ecological and socio-economic impacts. In response, the Trivandrum Development Authority (TRIDA) offered 0.1 hectare of land at Erumakuzhy, Attakulangara, located near the city centre, for TMC to manage its waste in the absence of alternate sites. Unfortunately, this approach was unsuccessful as it uprooted businesses, reduced land value and blighted nearby communities.

The accumulation of waste affected land and water resources, polluting water bodies and causing public health concerns for people living close to these sites. In the long term, unsustainable waste management results in the pile-up of unprocessed garbage. Sites containing this so-called "legacy waste" are notorious for producing leachate and act as storehouses of methane, a prominent greenhouse gas. With pressure mounting on TMC, they were forced to rethink their waste management strategy.

### Solution developed

The key premise of the new waste management strategy was that a change in attitude towards waste management practices was needed. By emphasizing recovery and recycling of waste and community mobilization, the TMC was able to eliminate the waste pile-up. The reclaimed land was converted into a number of uses, including a park, a materials recovery facility and a permanent demonstration corner for decentralized waste management initiatives. The park was named Sanmathi Udyanam, which translates to "good sense" as a nod to the change in attitude towards waste management practices in the city.

The treatment process began with earth-moving machines turning over the waste heap to stabilize the pile and prepare it for bioremediation, which removes environmental pollutants, before exposing the waste to air and composting bio-cultures. Once this is complete, workers began sorting and screening the pile using filters and meshes for valuable, reuseable and recyclable resources. Over the course of 2,567 working days, 1,600 tonnes of mixed waste were treated. Meanwhile, a total of 600 tonnes of compost, 5 tonnes of footwear, 3 tonnes of coconut shells and 900 tonnes of sand, grit, construction debris and compost were removed from one of the biggest dump yards in the city.

The recovered waste was bundled and compressed at TMC's waste facility in Manacaud, allowing for efficient transportation. All recyclable materials were handed to the Clean Kerala Company while non-recyclables were sent to a sanitary landfill. Meanwhile organic waste was directed to micro composting centres (MCCs). Once the waste was sorted, compost soil was used to refill and cover the site of the former dump.

A key aspect of the new waste management strategy was the way in which the TMC mobilized people who were out of work during COVID-19, based on their willingness to engage. This included people from informal settlements and migrant labour camps located close to the SMV School and Attakulangara Central school. They were paid daily wages of Rs280 based on employment guarantee scheme wages. A total of Rs.2.25 million (US$27,000) was spent on managing waste including processing, segregation, and disposal.

**Figure 11.1: Artist's impression of Sanmathi Park**

© Trivandrum Municipal Corporation

## Impacts of the solution

From the solutions implemented, the residents in Kerala were able to witness first-hand the capability of TMC to transform their surrounding environment. The solution implemented resulted in the clearing and treatment of 2,388 cubic meters of legacy waste at Erumakuzhy while ensuring land transformation. This enabled Kerala to champion the cause of reclaiming landfill sites for sustainable development through techniques such as bio-mining. However, it was evident that public opinion was against a centralized approach to waste treatment. To overcome this, policymakers decided to adopt a decentralized waste management system at the state level, with initiatives such as segregation at source to be mandated. Today, almost 100 per cent of households within the TMC's jurisdiction segregate waste at source, improving urban and environmental resilience.

The inclusion of workers from less advantaged backgrounds offered much needed employment opportunities, particularly during the difficult period of the COVID-19 pandemic. Processing and treatment of legacy waste opened up these employment opportunities, propelling the benefits of a circular economy value chain.

An 80 per cent reduction in the original estimated project cost was achieved in particular by engaging with private bodies through public-private partnerships to offset the total cost. This project enabled TMC to seek avenues for income generation through solid waste management (SWM). The revenue generated by TMC from selling recyclables accounted to 49 per cent of the total revenue generated through SWM processes. Additionally, there was a considerable reduction in the total cost of operation and maintenance by limiting door-to-door collection coverage to 10 per cent of households, with the remainder using MCCs. The major expenditure of Rs3.9 million (US$46,500) was spent on the disposal of inert waste and the production of refuse-derived fuels.

The solution implemented resulted in the clearing and treatment of 2,388 cubic meters of legacy waste at Erumakuzhy while ensuring land transformation. This enabled Kerala to champion the cause of reclaiming landfill sites for sustainable development through techniques such as bio-mining

**Figure 11.2: Demonstration of waste management practices in Trivandrum**


© Anna John

## Drivers and enablers of the solution

The key driver of successful decentralized waste management in Trivandrum was the support of the local community. Additionally, households were willing to segregate their waste so it could be taken to material collection recovery facilities. Salvaging these valuable resources opened up a revenue stream for the local urban authorities, initiating a circular economy value chain. The positive engagement of residents thus allows organizations specializing in waste segregation, such as the Clean Kerala Company and Indian Medical Association Goes Friendly, to work effectively. To reinforce this, information, education and communication (IEC) activities such as the "My Waste My Responsibility" campaign were deployed to further sensitize people on waste management practices.

The political will and leadership of TMC played a catalytic role throughout the project, from initiation to implementation. Furthermore, by engaging with the private sector through public-private partnerships and self-help groups for door-to-door collection, as well as allocating significant funding to process non-recyclable waste, the expenditure to the local authorities was reduced.

Enablers of the solution included higher level policy interventions which allowed for change in SWM practices. This included Kerala Suchitwa Mission (an initiative under the purview of Local Self Government Department of the government of Kerala to achieve waste reduction), the Green Protocol (adopted at the state level to alleviate waste generation and drive decentralized SWM practices, including segregation at source) and the national-level Solid Waste Management Rules 2016 (as per its provisions, local bodies are mandated to remediate legacy waste dumpsites and reclaim the land based on the guidelines used by the Central Pollution Control Board). Alongside policy interventions, standard operating procedures set by the Central Pollution Control Board were followed for recycling, co-processing and roadmaking, emphasizing how quality standards set by higher institutions enable efficient processes.

## Lessons learnt and development prospects

A key lesson learnt was that reclaiming waste-filled land is possible through an effective partnership between an engaged population and a responsive administration, ultimately supporting sustainable development and enhancing community involvement. Though most residents were already committed to segregating their own waste, local mandates and awareness programs were seen to further entrench good practices across different municipalities.

It was also noted that IEC campaigns can be effective in sensitizing people, especially if the stories are impact-oriented. Lessons learned from lived experiences made a profound impact, especially while dealing with environmental and climate issues. In this case, the government succeeded in fostering the ethos of "My Waste, My Responsibility" among citizens.

Lastly, economic prospects were explored for e-waste and other recyclable waste. A refuse-derived fuel plant has recently been set up on a trial basis at the park to explore the feasibility of converting waste into fuel for industrial use, marking a significant development in the economic prospects of e-waste and other recyclables.

*This case study was submitted by Kerala State Disaster Management Authority.*

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Kumar, A. J. (2020, November 4). Six months and 2,567 man days, city's biggest dump yard turns into garden cum park. *The Times of India*. https://timesofindia.indiatimes.com/city/thiruvananthapuram/six-months-and-2567man-days-citys-biggest-dump-yard-turns-into-garden-cum-park/articleshow/79035593.cms

TNN. (2020, November 4). City's biggest dump yard turns into "Sanmathi Park". *The Times of India*. https://timesofindia.indiatimes.com/city/thiruvananthapuram/citys-biggest-dump-yard-turns-into-sanmathi-park/articleshow/79030734.cms

12

## Strengthening Water Security in Chennai: The City of 1,000 Tanks Water Balance Project

**City/Locality:** Chennai
**Country:** India
**Region:** Central and Southern Asia
**Theme:** Sectoral interventions and resilient infrastructure as accelerators of climate action


### Context

Chennai, situated on India's Coromandel Coast, faces a range of interconnected challenges in water management. The city is struggling to keep up with the daily consumption of 1,580 million litres among its urban population: over 50 per cent of water demand is met by private and commercial borehole extraction, while 25 per cent is met by reservoirs with steadily diminishing water levels. Over time, natural groundwater recharge has deteriorated due to the increase of impervious areas of the city, sealing the soil and thereby lowering the capacity to replenish water supplies, increasing rainwater runoff and exacerbating flood risk and the urban heat island effect. Chennai's stormwater system offers little protection and is easily clogged with silt and sewage, further exacerbating the city's flood risk. Besides this, around half of Chennai's sewage goes untreated and is expelled directly into stormwater drains and rivers, further polluting the groundwater.

### Solution developed

As part of the Water-as-Leverage Programme, initiated by the Government of the Netherlands, the City of 1,000 Tanks project involves the creation of a water balance model for Chennai by transforming linear flows of water into a closed loops system. This water balance is achieved by collecting rainwater, treating wastewater and runoff pollution with decentralized nature-based solutions (NbS), and recharging the local aquifer. This helps prevent water scarcity by increasing groundwater reserves while mitigating the risks associated with high-frequency floods and environmental pollution. A Water Balance Pilot has been implemented as a demonstration project for the city at Little Flower Convent—a school that hosts 650 visually- and hearing-impaired students.

Using NbS, the City of 1,000 Tanks Water Balance Pilot repaired broken infrastructure, collected rainwater and treated wastewater in order to replenish the aquifer, thus enhancing local water security and climate resilience for the staff and students of Little Flower Convent. The project functions as an urban park within the school campus that contains recharge and wastewater treatment components. It operates as a live classroom for students, residents, experts, government officials and the city at large to witness NbS in action.

The Water Balance Pilot collects 27,000 litres of wastewater per day, which is treated in two stages. The wastewater first passes through underground anaerobic tanks, followed by treatment in a sub-surface flow wetland. No toxic chemicals are used for treatment, and all electricity requirements are supported by solar energy. The treated water achieves regulatory quality standards and is safely infiltrated into the ground. Meanwhile, during the monsoon season, recharge wells collect, store, filter and recharge rainwater. Throughout this process, beneficiaries have access to live data to monitor the system's performance.

Additionally, the City of 1,000 Tanks community engagement campaign recruited 53 children from 10 vulnerable communities as Water Ambassadors to identify water-related issues in their surroundings, raise awareness and catalyze social change at the community level. Water literacy initiatives were also implemented through means such as drawing, folk art, theatre, slogans and mime, as well as a six-part online animation film series in Tamil and English, articulating the vision of Chennai's journey towards a water-resilient future.

**Figure 12.1: Wetlands, infiltration gardens and pathways to treat, infiltrate and recharge the aquifer at Little Flower Convent**

© Cynthia van Elk & Water as Leverage

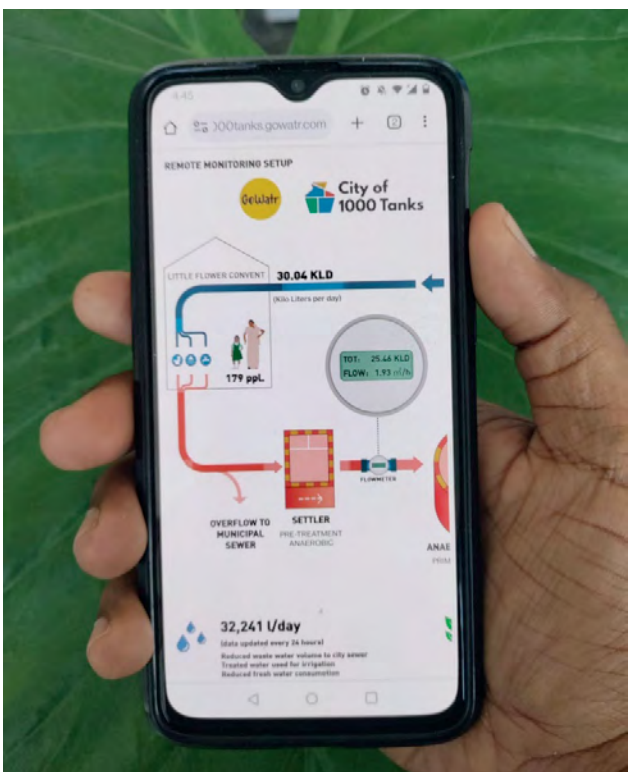
## Impacts of the solution

At the heart of this project is the principle of water balance, which transforms traditional linear water flows into closed-loop systems. The project has significantly improved the local water balance, reducing water stress during summer and enhancing rainwater management during monsoons. It has successfully addressed the persistent issue of sewage backflow, creating a safer and healthier environment. By collecting rainwater and treating wastewater locally, the project replenishes the aquifer, increasing water security. Every day, 27,000 litres of wastewater from residents, students and staff are treated, safely recharging the groundwater while irrigating 3,000 plants.

The project's rainwater recharge potential is estimated at as much as 300 cubic metres daily during an extreme, one-in-two-year rain event of 166 millimetres per day. Additionally, the increased green cover has enhanced the learning environment by reducing sound pollution and lowering temperatures by up to 5 degrees Celsius. The project boasts increased biodiversity and achieves an annual net zero carbon footprint through solar electricity. It serves as a model for unburdening old municipal infrastructure in urbanizing cities and demonstrates the potential for implementing nature-based solutions (NbS) within urban areas. The project has also increased institutional capacity and public awareness of such systems, clarifying the role of user behavior in their maintenance.

The project's rainwater recharge potential is estimated at as much as 300 cubic metres daily during an extreme, one-in-two-year rain event of 166 millimetres per day.

**Figure 12.2: City of 1,000 Tanks Water Balance Pilot, monitoring platform accessed through smartphones for public access to live data**

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## Drivers and enablers of the solution

Engagement with the community has been a cornerstone of the project's approach. The team worked closely with site beneficiaries before, during and after implementation, enabling the project to remain functional and relevant to the needs of those it serves. By facilitating dialogue and participation, the project has empowered individuals from various backgrounds to contribute to the narrative and visualizations that represent their collective aspirations for water management. The project also emphasizes capacity building through proof-of-concept initiatives. Stakeholders are engaged through guided tours, bilingual communication and performance data, which help raise awareness about NbS. Media coverage in both English and local languages has further amplified the project's impact, ensuring that the community is informed and involved.

A key strength of this project lies in its radically inclusive and multidisciplinary team, combining local and international expertise. This team, led by OOZE architects and urbanists, comprises local experts, academics, activists and practitioners such as Madras Terrace Architects, IIT–Madras, Care Earth Trust, Atma Waters, Eco Village International, Sunlit Futures and GoWatr, who bring a wealth of knowledge and experience to the table. The continuous support from the Government of Netherlands, Partners for Water, Chennai Resilience Centre, Goethe-Institute Chennai and the Wipro Foundation was key to the success and the future continuation of the project. Collaborating with governmental stakeholders across project stages has raised awareness for the City of 1,000 Tanks project, and paves the way for upscaling. The bilateral nature of the programme has enabled engagement and communication at various levels with the government. The mix of local and international expertise enabled, simultaneously, innovation and better local embedding of the project.

The project's systemic approach has enabled the project to operate simultaneously at the city and project scale and enables an open, context-responsive implementation strategy. Alongside this, working closely with site beneficiaries before, during and after implementation enabled the project to maintain its functionality and ensure its longevity. Continuous monitoring, using remote embedded sensors and water chemistry sampling, guarantees that treatment quality and quantity is consistent. Data sets are used to demonstrate efficacy and support capacity-building activities, enabling upscaling of NbS across Chennai and beyond.

## Lessons learnt and development prospects

Through engagement with local partners, the community and other stakeholders, it became clear that there were cultural inhibitions towards local wastewater treatment with NbS and infiltration of effluent. These had to be overcome by demonstrating the effectiveness of the system in a way that was both accessible and evidence-based. NbS is often perceived to be inappropriate for complex urban sites with limited space, though the project demonstrated how this can be overcome through well-considered design.

A key challenge of the project was missing documentation and data at the outset of the project, which hindered the development of site-specific projects like the City of 1,000 Tanks. The project included extensive documentation to establish with greater accuracy the performance capacities possible within a site-specific solution. Another issue faced was that repairs and connections to the existing infrastructure were often overlooked, which can lead to delays in implementation. The project foregrounded repair and retrofitting to enable suitable interfaces between old and new.

A prospect of the pilot project is that it serves as a proof-of-concept for the broader urban vision, enabling replication and upscaling across Chennai and beyond. It demonstrates the potential to implement NbS within cities as a model for unburdening old municipal infrastructure in urbanizing cities through localized treatment and reuse of water.

*This case study was submitted by the Netherlands Enterprise Agency, an executing agency of the government of the Netherlands.*

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13

## Empowered: How the City of Newcastle is Transitioning Away from Fossil Fuel-Based Industries Towards a Low-Carbon Economy

**City/Locality:** Newcastle
**Country:** Australia
**Region:** Australia and New Zealand
**Theme:** Sectoral interventions and resilient infrastructure as accelerators of climate action


### Context

Newcastle, located 160 kilometres north of Sydney, is Australia's seventh-largest city with a population of approximately 200,000 people. Home to the world's largest coal port, its economy has long relied on fossil fuels. However, recognizing the need to transition to a low-carbon economy, in 2019 the city declared a climate emergency and formally committed to the goals of the Paris Agreement, specifically striving to limit global warming to 1.5 degrees Celsius above pre-industrial levels.

Newcastle is now focused on promoting low emissions technologies, large-scale renewable energy, green hydrogen and ammonia export hubs, and sustainable metal and minerals processing. This shift presents both challenges and opportunities as Newcastle seeks to support impacted communities and ensure a just transition towards a new economy.

### Solution developed

The City of Newcastle in Australia is transitioning away from fossil fuel-based industries towards a low-carbon economy, driven by a commitment to lower greenhouse gas (GHG) emissions and achieve net zero operational emissions by 2030. The local authorities aim to reduce emissions from its own operational emissions, focusing first and foremost on their own facilities and properties, and transitioning towards large-scale renewable energy generation. These initiatives aim to reduce GHG emissions and reliance on fossil fuels while promoting sustainable energy generation and efficiency.

Newcastle has implemented several solutions to achieve this goal, including:

- The first main component is the establishment of renewable energy generation facilities. The Summer Hill Waste Management Centre (SWMC) was fitted with a bioenergy facility to generate electricity from biogas harvested from the landfill site. A landfill site at the SWMC that had reached full capacity was fitted with a 5 megawatt (MW) solar farm, comprising 14,500 solar panels. The landfill site was contaminated and difficult to use for other purposes. Finally, several rooftops and car parks of the municipality's own facilities were fitted with solar photovoltaic systems and battery energy storage systems totalling 818 kilowatts (kW), generating approximately 1 gigawatt hour (GWh) of renewable energy annually since 2012.

- Apart from on-site energy generation, Newcastle also upgraded 93 per cent of the city's main road streetlights to energy-efficient LED luminaries between 2020 and 2022, in partnership with the local energy distributor, Ausgrid.

- The city has tripled the number of public electric vehicle (EV) charging ports, adding 32 ports across 11 new locations in the city. The new chargers, powered by 100 per cent renewable energy, complement the existing EV charging infrastructure.

- Finally, acknowledging that (at least in the short term) the city cannot supply all of its own renewable energy needs, the city entered into a power purchase agreement (PPA) with the Sapphire Wind Farm in 2020, located 350 kilometres to the north of Newcastle, to purchase additional renewable electricity for operations.

## Impacts of the solution

These initiatives have already led to significant reductions in GHG emissions, operational costs, and reliance on fossil fuels. The City of Newcastle has achieved a significant reduction in GHG emissions through these initiatives. In 2020, City of Newcastle became the first local government in New South Wales to use 100 per cent renewable electricity for its own municipal operations.

At the SWMC, 62 per cent of $CO_2$ equivalent emissions were captured and used at the bioenergy facility, generating 17 MWh of energy—enough to power 3,000 homes. In 2023, the solar farm produced 7,027 MW of renewable electricity. The street light upgrade program resulted in a 67 per cent decrease in electricity use from 2009 to 2022.

In 2020, City of Newcastle became the first local government in New South Wales to use 100 per cent renewable electricity for its own municipal operations.

**Figure 13.1: Solar farm at Summerhill Waste Management Facility, Newcastle**

Drivers and enablers of the solution

## Drivers and enablers of the solution

The City of Newcastle's climate program is largely driven by the commitment of its elected representatives to take decisive action on climate change. As a long-standing member of Local Governments for Sustainability (ICLEI), Newcastle is actively involved in global efforts to mitigate climate change. It has allocated dedicated staff resources to ensure the successful delivery of its operational net-zero program. These efforts culminated in the adoption of a shared vision outlined in the Newcastle 2040 and the Community Strategic Plan in June 2022. In response to community feedback, addressing climate change is a key priority in the Community Strategic Plan, with a strong emphasis on achieving net zero. The Newcastle Environment Strategy, which was recently adopted following public consultation, reaffirmed community support, with 78 per cent of respondents endorsing a transition to net zero operations and backing a citywide shift to net zero. Key drivers of this transition, accelerated by the adoption of ambitious targets, include community support, commitment from elected representatives, access to funding and dedicated staff resources.

The transition to renewable energy can generate cost savings in the long run, but requires up-front investment, which can be difficult to access for local governments. Among the more expensive components of the transition was the construction of an AU$8 million solar farm at the Summerhill Waste Management Centre. This solar farm was funded through a 10-year loan from the Clean Energy Finance Corporation (CEFC), which is an Australian Government-owned green bank that invests in clean energy, and an AU$1 million grant from the New-South Wales Government's "Waste Less, Recycle More" initiative. Revenue from selling renewable electricity is being used to offset the loan repayment to the CEFC, with Newcastle expected to pay off AU$4.2 million of the loan and AU$3.7 million from electricity generation. Additionally, the PPA with the Sapphire Wind Farm led to stable and cost-efficient energy prices, saving an estimated AU$500,000 annually for streetlights between 2022 and 2023.

## Lessons learnt and prospects for development

The city of Newcastle's net zero program provides a scalable and replicable suite of options to assist municipalities and other public sector organizations transition their operations to net zero emissions. Setting ambitious, evidence-based targets has provided Newcastle with a clear direction. The Newcastle Climate Action Plan 2020-2025 included a target of achieving net zero operational emissions by 2030, supporting the broader city-wide goal of reaching net-zero emissions by 2040. Identifying and simplifying data collection and reporting of operational emissions and energy costs was a critical step in Newcastle's energy transition, allowing the identification of the areas of greatest impact and return.

The cost savings achieved through emission reductions, and the utilization of renewable PPAs to create stable and consistent energy costs, demonstrate the long-term economic benefits of transitioning to 100 per cent renewable electricity. This is especially important for publicly funded organizations that are accountable to taxpayers.

*This case study was submitted by the City of Newcastle, Australia.*

### More information

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14

## Integrated Energy Management in the City of Sousse, Tunisia

**City/Locality:** Sousse
**Country:** Tunisia
**Region:** Northern Africa and Western Asia
**Theme:** Sectoral interventions and resilient infrastructure as accelerators of climate action


### Context

Tunisia's cities are home to 70 per cent of the country's population and consume a significant share of the country's energy to fuel construction, urban transportation and industries. Rising energy consumption due to rapid urbanization, coupled with a reliance on imported fossil fuels, both exacerbated Tunisia's greenhouse gas emissions and increased its vulnerability to climate change. Furthermore, being at the mercy of global energy market fluctuations, Tunisian cities suffer from inflation, increasing energy prices and temporary blackouts. The high upfront costs of sustainable investments and a lack of information on green solutions have resulted in buildings that generally lack thermal comfort, significantly impacting public health and living conditions while further increasing energy consumption. Cities are pivotal in mitigating the adverse impacts of climate change on urban populations. As planners, they integrate sustainable energy supply and management in urban design, while facilitating the transition to more sustainable transportation modes; as regulators, they enforce national guidelines and establish policies on the construction and industrial sectors; and as facilitators, they strengthen collaboration among stakeholders, leverage investment and foster innovation. Most importantly, cities can lead by example, becoming model energy consumers by investing in energy efficiency solutions and clean technology, demonstrating the viability and benefits of sustainable energy management.

### Solution developed

In 2018, the City of Sousse adopted an integrated urban development approach to align with the country's energy transition. Supported by the Swiss Secretariat of State for Economic Affairs (SECO), within the framework of the integrated urban development programme, this approach encompassed urban planning, mobility, climate resilience and energy management. To help achieve this, Sousse developed an Integrated Energy Management System, enabling municipal departments to monitor, manage and optimize their energy consumption while channelling investment towards decentralized solar energy production.

A key component of this system is the Municipal Energy Dashboard, which measures energy and water consumption for municipal facilities, including buildings and vehicles, and public services infrastructure such as lighting, waste collection and green area management. Indeed, measuring energy consumption is a critical step towards optimizing its use, detecting system failures, optimizing service delivery and making data-driven investments for the rehabilitation of equipment and public infrastructure.

For the city of Sousse, the dashboard has become an essential tool for daily operations, maintenance, informed decision-making, target-setting and investment planning.

**Figure 14.1: Installation of the photovoltaic system at Hmadet Douik in the municipality of Sousse**

© Institute for Development, Environment and Energy (IDE-E)

The system is linked to a cloud-based database, which receives real-time energy consumption data through smart meters installed on public lighting and buildings, thanks to the daily entry of consumption data when municipal vehicles are refuelling. This database also supports the city's geoportal, which maps geographically relevant energy data for public lighting, waste collection, public transportation and solar production potential.

## Impacts of the solution

The Integrated Energy Management System has significantly enhanced the municipality's ability to make informed decisions, focus investments on critical areas and identify opportunities for tangible results with substantial returns on investment. Over the past three years, the municipality reduced fuel consumption by 15 per cent, achieving an annual reduction of 162 tCO2e. It also invested in retrofitting its public lighting system and established a four-year rehabilitation plan to modernize the entire system by 2028. This plan aims to reduce the energy bill by 40 per cent, resulting in US$1 million in savings and cutting carbon emissions by 3,500 tCO2e annually.

Additionally, the municipality of Sousse prioritized the rehabilitation of 15 public buildings, aiming for a 25 per cent energy gain and a reduction of 900 tCO2e per year. To meet the remaining energy needs, the municipality is investing in solar rooftops, with a pilot installation on the city's Environmental Department serving as a model for a broader strategy to equip all municipal rooftops by 2025.

The municipal invested in retrofitting its public lighting system and established a four-year rehabilitation plan to modernize the entire system by 2028. This plan aims to reduce the energy bill by 40 per cent, resulting in US$1 million in savings and cutting carbon emissions by 3,500 $tCO_2e$ annually.

Furthermore, the municipality installed GPS software linked to the energy dashboard to improve the control of municipal vehicle use. They also optimized waste collection paths to make better use of collection trucks, enhance vehicle performance in terms of waste load transported daily, and minimize fuel consumption.

## Drivers and enablers of the solution

For the Integrated Energy Management System to provide relevant analysis for planners and decision-makers, a range of enabling prerequisites were needed. First, in 2019, the city conducted energy audits on all municipal buildings, infrastructure and vehicles, including a comprehensive assessment of the public lighting system, an exhaustive inventory of the equipment installed, and the collection of energy consumption data over several years to enable comparisons. The results allowed the city to set up a comprehensive database providing the basis for the initial analysis.

Between 2020 and 2024, the city, with the support of SECO, has installed smart meters on public lighting and building facilities. For regular updates on fuel consumption data, a daily data-entering protocol was also established at the gas station fuelling municipal vehicles. These measures have ensured that real-time data is collected on a regular basis and transferred to the database feeding the Municipal Energy Dashboard and Geoportal.

In 2024, efforts have centred on enhancing the software, establishing a governance system, and creating user protocols. This has included capacity building of at least 15 people involved in managing the system

since the start of the project, covering tasks from data collection and updating to processing and analysis, software management, reporting and communication. These steps ensure the system is fully integrated and effectively articulated within the city's daily operations.Lastly, a key motivation for the city to invest in energy management and utilize the dashboard for data-driven investments is its participation in the national Alliance des Communes pour la Transition Energétique (ACTE) Program and the associated ACTE-MEA label. Indeed, the Agence Nationale pour la Maîtrise de l'Énergie (ANME) has established a certifying process, based on the European Energy Award, that encourages Tunisian cities to continuously improve their energy management performance, with the best-performing municipalities recognized for their contribution. In 2020, Sousse was the first Tunisian city to be audited and awarded the ACTE-MEA label.

**Figure 14.2: Energy Management Dashboard interface**


Source: Institute for Development, Environment and Energy (IDE-E)

## Lessons learnt and prospects

Sousse, with its innovative Integrated Energy Management System and Municipal Energy Dashboard and Geoportal, has demonstrated the value of data-driven investment. Such investments have yielded lower levels of energy consumption, emission reductions and significant cost savings, linked to energy efficiencies and gains in maintenance. The city's success has already inspired nearby municipalities, with 10 currently supported in leveraging Sousse's achievements to adopt similar practices. This initiative is fostering a regional network of "cities in energy transition".

In 2024 and 2025, the system will be upscaled to include additional functions the city considers to be crucial—such as the monitoring of the use of municipal vehicles and maintenance—and will be extended to new areas linked with natural resource management and climate resilience, such as waste collection and the use of irrigated green spaces. A key concern, besides the continued updating of consumption data, is the establishment of internal protocols to ensure regular (and where possible automatic) updates to the performance of public facilities and units managed by the dashboard.

Minor adjustments to the software will be needed should the system be replicated in a different geographic context; however, most of the functions could simply be adapted or extended to new environments and needs. The main challenges of replication in new cities—and other countries, such as neighbouring Algeria, where a similar software has recently been introduced—are related to the above-listed drivers. These drivers provide the necessary ground for the system to be effectively deployed, properly operated, and to yield the expected results: relevant analysis to inform daily operations, appropriate planning and targeted investment in sustainable energy management.

*This case study was submitted by the Institute for Development, Environment and Energy (IDE-E), Urbaplan and the Municipality of Sousse.*

## More information

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15

## Enhancing Urban Mobility through Low-Carbon Water Transport

**City/Locality:** Kochi
**Country:** India
**Region:** Central and Southern Asia
**Theme:** Sectoral interventions and resilient infrastructure as accelerators of climate action


### Context

Kochi is an important port city along the western coast of India. The city is spread over a cluster of islands and has an interconnected system of lakes, canals and lagoons that residents have used to get around for hundreds of years. These unique spatial characteristics make the city vulnerable to sea level rise and flooding, but also afford unique opportunities for sustainable water transport.

In the early 20th century, about 90 per cent of residents in the State of Kerala relied on small boats to get around the various islands and reach the mainland. The gradual proliferation of roads and bridges, coupled with underinvestment in ferries and jetties, has led to an increasing shift to road-based transport. This has resulted in traffic congestion, pollution and increased carbon dioxide emissions. Urban sprawl, the limited capacity of the road network and increased private vehicle ownership have exacerbated the situation.

These challenges called for the revitalization of Kochi's ferry services to improve the mobility of residents while reducing carbon emissions, protecting the environment and the people from climate impacts, and providing more opportunities for eco-tourism.

### Solution developed

The revitalization of Kochi's ferry services started in 2010 with a feasibility study, and after years of planning Kochi opened the first lines of its new Kochi Water Metro project in 2023. The project entails the development of a state-of-the-art and environmentally friendly water transport system that will connect Kochi's island communities with the mainland. This network will be run by a fleet of 78 battery-operated electric hybrid boats, with capacity varying from 50 to 100 passengers, serving 38 modern terminals across 15 routes, for a total distance of 76 kilometres.

The project can trace its origins to an innovative transport sector strategy, the preparation of which was supported by the Cities Development Initiative for Asia (CDIA) and co-implemented by GIZ and the Asian Development Bank (ADB) from 2007 to 2018. The CDIA, which is now a multi-donor trust fund managed by the ADB, helped prepare an initial pre-feasibility study that came out of the transport strategy. By incorporating climate adaptation and mitigation perspectives into the transport system design, it provided a systematic analysis of the effects of future climate scenarios on the infrastructure project, and the emissions savings that could be achieved by transitioning the primary mode of transport from roads to waterways.

In 2016, the German development bank (KfW) and the Government of Kerela signed a loan agreement for an 85 million (US$92 million) investment to deliver an environmentally friendly and sustainable ferry service in Kochi. While the government retained key design specifications outlined in the CDIA pre-feasibility study, the partnership helped elevated the project to a higher standard.

In April 2023, the Kochi Water Metro started its commercial operations with its two maiden routes: High Court to Vypin Island and Vytilla to Kakkanad. In April 2024, three more routes were added: High Court to Fort Kochi, High Court to South Chittoor, and South Chittoor to Cheranalloor. To date, more than 2.5 million passengers have already used the services via its five routes. Once fully operational in 2035, the Kochi Water Metro will connect 10 island communities with Kochi's mainland and serve about 100,000 passengers daily, thereby providing them with fast, reliable and eco-friendly water transport.

**Figure 15.1: A boat from the Kochi Water Metro Service**

© An Rubenecia, CDIA

## Impacts of the solution

The Kochi Water Metro is now serving as a reliable and state-of-the-art passenger transport option—a far cry from the poor conditions of ferries and jetties that Kochi residents had been familiar with before. The time savings reported are significant, in some cases reducing what used to be a two-hour commute using road-based transport to just 15 minutes by boat.

The Kochi Water Metro is designed to cater to all kinds of passengers, including women and other vulnerable populations, and to ensure their safety and convenience. The installation of security, surveillance, communication and emergency response systems helps to ensure the safe operation of the network. An automatic passenger control system further helps prevent overcrowding in boats, a primary cause of accidents in water transport.

The boats have been designed and constructed in a way that lowers their environmental impact. The use of lightweight and recyclable materials, together with a low draft and wake design, results in reduced power consumption and noise emissions, thus limiting disruption to the flora and fauna in the waterway. To respond to tidal variations and future increases in sea level, all terminals and jetties have floating pontoons to ensure safe boarding amid any change in water levels. The use of electric propulsion for the boats is further expected to reduce greenhouse gas emissions by at least 22,400 tonnes per year upon full implementation. Kochi Water Metro further aims to achieve 100 per cent renewable energy operation through a 17 megawatt peak (MWp) solar plant. Initially, 10 MWp will be used starting in 2025 to cover the early stages of operation. The project supports India's target of becoming carbon neutral by 2070.

The boats have been designed and constructed in a way that lowers their environmental impact through use of lightweight and recyclable materials, together with a low draft and wake design, resulting in reduced power consumption and noise emissions, thus limiting disruption to the flora and fauna in the waterway.

**Figure 15.2: Integrated Public Transport Map of Kochi**


© Kochi Water Metro Limited

## Drivers and enablers of the solution

The planning and design of the Kochi Water Metro project was enabled through the intersection of a number of key drivers. First, as described under the solution, the project capitalized on emerging technologies and adapted them to the city's specific requirements. For example, the boats are using Lithium Titanate Oxide, considered to be the safest and longest-lasting battery available commercially in the world. The battery can be recharged in just 15 minutes.

The Kochi Water metro was implemented as part of an integrated transport sector strategy that incorporated climate considerations from the start. It paid particular attention to feeder systems and connectivity with other modes of transport. By locating the ferry terminals in close vicinity of other modes like buses, the metro rail, auto-rickshaws, and other feeder systems, the potential for increased ridership was greatly accelerated.

Kochi's transport sector strategy, which CDIA helped prepare in 2010, was an important tool to pave the way for the project to gain political support and stakeholder buy-in from development to implementation. The project is owned by the Kerala state government, which contributed 20 million (US$21.7 million) to the project's viability gap. The CDIA-supported pre-feasibility study entailed climate change analysis, considering not only the emissions impact of the ferry services but also the climate risks and the extent of vulnerability of the investment, as well as the potential adaptation measures aimed at building the city's resilience against climate impacts.

Finally, the Kochi Water Metro leveraged existing expertise for running public transportation from the Kochi Metro Rail Limited company. Through a special purpose vehicle arrangement, the Kochi Metro Rail Limited was tapped for the operation and maintenance of the water ferry system. This enabled the Kochi Water Metro project to benefit from the project management experience of the company in implementing the Kochi Metro Rail.

## Lessons learnt and development prospects

Despite the benefits of inland waterway transport, many cities have yet to harness its full potential. Given the fact that many cities around the world are located along navigable waterways, there is enormous potential to implemented water-based transportation as a solution that is both highly adaptable to climate change and can help mitigate emissions. The Kochi Water Metro offers a prototype of how other cities may revitalize their water transport and elevate it to include climate change considerations and principles of sustainable urban development.

*This case study was submitted by Cities Development Initiative for Asia (CDIA).*

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16

## From Grey to Green: Resilient Transport Infrastructure through Nature-Based Solutions in Brussels

**City/Locality:** Brussels
**Country:** Belgium
**Region:** Europe
**Theme:** Sectoral interventions and resilient infrastructure as accelerators of climate action


### Context

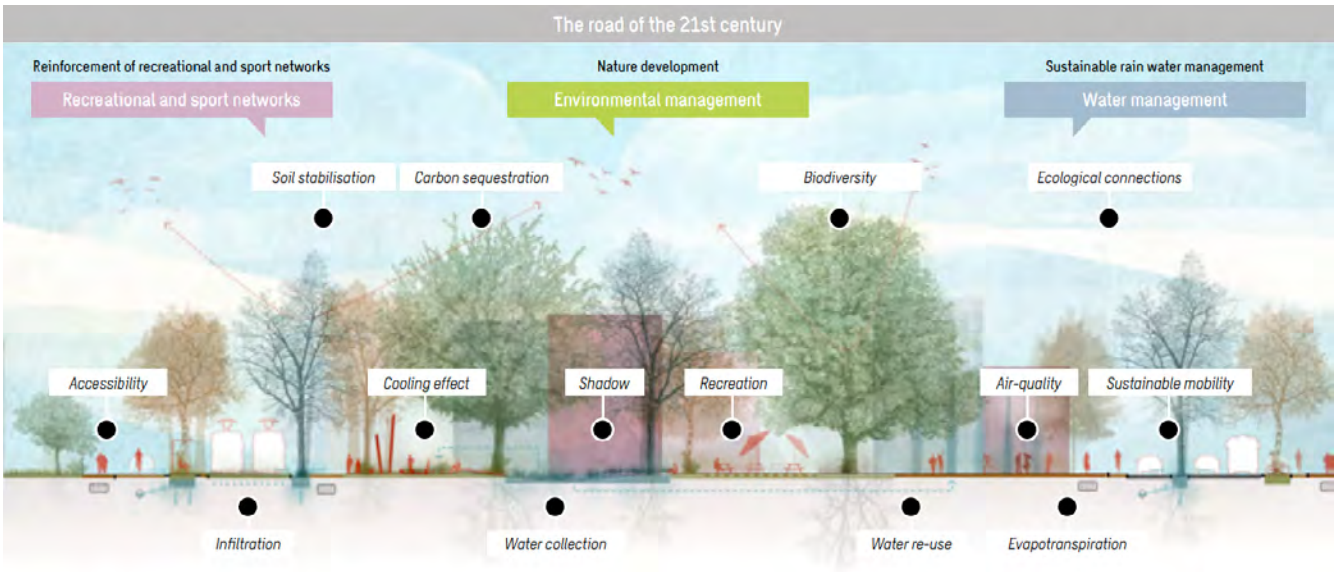
The Brussels Capital Region, like many urban areas, faces significant challenges due to high levels of paving, where nearly 40 per cent of the region's surface is covered with impermeable materials such as concrete and asphalt. This extensive "mineralization" of the ground contributes to numerous environmental and social issues, including poor water management, reduced biodiversity and increased urban heat island effects. Traditional grey infrastructure like pavements and roads are often not capable of draining away water fast enough during heavy rains, instead acting as barriers behind which water collects, potentially leading to flooding.

Recognizing these challenges, Brussels Mobility, the regional agency responsible for managing public roads, initiated an ambitious project aimed at transforming the city's regional roads into more climate-resilient and socially inclusive spaces. The project's focus is not only on environmental benefits, but also on improving the quality of life for residents by creating more accessible, cooler and aesthetically pleasing urban environments. This transformation towards "roads of the 21st century" involves "demineralization" of road surfaces, the addition of green spaces, the application of nature-based solutions (NbS) and urban renewal initiatives that collectively contribute to enhancing the region's ecological and social environments.

### Solution developed

The strategic vision behind this initiative is to redefine the functionality of regional roads, traditionally seen as mere conduits for transport, into multi-functional spaces that contribute positively to the urban ecosystem and community well-being (see Figure 16.1).

**Figure 16.1: The road of the 21st century, serving a variety of social and environmental functions**




Source: Sweco, 2023

To address the issues of high mineralization and its associated impacts, Brussels Mobility developed a comprehensive solution that includes three main stages—strategy, design, and ecology:

- The strategic component involved developing a vision and action plan for demineralizing and greening regional roads. This strategy was not only reactive but also proactive, aiming to anticipate future challenges related to climate change and urban growth.

- The design stage provided technical support for reconfiguring the regional roads to incorporate green spaces, permeable surfaces and tree canopies. This technical support was crucial in ensuring that the road designs were not only functional, but also contributed to the broader social and ecological goals of the project.

- The ecological stage focused on implementing ecological management plans for all green spaces managed by Brussels Mobility, ensuring that these areas were not only established but also maintained in a way that maximized their environmental benefits.

The demineralization of Brussel's roads is primarily achieved through NbS. Restoring natural water cycles through better road design can enhance urban irrigation potential and mitigate heavy rainfall effects, including reducing stormwater pollution, flooding and associated risks to people and property. Swamps, bioswales and rain gardens were integrated into streetscapes and sidewalks, which channel road runoff away from sewer systems. Additional NbS include rainwater storage, green roofs and other permeable structures, all contributing to more effective rainwater management.

A key element of the solution was the use of a Geographic Information System (GIS) to identify priority areas for intervention. Neighbourhoods that were the farthest from existing green spaces were prioritized, ensuring that the benefits of demineralization and greening through NbS were distributed equitably across the region. This approach culminated in the creation of the "Plan Pluriannuel d'Investissement," a multi-annual investment plan aimed at creating climate-resilient regional roads and setting clear project priorities.

## Impacts of the solution

By targeting nearly one-third of the urban region's open space, this ongoing project is expected to significantly reduce urban heat stress, increase biodiversity and improve water management across the Brussels Capital Region. For instance, on Avenue du Parc, located in the commune of Forest, the project has already resulted in a substantial increase in tree cover, from 60 to 143 trees, an expansion of green spaces from 25 to 35 per cent of the total area, and an increase in permeable surfaces from 16 to 26 percent, all of which contributed to better stormwater management and reducing flooding risk. The various projects that fall under Brussel's strategy are part of a network of interventions. The networked quality vastly enhances the impact of individual projects.

By targeting nearly one-third of the urban region's open space, this ongoing project is expected to significantly reduce urban heat stress, increase biodiversity and improve water management across the Brussels Capital Region

**Figure 16.2: The integrated network of green roads and other green spaces in Brussels**

Source: Sweco, 2023

Another noticeable impact has been the creation of dedicated spaces separating cyclists from vehicular traffic, improving road safety and comfort for cyclists. In addition to these transportation enhancements, the completed projects have made significant strides in expanding green spaces, which in turn reduce urban heat stress. The effects of these developments are felt by residents almost immediately, as each completed phase offers tangible improvements to the urban environment. The reduction in heat stress, improved air quality, and the enhanced aesthetic appeal of public spaces contribute to a healthier, more enjoyable urban environment. Additionally, the project supports sustainable mobility by creating more pleasant and safer conditions for pedestrians and cyclists, further encouraging low-carbon modes of transport.

## Drivers and enablers of the solution

Several key factors have driven the conceptualization and implementation of this project. First and foremost is the strategic vision of Brussels Mobility, which recognized the importance of transforming regional roads into multifunctional, resilient spaces. This vision was supported by strong collaboration between Brussels Mobility and the nineteen municipalities that make up the Brussels Capital Region, as well as other key organizations such as Urban Brussels and Brussels Environment. The project also benefited from peer-to-peer learning and benchmarking against similar state-of-the-art projects in other cities, which helped set ambitious yet achievable targets for the demineralization and greening initiatives.

Another critical enabler was the development of a comprehensive strategy and methodology that guided the project's implementation. The use of GIS and multi-criteria analysis ensured that interventions were data-driven and targeted where they would have the greatest impact. The integration of technology is crucial and should be actively encouraged. Digital tools can enhance cooperation across multiple levels and stakeholders. Geospatial techniques, data and mapping—whether physical or ecosystem-based—are vital to ensure the creation of the most appropriate nature-based solutions.

The strategic collaborations behind this project exemplify a model of urban transformation that prioritizes sustainability and resident well-being. Moreover, the integration of community input through initiatives like "Brussels Plant", where inhabitants of the Region are consulted on ideas for greening and demineralizing their own streets, helped generate public buy-in to the project. This highlights the importance of participatory planning in achieving environmental goals. Without the engagement of local communities in the planning and execution stages to foster a sense of ownership and responsibility for local green spaces, initiatives such as these may fail to be sustainable in the long term.

## Lessons learnt and development prospects

Until recently, solutions for constructing climate resilience have mainly focused on grey infrastructure such as storm drains, embankments or retaining walls. However, grey infrastructure is generally not as resilient, sustainable or cost effective as NbS. These NbS offer innovative approaches to build resilience whilst providing a plethora of economic, social and environmental benefits. NbS are usually preferable to grey infrastructure solutions, as they have the potential to tackle several problems simultaneously. The project offered a number of key lessons in their application:

- Project developers and planners should evaluate the functions and benefits of NbS based on each area's unique site conditions to ensure that decision makers are convinced of their suitability. Evaluating the site involves considering the practicality, costs and geographical factors that could impact the effectiveness of the solutions. Thorough site-specific analysis ensures that NbS are tailored to the context, making them more likely to gain approval.

- NbS should be part of an integrated governance approach that involves various experts, including those in ecology, water management, infrastructure, architecture and energy. This collaborative approach helps planners and developers design more effective, sustainable solutions. By working together, specialists can combine their knowledge to ensure that NbS not only address environmental issues, but also enhance overall infrastructure and energy efficiency.

- The protection of existing ecosystems should be prioritized when developing NbS. Planners should first focus on conserving current natural systems, managing them sustainably to retain their benefits. If conservation is not feasible, restoration or rehabilitation of degraded ecosystems should be considered before creating new NbS. This approach supports long-term ecological health and ensures the sustainable generation of ecosystem services.

- NbS should always be considered across various spatial scales, from cities to landscapes, down to neighbourhoods and individual buildings. By addressing problems at their source, such as upstream forests managing floodwaters, the overall resilience of downstream areas can be enhanced.

*This case was submitted by BUUR Part of Sweco, Belgium.*

### More information

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# Case studies on multi-level governance for inclusive climate action

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## Building the Climate Resilience of Vulnerable Urban Populations in Bamenda, Cameroon

**City/Locality:** Bamenda
**Country:** Cameroon
**Region:** Sub-Saharan Africa
**Theme:** Multi-level governance for inclusive climate action


### Context

Sisia is a community within the city of Bamenda, Cameroon, home to approximately 22,000 residents, most of whom are low-income earners with an average monthly household income of US$80. Areas within Sisia have been classified as ecologically fragile zones in local planning documents, where human settlement is prohibited. However, due to the lack of suitable land tenure available to residents in other parts of the city, many people have been forced to make unauthorized encroachments into this area.

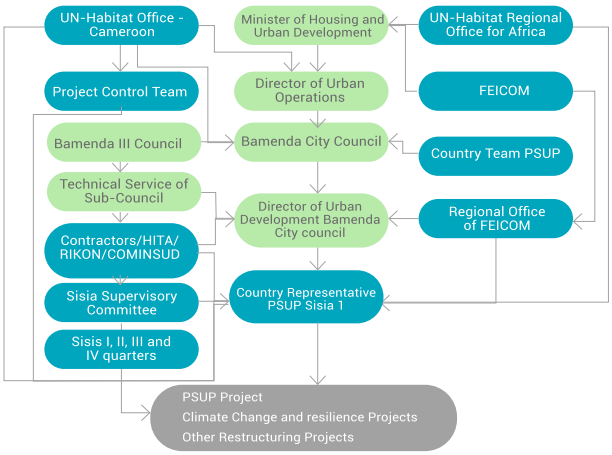
The lack of an enabling environment for land tenure and basic services in policy and practice has ultimately led to a situation in which the population faces significant risks from landslides and heavy flooding, both of which have resulted in the loss of lives and property. At least two children have lost their lives due to landslides since 2018. The risk of landslides is heightened as residents obtain fuelwood from local forests—the primary energy source for most poor households—lowering the ability of those forests to retain water and soil during heavy rainfall events and increasing the risk of landslides. At the same time, with homes build directly in water catchment areas, the risk of flooding has increased and threatens to contaminate Sisia's dwindling local potable water sources.

### Solution developed

In response to these challenges, a pro-poor community project was launched in Sisia. The project proposal was informed by research from the Sisia Participatory Slum Upgrading Programme (PSUP), studies conducted by Cameroon's Ministry of Housing and Urban Development and earlier pilot projects in other cities in Cameroon.

While the technical solutions to lower the risk and impact of flooding are generally well understood, the project recognized that the main challenge to implementation were the existing governance frameworks. Figure 17.1 maps out some of the hierarchies and relationships between different organizations, with the government actors highlighted in green.

**Figure 17.1: Organogram of the governance structure of Bamenda (government actors in green)**




The project was initiated through a partnership between UN-Habitat, FEICOM (which is the national government's Special Council Support Fund for Mutual Assistance), and local actors from the Bamenda City Council and Bamenda III Council. In conventional approaches to reduce the risk of flooding and landslides, the local community might only be consulted or informed, but in Sisia the community actively shaped these interventions by prioritizing their needs and proposing solutions, ensuring the project addressed their most pressing concerns. The community was supported through a series of workshops in which they received information on the environmental impacts of their actions and the effects of climate change. The implementation of the project was overseen by the Sisia Supervisory Committee (SSC), which consists of 50 members from 40 surveyed blocks of Sisia. The SSC, which prioritizes gender inclusivity, played a pivotal role in selecting the projects to be implemented. The SSC members serve as a control team at the local level, overseeing the quality and progress of the work being executed. They work closely with the control team instituted by the project partners. Regular site meetings between project partners, contractors and SSC leaders ensure that all stakeholders have a voice in the project's execution. This collaborative approach helps maintain transparency and accountability.

The project area was divided into four planning units, each with their own local administrative structure under a quarter head. The four quarter heads are ex-officio members of the 50-man SSC which is elected by the population with the main role of mobilizing the local population for project execution, holding regular meetings and reporting to the project partners. Splitting the project area into quarters facilitated effective localization, allowing efficient scaling of the project, enhanced community participation and implementation, as well as ensuring cultural sensitivity.

While the community took a leading role in the project, there were many other actors involved (see Figure 17.1). This multi-level governance approach to the project allowed expertise from other levels of governance to be used at the local level. The project has shown that multi-level governance can be streamlined, with each partner contributing to the overall goal of enhancing climate resilience.

## Impacts of the solution

The project was shaped by a rapid assessment of the community's vulnerabilities, including exposure to floods, waterborne diseases, land tenure insecurity and limited access to basic facilities. These insights informed key interventions, such as bridge and culvert construction, to reduce flooding by at least 60 per cent. Additionally, recognizing their vulnerability, residents at risk from landslides expressed a willingness to relocate to designated resettlement areas. Efforts to protect and manage Sisia's water sources aimed to decrease the community's risk of waterborne diseases by 80 per cent. Additionally, the project focused on environmental conservation through the establishment of a tree nursery, planting trees across two hectares, and reinforcing water catchment areas with water-yielding trees. These measures aim to reduce landslides and improve the area's carbon capture capacity.

Through the process, the people living in Sisia now have a much better understanding of potentially harmful actions contributing to the recurrence of floods. Since the implementation of the project, no major flood has occurred at the time of writing. The project is improving stream crossings, and residents have taken the initiative to build water catchments and tanks, no longer relying on shallow wells as before. In the past two years, only one case of waterborne disease has been reported by the Health District in Sisia, compared to over six cases in 2018. Furthermore, the partners—UN-Habitat, FEICOM, Bamenda City Council, and Bamenda III Council—used the project to create a guide for integrating climate action in Bamenda and beyond.

An unfortunate outcome of the project was the relocation of 5,100 people from 850 households from the Sisia community. For these people, the risk of landslides and floods were deemed too great to allow for in-situ upgrading. A contractor was hired to manage the resettlement process, while the expropriation indemnity of the 850 households is handled by the Government of Cameroon.

The costs of displacement are to be borne by those displaced—with "recovery payments" from the resettled population to cover the cost of infrastructure and a plot of land 1,000 square metres in size for each family, valued at US$26,500, to be paid at US$2,600 a month for 10 years.

The project focused on environmental conservation through the establishment of a tree nursery, planting trees across two hectares, and reinforcing water catchment areas with water-yielding trees. These measures aim to reduce landslides and improve the area's carbon capture capacity.

## Drivers and enablers of the solution

A significant enabler of the project has been the incorporation of a High Intensity Labour Approach (HIMO), where two-thirds of the work is performed by the community. This includes activities such as establishing tree nurseries and planting, protecting water catchments and implementing flood control measures. Women and youth from the Sisia community are deeply involved in the project's execution. Many of them have taken on tasks such as mixing concrete for bridge construction, which not only empowers them but also ensures they are invested in the sustainability of the infrastructure that will eventually be handed over to them.

**Figure 17.2: Water storage tank at Sisia 3**

© Pope Jones, 2024

Two important funding agreements were established to enable the implementation of the project. The first was a protocol between UN-Habitat, FEICOM, Bamenda City Council and Bamenda III Council outlining the terms of the partnership, while a second agreement covered the funding. In total, US$518,222 was secured to implement sustainable flood management strategies and bolster community resilience, enabling the implementation of the project. Of the total amount, US$488,865 was allocated for physical investments, with FEICOM financing up to 80 per cent through a grant, while the remaining 20 per cent was contributed by Bamenda City Council and Bamenda III Council. UN-Habitat provided institutional support of US$23,707, while Bamenda City Council and Bamenda III Council contributed US$5,659 towards monitoring and reporting. These agreements have facilitated the timely release of funds, allowing two contractors, HITA and RIKON Enterprises, and the NGO COMINSUD to implement the project. The work was already 60 per cent complete within the first two months of the eight-month project timeline. The project's outcomes highlight the effectiveness of partnership-based financing in driving progress toward climate goals. Additionally, community financing efforts are ensuring that the project remains sustainable after its completion and handover in October 2024.

## Lessons learnt and development prospects

The resilience component of the PSUP progress report, besides contributing to Sustainable Development Goal (SDG) 17 on partnerships, has also seen the project contribute locally to SDGs 6, 11 and 13 and realization of the New Urban Agenda. Improved access to potable water from the spring sources which are being protected by the project, not to mention the strong community spirit that has driven it forward, promises to boost future resilience. Overall, building partnerships guarantees not only a higher quality of climate change programming, but also supports access to financing.

*This case study was submitted by Bamenda City Council and UN-Habitat Regional Office for Africa.*

### More information

Kometa, S. S., & Akoh, N. R. (2012). The hydro-geomorphological implications of urbanization in Bamenda, Cameroon. *Journal of Sustainable Development*, 5(6), 64-73.

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## Moving governance in Sucre, Bolivia

**City/Locality:** Sucre
**Country:** Bolivia (Plurinational State of)
**Region:** Latin America and the Caribbean
**Theme:** Multi-level governance for inclusive climate action


### Context

Urban areas have been expanding significantly in Bolivia over the past decade. This new context leads to two phenomena: the formation of new settlements in the urban periphery that tend to be vulnerable to climate change, and the densification of pre-existing urban areas, leading to increased pressure on basic services and ecosystems. Bolivia is highly vulnerable to the impacts of climate change, with rural and urban poor populations particularly affected by events such as floods and droughts.

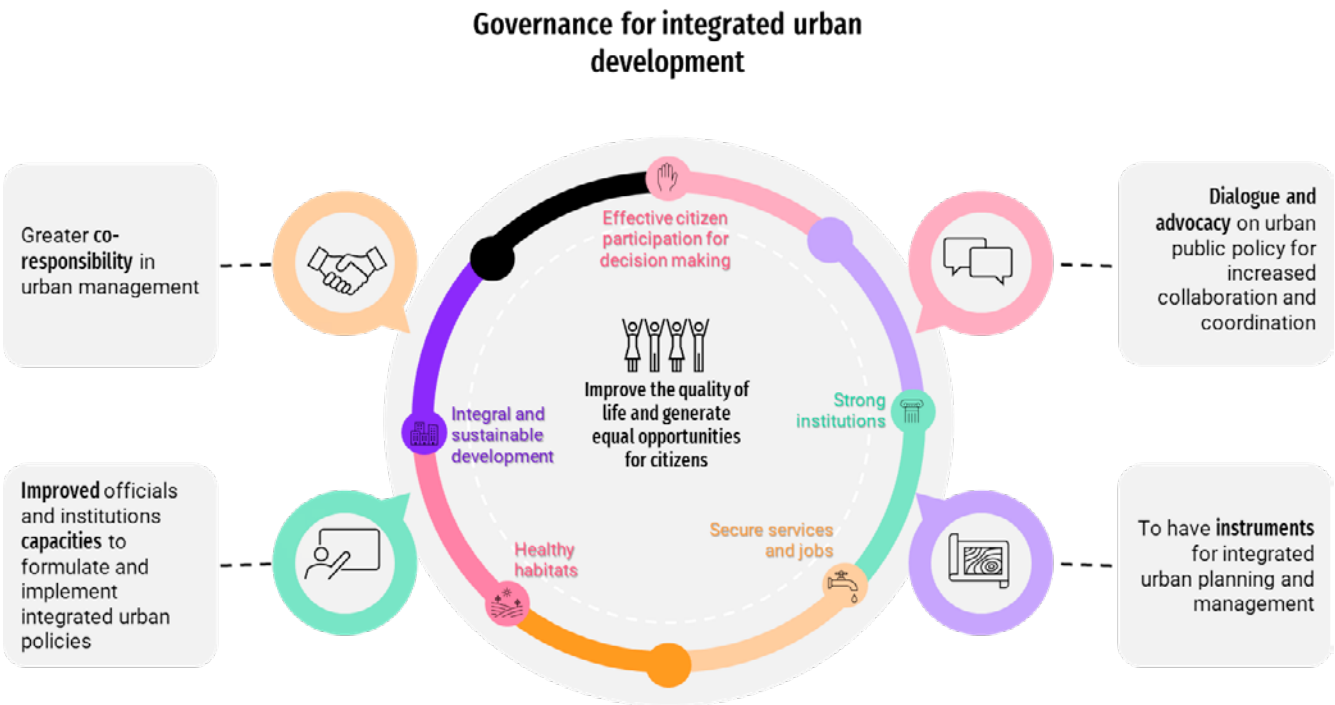
The municipality of Sucre is an intermediate city with a population of over 360,000 inhabitants. It is characterized by rapid urban expansion that has exacerbated social inequality. Sucre experiences prolonged periods of water stress, droughts, intense rains, hailstorms, landslides and frost.

These conditions leave 44 per cent of the population particularly vulnerable to the impacts of climate change. At the same time, per capita carbon emissions in Sucre are higher than the average for Bolivian and Latin American cities, at 2.3 $tCO_2e$. In particular, the transportation, industrial and waste sectors in Sucre are sources of high carbon emissions.

### Solution developed

In response to these pressing issues, Helvetas, a Swiss Intercooperation organization, launched the CoRe Urban project in Sucre. This project sought to bolster urban resilience through a collaborative governance approach which emphasizes citizen co-responsibility. Supported by the municipal government, which became a crucial partner, the project aimed to integrate climate adaptation into urban development through four main pillars.First, the project focused on political dialogue and advocacy to enhance coordination between the national and local levels and between different stakeholders (such as donors and civil society), aiming to influence urban policy positively. Some dialogues also focused on promoting joint reflections on the main climate challenges in Sucre. Second, the project aimed to develop urban planning instruments to address Sucre's specific challenges, institutionalizing and assigning clear responsibilities to different departments and layers of government. Third, the project prioritized local capacity building, offering training to municipal staff, national level technicians and academics to formulate and implement comprehensive urban policies. Fourth, the project promoted citizen co-responsibility, encouraging active and effective public participation for the development of urban solutions.

**Figure 18.1: Governance framework for integrated urban development**




Source: Ariel Almendras & Helvetas Swiss Intercooperation

In addition to these governance mechanisms developed by the project, specific actions were also deployed under the project that served as test cases for the new governance mechanism. To promote nature-based solutions and participatory urban agriculture, a neighbourhood urban garden was implemented. To facilitate the formulation of inclusive public policies and to support local urban management, meanwhile, a City Observatory was created in Sucre: this played a crucial role in collecting, organizing and analyzing urban data, providing reliable information for informed decision-making. Lastly, an open competition was created, the Sucre Ideatón, to invite residents to generate projects and ideas enhancing community participation in urban and climate actions.

## Impacts of the solution

The CoRe Urban project has had a profound impact on Sucre's approach to urban management and resilience. It successfully developed strategic content for municipal and national instruments, demonstrating how highly participatory actions can be implemented with limited financial resources while remaining dynamic and effective. The project established a collaborative platform that facilitated ongoing interaction among various levels of government and other stakeholders, fostering a culture of cooperative territorial governance. These governance interventions showed great potential for replication and scalability. The participatory nature of the project also led to greater mainstreaming of the Sustainable Development Goals and emphasized the potential of local actions to achieve global agendas.

The CoRe urban project successfully developed strategic content for municipal and national instruments, demonstrating how highly participatory actions can be implemented with limited financial resources while remaining dynamic and effective.

## Drivers and enablers of the solution

The success of the CoRe Urban project can be attributed to several key drivers and enablers. Dialogues and opportunities for citizen participation have enabled critical thinking, allowing meaningful exchange, strengthening local governance and enhancing the quality of urban development plans. The Sucre Ideatón competition exemplified this participatory approach, energizing collective action and demonstrating the effectiveness of local governance with minimal costs. The CoRe Urban project also highlighted the importance of strategic alliances. By fostering collaboration among diverse stakeholders, the project promoted a shared vision for urban resilience and sustainability.

Capacity building was another crucial factor. Training municipal staff and other stakeholders equipped them with the knowledge and tools necessary for integrated urban development and climate change adaptation. This enhanced their ability to understand and address local problems through comprehensive strategies. The creation of the City Observatory further facilitated data-driven urban planning, ensuring that decisions were based on relevant and reliable information.

**Figure 18.2: Project Flexible Tactical Furniture promoting citizen participation**

© Helvetas Swiss Intercooperation

## Lessons learnt and prospects

The success of the CoRe Urban project in Sucre led to its replication in the city of Tarija and informed the development of Helvetas' Resilient Cities Model, which facilitates replication by local authorities and stakeholders in other urban settings. The project underscored the importance of integrating conceptual frameworks with practical actions, showing that substantial progress can be made with limited resources. The CoRe Urban project has significantly influenced both national and municipal efforts by demonstrating the ability to achieve substantial results with minimal human and financial resources, highlighting the critical need for increased support in urban development, local adaption and resilience building. This approach underscores the project's potential for scalability across various contexts and settings.

*This case study was submitted by Helvetas Swiss Intercooperation.*

# Case studies fostering innovation for inclusive climate action in cities

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## Knowledge to Action: Teaching Children about Climate Change through a Card Game in Ya'an City

**City/Locality:** Ya'an
**Country:** China
**Region:** Eastern and South-Eastern Asia
**Theme:** Fostering innovation for inclusive climate action in cities


### Context

Understanding climate change is not only essential for protecting our environment, but also for preparing ourselves for future challenges. Children today will be the generation most impacted by climate change. Yet at present, climate-sensitive safety education in schools and communities is neither comprehensive nor child-friendly. It typically fails to effectively connect natural hazards that are experienced by children in their everyday life to an understanding of the changes in climate that are causing these shocks.

### Solution developed

In July 2023, the Save the Children International China Country office (SC China) developed "Xiao'an's Summer", a climate change-themed card game which aims to equip children aged 5-12 with a better understanding of climate hazards and eco-friendly behaviours. The project was piloted in Ya'an City, Sichuan Province in Southwestern China. This region of China is a disaster-prone area due to its geological position, diversified landforms and complex climate. It is exposed to high risks of urban flood, earthquake, landslide, extreme heat and wildfire, as well as medium risks of river flood, cyclone and water scarcity. Many of these hazards have already been exacerbated by climate change, and this trend is expected to amplify.

"Xiao'an's Summer" is set in a flooded hometown and introduces climate change-induced disasters like floods, extreme heat and the greenhouse effect. Players simulate climate change and natural hazards by drawing cards and moving game pieces. The game also guides players to take eco-friendly actions after playing. This game teaches children about climate change in a fun and interactive way and encourages them to take green actions with their families. Activities include organizing evacuation drills, reducing disposable tableware, minimizing food waste, making toys from discarded items, and sharing knowledge on climate hazards and responses to disasters.

From August to November 2023, the card game "Xiao'an's Summer" and SC China's Family Safety Plan were used to create activities with a local partner—Ya'an Yilian Disaster Risk Reduction Service Centre. More than 20 activities were conducted, targeting 1,010 children across five schools and three communities in the Shimian County, Lushan County and Mingshan District in Ya'an City, Sichuan Province. Through fun and engaging participatory lessons, these activities improved children's knowledge, behaviours and reactions, equipping them with a better understanding of climate risks and natural disasters.

**Figure 19.1: Children playing the card game "Xiao'an's Summer" after class in the corridor**

© Ya'an Yilian Disaster Risk Reduction Service Centre

The game also allowed local contexts to be taken into consideration during these activities: for one school in the earthquake-prone Caoke Township, earthquake preparedness skills were emphasized; while for a school near the Longtoushi Reservoir, water safety knowledge was emphasized through drowning prevention games.

## Impacts of the solution

With a budget of US$17,500, this small project has directly reached 524 girls, 486 boys, 284 women and 35 men in six months. The main impact of the project has been to raise awareness and improve children's knowledge on climate hazards. As one Yilian staff member stated: "The children paid extraordinary attention to the content. Their responses, thoughts and engagement have surprised us." One child shared: "The story in 'Xiao'an's Summer' does not feel foreign—I remember Ya'an Qingyi River flooded in summer after continuous rainfall. Global warming and climate change affect us all, and we should all learn how to protect the environment."

Another significant impact of the initiative was the behavioral change observed among the children. They took proactive follow-up actions, such as creating informative posters on fire safety and earthquake preparedness for their neighborhoods, conducting safety assessments at home, and participating in community outreach activities. They also embraced green practices by repurposing discarded items—turning bottles into penholders, revamping old toys and giving worn fabric bags new life. Additionally, they adopted waste management techniques, shared recycling tips and posted photos of their efforts to reduce food waste.

With a budget of US$17,500, this small project has directly reached 524 girls, 486 boys, 284 women and 35 men in six months. The main impact of the project has been to raise awareness and improve children's knowledge on climate hazards.

**Figure 19.2: Children practising garbage classification in community**

© Ya'an Yilian Disaster Risk Reduction Service Centre

The "Xiao'an's Summer" card game further contributed to increased sustainability. By growing plants, children learned about plant life cycles and how tree planting helps combat environmental challenges such as water and soil erosion. Through the "Trash to Treasure" activity, they crafted unique artworks from discarded materials, breathing new life into items like plastic bottles and fabric scraps. Post-game, the "Little Environmentalist" group, composed of community children, engaged in child-led green advocacy. They practiced garbage classification, environmental management and knowledge sharing with community residents, reinforcing the game's impact on sustainability and environmental awareness.

## Drivers and enablers of the solution

The solution was a success because the game is easy for children to understand and enjoy. Climate change is an intricate topic, involving complex science. For children aged 5-12, it is not necessary to explain every detail and principle of climate change, as presenting the basic concepts in an engaging way, showing how issues connect to their daily lives, is more effective. Activities should also be designed for children to participate easily, so that they can better understand and cope with climate change in practice, thereby cultivating their awareness and sense of responsibility for environmental protection.

Another key driver of the solution's success was the establishment of strong partnerships. Developing in-depth relationships with local partners was integral to the project's success. Working closely with local partners provided a comprehensive understanding of local disaster risks and offered deeper insight into the social environment and the real needs of the beneficiaries. This provided valuable information to develop a more targeted strategy. During the development of the project, SC China planned and executed projects with various partners, sharing resources and information, and conducted trainings to enhance the operability and effectiveness of the project. Through these partnerships, the target groups were reached more efficiently, enhancing the project's impact and sustainability.

## Lessons learnt and development prospects

The card game offers opportunities to be adapted to be used in other cities or contexts with risks of flooding, drought, heat waves and cold waves. Between 2018 and 2023, SC China promoted child-centred Disaster Risk Reduction and Comprehensive School Safety Management in schools and communities, directly benefiting 735,292 girls and 849,500 boys, 450,849 women and 312,192 men. To ensure the sustainability of the Comprehensive School Safety work in China, and with evidence, feedback and good practices collected from the pilot zones, a book titled Comprehensive School Safety: Theory and Practice of Safety Management in Primary and Secondary Schools has been published in December 2023. It was also under this project Xiao'an's Summer was developed and piloted.

*This case study was submitted by Save the Children International China Country office.*

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## Building Community Resilience from Heatwaves for Delhi's Urban Poor

**City/Locality:** Delhi
**Country:** India
**Region:** Central and Southern Asia
**Theme:** Fostering innovation for inclusive climate action in cities


### Context

India's capital Delhi is experiencing significant challenges due to extreme climate conditions—a situation that is worsening with accelerating climate change. Between March and May 2022, Delhi experienced five heat waves with record-breaking temperatures reaching up to 49.2 degrees Celsius, leading to devastating socioeconomic and public health impacts. The urban heat island effect, where densely built-up urban areas experience higher temperatures than surrounding rural areas, is exacerbating the rise in extreme temperatures.

For millions of Delhi's residents, particularly those living in low-income neighbourhoods, the situation is dire. Research has indicated that more than 80 per cent of the heat gain in these homes occurs through the roof. This has severe implications for the urban poor, who can rarely afford air conditioning or even basic cooling solutions like fans. Tin-roofed homes, common in these areas, are particularly vulnerable to heat. The lack of proper insulation or reflective materials in roofing contributes significantly to the internal heat build-up, further exacerbating the health risks faced by residents and turning living spaces into "ovens".

### Solution developed

In response to these challenges, the Sustainable Environment and Ecological Development Society (SEEDS), supported by a grant from Microsoft's AI for Humanitarian Action initiative, has implemented a range of innovative solutions to combat extreme heat in vulnerable communities in Delhi.The SEEDS technical team developed an AI-based model to identify hyperlocal risk information based on the type of roof. This model was then combined with heat advisories from the Indian Meteorological Department to identify the most vulnerable localities within Delhi. For these communities, SEEDS developed and deployed three cool roof models for different types of homes using locally sourced recycled materials, and introduced a prototype bamboo shelter as a "cool room" for community members to find refuge from the heat. Through engagement with the community, several traditional technologies for cooling were also identified: lining roofs with millet seeds and sprinkling them with water, for instance, or covering them with mud and growing vegetables. These traditional techniques also had the co-benefit of providing fresh food.

**Figure 20.1: An AI-generated map highlighting vulnerable homes and hyper-local risk information**

© SEEDS

Alongside the technological innovation, the project also applied social innovation by educating communities about heat risks and protective measures. In those urban areas that were identified as high-risk, SEEDS launched the "Beat the Heat" campaign, which trained community members on climate change, extreme heat and preparedness. First responders were also trained to ensure immediate community action during heatwaves. Communities were encouraged to use locally available materials for thermal comfort, including crafting shelters from discarded plastic bottles, installing green nets for shade, and using recycled fabrics for shading solutions. These efforts have provided practical, low-cost strategies to reduce the impact of extreme heat on Delhi's most vulnerable populations.

To further enhance heat preparedness, technological and social innovation were again combined by installing an automated weather station, providing real-time data on temperature and humidity that was subsequently linked to community actions such as minimizing outdoor activities and ensuring proper hydration.

## Impacts of the solution

A total of 139 households have so far received thermal roofing with insulation sheets to enhance temperature regulation. The deployment of three cool roof models, tested with data loggers, showed substantial temperature reductions ranging from 12 to 28 per cent compared to conventional tin roofs. Additionally, two water stations were established, giving residents easier access to much needed water during heatwaves.

A total of 139 households have so far received thermal roofing with insulation sheets to enhance temperature regulation

In total, around 415 awareness and training sessions have been held for community members and key stakeholders. As a result of the dedicated awareness efforts and interventions carried out through the project, close to 40,000 individuals have been impacted to date. An early warning system, which provided real-time data on temperature and humidity, empowered communities to take proactive measures during heatwaves, further enhancing their preparedness.

**Figure 20.2: SEEDS community member inspects the insulation in a family home**

© SEEDS

The benefits of these interventions extended beyond immediate heat relief, leading to broader positive effects on the community. Educational outcomes improved as cooler environments reduced school dropout rates linked to heat stress. Economic activity also benefited, by allowing local artisans such as bamboo weavers to work longer hours due to street shading, resulting in increased productivity and income. Access to cool, safe drinking water from new water stations improved hydration and reduced heat-related health issues for both residents and the transient population.

Additionally, residents with cool roofs reported better sleep patterns, as cooler indoor temperatures mitigated the adverse effects of heat on sleep. There was also a noticeable reduction in skin rashes, likely due to lower temperatures and improved indoor air quality.

## Drivers and Enablers

Community engagement and participation consistently underscored the vital role that women play in household and community resilience, especially during extreme weather events like heatwaves. SEEDS conducted extensive orientation sessions with community women to educate them about the risks associated with extreme heat and the steps they could take to protect themselves and their families.

Following these orientations, specialized training was provided to Accredited Social Health Activists and people working in "Anganwadis" (community schools and child-care centres). The people working in these places are key figures in promoting community health and these training sessions equipped them with the knowledge and skills needed to perform early interventions to prevent heatstroke and other heat-related health issues. The training also encouraged these health workers to collaborate with women in the community, creating a network of informed and proactive individuals dedicated to reducing the impact of heatwaves.

**Figure 20.3: SEEDS community mobilizer conducting consultations on climate change and extreme heat in Delhi**

© SEEDS

Group discussions focused on women and children have yielded promising results in empowering communities to mitigate the adverse effects of heatwaves by providing a platform for women to share their experiences and learn from one another. Working together, they have collectively built their capabilities to cope with future heatwave seasons: for example, by alerting their communities about impending heatwaves and sharing practical advice on how to stay safe. Their engagement in the project led to the formation of a group of activist women who now serve as community leaders in the fight against heat-related health issues. By placing women at the centre of their interventions, the project has effectively harnessed their influence and leadership within the household and community, leading to more robust and sustainable outcomes in mitigating the challenges posed by extreme heat.

## Lessons Learnt and Development Prospects

The experiences in Delhi underscore the importance of integrating technological and social innovation to combat heat stress effectively. While technological advancements and scientific developments play a crucial role in mitigating the impact of extreme heat, the knowledge and practices rooted in community experiences and traditional technologies are equally important. Together, these approaches can form a robust strategy to enhance resilience among urban poor communities. These solutions demonstrated in Delhi, while effective, need broader implementation across other vulnerable areas to create a more comprehensive and resilient urban response to heatwaves. To replicate such solutions in other urban areas requires the building of partnerships at various levels, starting with urban poor communities and extending to policy-level institutions. Nature-based solutions (NbS) like green infrastructure, cool roofs, and shaded public spaces, offer sustainable and cost-effective ways to reduce heat stress at both the macro and micro levels. Their promotion and implementation should be a priority in other urban areas where heat stress poses a significant risk. To achieve this, it is necessary to engage with key policy-level institutions to ensure that these NbS are integrated into urban planning and development policies.

*This case study was submitted by SEEDS.*

### More information

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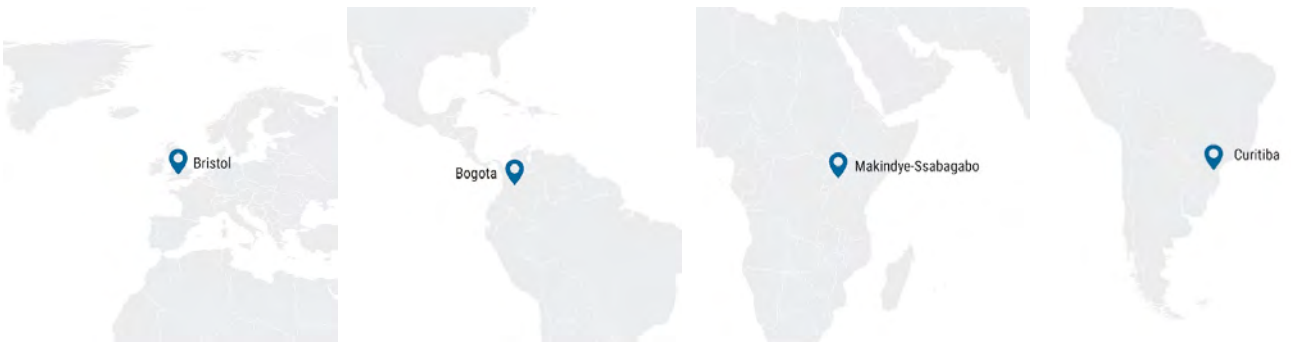
## The Climate Smart Cities Challenge: Mobilizing Innovative Climate Action in Bogotá, Bristol, Curitiba and Makindye Ssabagabo

**City/Locality:** Bogotá, Bristol, Curitiba, Makindye Ssabagabo
**Country:** Multinational (Colombia, United Kingdom, Brazil, Uganda)
**Region:** Multiregional (Latin America, Europe, Sub-Saharan Africa)
**Theme:** Fostering innovation for inclusive climate action in cities




### Context

Innovation is key to bridging the gap between climate action rhetoric and effective, people-centred implementation on the ground. Yet it is not always clear how such innovation is best stimulated in a way that encourages peer-to-peer learning and fosters partnerships.

In 2021, UN-Habitat and Viable Cities, the Swedish strategic innovation programme, together with Bogotá (Colombia), Bristol (UK), Curitiba (Brazil) and Makindye Ssabagabo (Uganda), launched the Climate Smart Cities Challenge, a challenge-driven innovation initiative to transform systems that reduce climate impacts. The cities' climate and related challenges were defined through a multi-stakeholder process.

- In Bogotá, freight transport accounts for 16 per cent of particulate matter emissions and 10 per cent of greenhouse gas (GHG) emissions. Approximately 67,000 delivery vehicles (primarily belonging to small businesses and operating informally) move through the city daily, many empty of cargo and fuelled by diesel.

- In Curitiba, the city faces a range of barriers to achieving climate neutrality by 2050. These include rising energy costs, a high dependence on private automobile use (comprising over 50 per cent of all vehicles on the road) and inadequate solid waste management, with 80 per cent of recyclable waste sent to landfills.

- Bristol aims to achieve carbon neutrality by 2030, but is also contending with a housing crisis, with 15,000 families on the housing waitlist and 800 in temporary accommodation. Given that 40 per cent of the UK's GHG emissions are attributed to buildings, the city's housing need and climate ambitions are potentially in conflict.

- In Makindye Ssabagabo, homes already account for 9 per cent of GHG emissions. This situation is exacerbated by a 10 per cent annual growth in population, and the need for approximately 190,000 affordable housing units. Consequently, the city faces a challenge in supporting the development of essential housing stock while respecting its climate commitments.

### Solution developed

Centred on challenges defined by cities themselves, the Climate Smart Cities Challenge opened the competition to innovators internationally. From 179 applications received, 45 finalists were selected across the four cities. With coaching and collaboration, finalists formed teams and submitted joint proposals to the cities. Four winning teams — Green Routes, Thriving Places, Green Community Cities and Smart Neighbourhoods—were awarded up to 100,000 each to plan a system demonstrator for their solution.

- In Bogotá, Green Routes has developed a digital transport management system that uses smart technology to optimize delivery routes and reduce transport time and costs, while also minimizing the carbon footprint of deliveries. The system drives operational excellence for transport companies, enhances mobility and air quality, creates a freight marketplace for small businesses and provides data for evidence-based policy making.

- In Bristol, Thriving Places has developed a solution to optimize the potential of underutilized brownfield sites, redefining the viability of such developments. In addition to sustainable and affordable housing built on six sites, a digital twin is under development to simulate the viability of brown field site development at scale, in Bristol and beyond.

- In Makindye Ssabagabo, Green Community Cities is developing climate responsive affordable housing neighbourhoods, using smart building technologies and urban form to mitigate greenhouse gas emissions, promote resilience, and construct a circular economy of waste and resources. The development addresses housing finance solutions, the creation of an enabling institutional environment, and the promotion of continuous learning tools, aiming for replicability, scalability and applicability to other locations in Uganda and globally.

- In Curitiba, Smart Neighbourhoods developed a behavioural change model for citizen participation to create sustainable neighbourhoods through urban public cleaning, efficient household energy consumption, integrated waste and mobility services, composting and urban farming. The demonstrator has begun with the implementation of a neighbourhood composting and farming program.

## Impacts of the solution

The challenge has catalyzed innovations for urban climate action, fostered new partnerships between cities and innovators, and unlocked funding from international donor agencies, municipal public finance and private sector commitments.

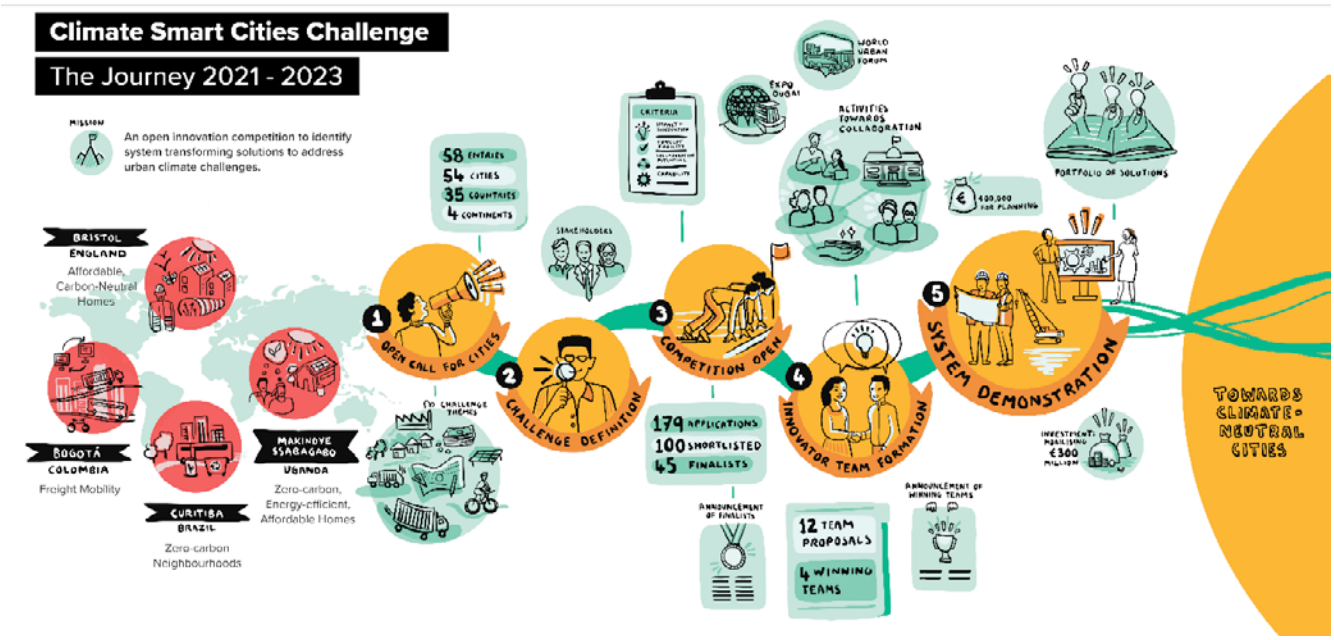
- In Bristol, the City Council and Challenge winners have signed a development agreement, estimated at £10 million, to design and deliver 29 net zero affordable homes in 2024, demonstrating the newly developed viability model.

- In Makindye Ssabagabo, Challenge partners have successfully raised US$380,000 in grant funding towards advancing the work on zero-carbon affordable housing in the city. The Municipal Council and a winning team member have partnered to recycle an estimated 62 tonnes of plastic waste each month, generating eight direct and 70 indirect employment opportunities, and US$200 rental income to the city each month.

- In Bogotá, the Green Routes platform has been implemented by two freight companies, generating over 108 optimal routes for 1,416 transport requests by 175 vehicles. Successful implementation of the platform will rest on a data governance and sharing partnership between the winning team, freight companies and the city government.

- In Curitiba, the city has been supported in the implementation of its climate policy—PlanClima—through the establishment of a Climate Smart Cities Challenge cross-functional committee set up by Mayor's decree.

**Figure 21.1: The journey of the Climate Smart Cities Challenge**

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## Drivers and enablers of the solution

The challenge has served as a platform to foster partnerships and identify effective, impactful solutions. Participating cities set ambitious climate goals, mobilized diverse problem solvers, and developed transformative solutions. Political and technical leadership within the participating cities, evidenced especially by the establishment of cross-functional and dedicated delivery teams, has been instrumental in achieving outcomes. Additional resources afforded by the challenge strengthened capacities within each city. The challenge awarded winning teams with grants to support the planning of a system demonstrator that has then served to leverage further funding, build partnerships and implement innovative solutions. Through the process, expertise on systems innovation, coaching and contracting was provided to the cities and innovators.

In addition to the Challenge process, policy, procurement and partnership frameworks in each of the cities have been essential in driving and enabling effective outcomes.

- In Bristol, the council has a legal duty to prevent homelessness. Current temporary accommodation pressures cost the council about £11 million a year, making the development agreement with the Challenge winners politically even more important.
- In Bogotá, a robust enabling environment founded on the city's environmental and freight mobility policies has enabled initial adoption of the Green Routes platform by freight companies.
- In Curitiba, the municipal policy for climate adaptation and mitigation (PlanClima) and a cross-functional committee dedicated to the Challenge has resulted in an urban garden and composting system demonstrator.
- In Makindye Ssabagabo, commitment to secure land for a low-carbon, affordable housing system demonstrator has continued to garner interest from private sector actors and financial institutions.

**Figure 21.2: An urban garden in Curitiba by CSCC finalist and winning team member Ambiente Livre**

© Ambiente Livre

## Lessons learnt and development prospects

The Climate Smart Cities Challenge model is replicable across a wide range of climate goals and contexts. Lessons from delivering the Challenge have been applied to city-focused Challenges including the Katowice Energy Innovation Challenge and the Sustainable Cities Challenge. Moreover, solutions developed in each of the cities are also replicable and scalable. In Bristol, a digital twin will help determine the scalability of the new viability model for net zero affordable homes across other brownfield sites in the city and around the country. The freight emissions platform built for Bogotá was presented at the Latin American E-Mobility Forum, garnering interest from other cities. The fact that the Climate Smart Cities Challenge has been delivered in four cities in different regions of the world demonstrates how the Challenge process can be scaled, promoting urban leadership to direct efforts towards innovation and systems change. There is great potential to further build on the collaboration to explore how the four participants, together with other pioneering cities, can scale efforts in relation to key climate action areas. One such example is to build on the cases from the four cities to create clear financial mobilization efforts needed for scaling up climate action in cities globally.

*This case study was submitted by UN-Habitat's Innovation Unit.*

### More information

Climate Smart Cities Challenge (n.d.). https://climatesmart.citieschallenge.org/

22

## Using Data and Machine Learning for Dengue Risk Monitoring and Prediction in Bengaluru

**City/Locality:** Bengaluru
**Country:** India
**Region:** Central and Southern Asia
**Theme:** Fostering innovation for inclusive climate action in cities


### Context

In recent years, dengue has emerged as a significant public health challenge in India. The incidence of dengue notably increases during the Indian summer monsoon rainfall period, when conditions are optimal for the dengue-spreading Aedes mosquitoes. The incidence of dengue is highly sensitive to climate conditions, notably temperature, precipitation and relative humidity. As climate change alters precipitation patterns and prolongs the duration of annual transmission seasons, it is creating new habitats for mosquitoes and facilitating the spread of viruses.

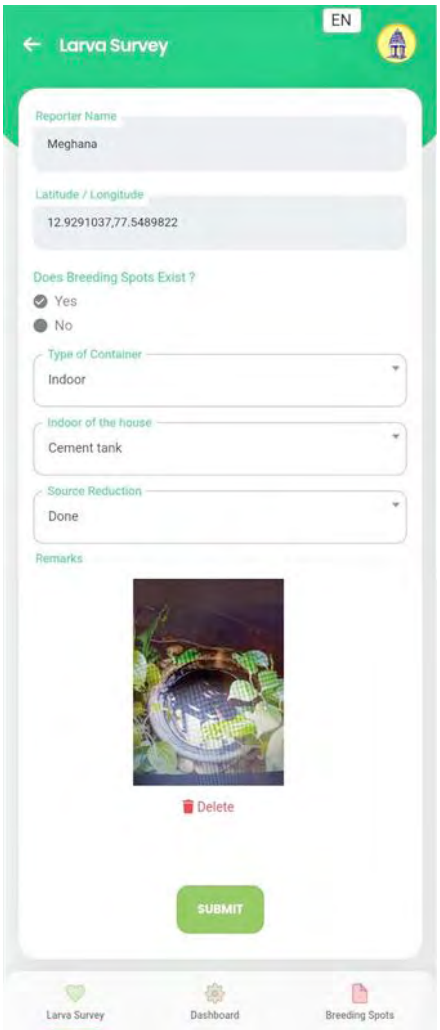
The city of Bengaluru is particularly exposed to the disease. Over 50 per cent of reported cases of dengue in the state of Karnataka are from the Bruhat Bengaluru Mahanagara Palike (BBMP), which covers the greater Bangalore metropolitan area. Annual reported cases are expected to increase, due not only to changing climate conditions but also as a result of the rapid expansion of the city. Bengaluru has experienced a 170 per cent expansion of its built-up area between 1985 and 2015, while its population is projected to nearly double by 2050, from 10 million inhabitants in 2019. In a context of unplanned urbanization, without adequate provisions for housing, sanitation or reliable water supply, the conditions pose a variety of health threats, including dengue.

### Solution developed

Combatting the increased exposure to dengue requires robust monitoring and preparedness tools for the health department of the BBMP. By leveraging institutionalized disease surveillance systems, and through multi-stakeholder consultations with city and state officials, the non-profit organization Artificial Intelligence & Robotics Technology Park (ARTPARK), in collaboration with the Indian Institute of Science (IISc), International Centre for Theoretical Sciences (ICTS-TIFR) and Northeastern University, Boston, developed a monitoring and forecasting platform to help improve preparedness and timely response to dengue outbreaks.

The platform was developed to classify dengue outbreak risk zones (green, yellow, orange, red) based on the World Health Organization's (WHO) technical handbook for dengue. This platform uses data from dengue cases in the city, meteorological data and population density, alongside additional information such as ecological, entomological and demographic factors. The platform assists in the early detection of outbreaks and temporal and spatial clustering of dengue cases, providing city administrators with the information needed to strategically coordinate activities to manage the spread of dengue, such as fever surveillance, sanitation, vector control and awareness generation. The forecasting and risk zone classification are currently provided for up to 240 sub-districts in Karnataka and the eight administrative divisions of the BBMP, and have been embedded into the decision-making workflow.

**Figure 22.1: User-side of the larval survey app that supports an entomological survey and fumigation team**

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## Impacts of the solution

While the roll-out of the project is still in its early days and the impacts on the prevalence of dengue cannot yet be assessed, the project has already resulted in tangible outcomes. The main impact of this project has been the creation and operationalization of a cross-sectoral collaboration between city health administrators, state authorities, epidemiologists and data scientists to tackle climate-sensitive health challenges like dengue. This partnership enabled the leveraging of available resources for innovations in data science and analytics, integrating them into routine public health operations.

The ecosystem created under the project contributed towards the institutionalization of these efforts through the One Health Cell and Climate Cell within BBMP. These cells have embedded health and climate considerations into urban planning and administration, further strengthening the city's long-term resilience.

Another significant outcome, emerging from these successful collaborations, has been to inform gaps in data quality. A robust data pipeline has been created to ensure the standardization, harmonization and clean-up of data from multiple sources and make them available for analysis in a secure manner. These activities have provided a launchpad for multiple research and innovation groups to address dengue management in the city. There are currently at least eight different groups working on various approaches for dengue management and control by leveraging the data pipeline.

Vector control activities are a critical component of dengue management and can be an important predictor for outbreak risk. Through the initiative, it was identified that data related to vector control activities are fragmented. In response to this, the health wing of BBMP digitized the vector surveillance and control systems through the "Platform for Integrated Surveillance and Management of Health Application (PRISM-H)"– made possible with the support of ARTPARK. The use of the platform has led to the identification of over 40,000 mosquito-breeding sites by community health workers (see Figure 22.1), expanding community outreach and increasing the project's overall impact. Moreover, as vector-borne disease management is closely tied to climate resilience, the forecast models, originally delivered in report form, are now being integrated into the Integrated Control and Command Centre (ICCC) to enhance timely monitoring.

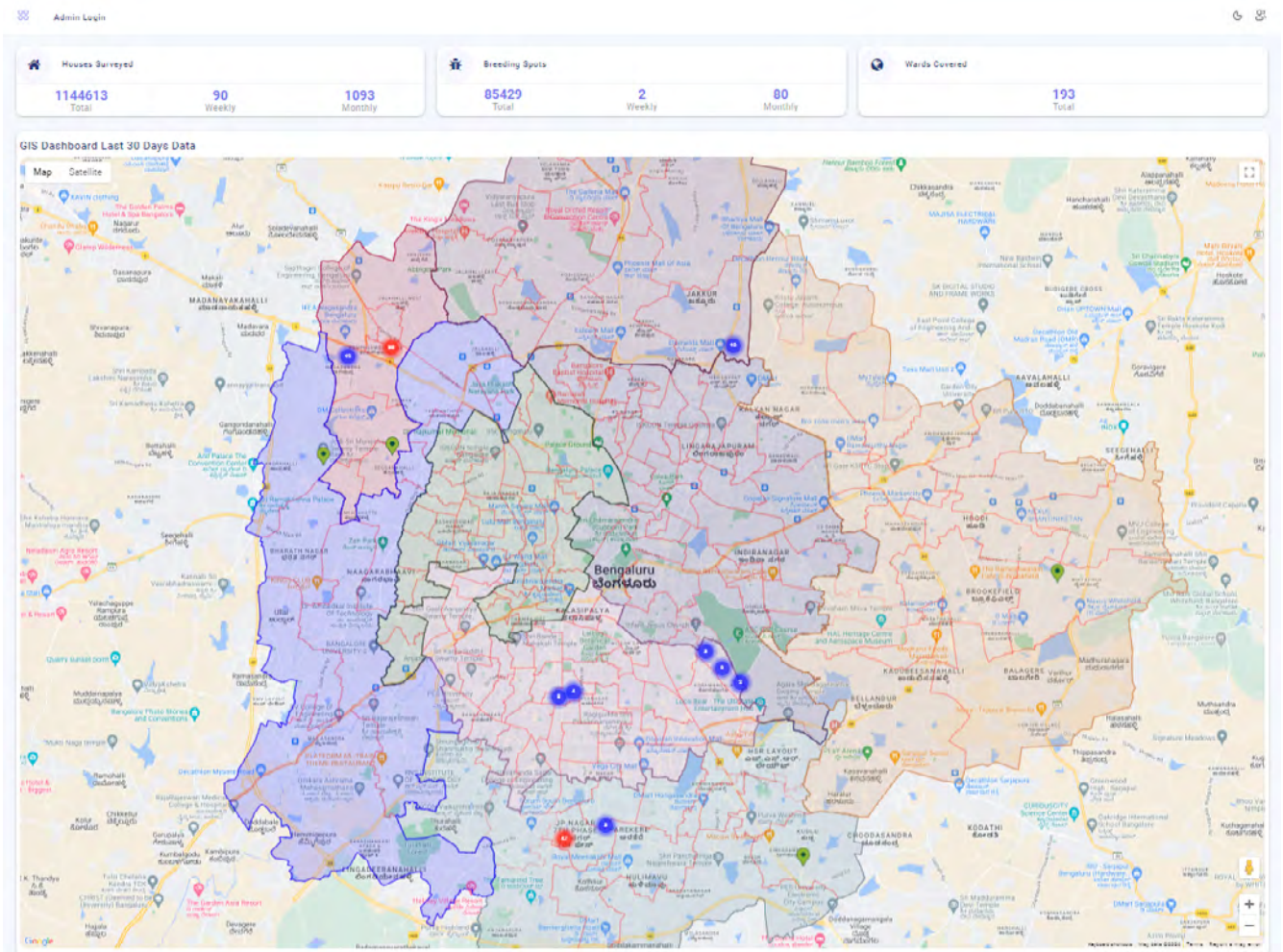
The main impact of this project has been the creation and operationalization of a cross-sectoral collaboration between city health administrators, state authorities, epidemiologists and data scientists to tackle climate-sensitive health challenges like dengue.

## Drivers and enablers of the solution

Institutional buy-in, through support from the government at the state, district and municipal administrations, along with climate governance frameworks and administrative systems, have been instrumental for the success of the project. There was significant interest and buy-in from senior BBMP officials, including the Commissioner and Special Commissioner of Health. BBMP had benefitted significantly from data-centric innovations during the recent COVID-19 pandemic, and there was a keen interest in institutionalizing such efforts for existing and emerging threats.

Steps had already been taken to achieve this through the ICCC. Building on this institutional momentum, BBMP also adopted the "Bengaluru Climate Action Plan", which establishes a strong framework for the city's efforts toward implementing mitigation and adaptation objectives.

**Figure 22.2: Admin-side for monitoring of entomological survey and fumigation**




© ARTPARK & BBMP

Data science innovations largely depend on data availability: in this regard, dengue was a feasible starting point for climate-sensitive disease because it was prioritized by surveillance programs, such as the National Vector Borne Disease Control Programme and Integrated Disease Surveillance Programme. The availability of at least five years of data, combined with other publicly available datasets, made this possible. The journey from data to insights requires an understanding of priorities and the needs of administrators, as well as an awareness of the latest advances in data science, analytics and computational techniques to translate them into actionable outcomes. This process necessitates close collaboration and coordination among experts from multiple disciplines. The Technical Advisory Committee, established during the COVID-19 pandemic, laid the groundwork for these partnerships. Additionally, academic institutions in Bengaluru brought expertise and experience in disease surveillance within the city, which could be readily leveraged.

## Lessons learnt and prospects

The platform is a good starting point for leveraging data and analytics in routine operations and decision making. However, it is important to note that the insights must continue improving with changes in context, climatic factors, disease dynamics and available data. Creating a working group with expertise and experience in responding to climate-induced public health challenges will further enhance this effort, informing regional policies and creating a pool of experts prepared to manage future pandemics.

The solution will be evaluated for a potential scale-up across other cities in India. The evaluation will cover the clustering, forecasting and risk classification model developed for dengue, taking into account local and regional contexts. The solution is planned to be integrated into the Integrated Health Information Platform, which is the advanced disease surveillance system of the operational Integrated Disease Surveillance Programme for scaling across other parts of India. The administrative structure of the National Centre for Disease Control, which anchors communicable diseases and the objectives of climate change and human health in India, will also be leveraged. The solution will embed "climate change and health" into the routine structures of the subnational administration by aligning the solutions with national or global objectives for sustainability.

Replicating the platform's success in other regions requires active engagement with local stakeholders and ongoing engagement between the technical teams and developers, with the city's public health department to handhold where necessary and communicate the model results and interpretation. This includes understanding regional priorities, leveraging existing frameworks, and collaborating with local government officials, public health agencies and research institutions. These stakeholders play a critical role in contextualizing the platform, addressing local challenges, and ensuring alignment with existing systems and resources. Their involvement will help drive adaptation and acceptance in new regions.

In international contexts, similar disease surveillance programmes and meteorological services can be leveraged to replicate the platform's success. Complete and regular collection and analysis of epidemiological and entomological surveillance data are essential, along with data digitization, to scale up the solution effectively. As cities increasingly adopt data-driven approaches, health and climate change concerns should be prioritized in urban planning, with solutions such as the platform integrated into the systems of local urban authorities.

*This case study was submitted by ARTPARK.*

## More information

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# Case studies presenting financing interventions for climate change in cities

23

## La Borda Cooperative Housing: Tackling Affordable Housing and Climate Change in Barcelona through Community Land Trusts

**City/Locality:** Barcelona
**Country:** Spain
**Region:** Europe
**Theme:** Financing interventions for climate change in cities


### Context

Barcelona faces a complex intersection of climate change and access to housing challenges, especially in the aftermath of the 2008 global financial crisis and the "burst" of the housing bubble. This increased pressure on households faced with higher levels of unemployment, lower wages and limited homeownership financing options exacerbated the shortage of affordable homes. At the same time, rising temperatures and increased heatwave risks have strained energy consumption and water supply, further disempowering communities.

As part of the response to the intertwined challenges, the City of Barcelona adopted the Right to Housing Plan (2016-2025). The Plan aims to more than double the number of affordable housing units in the city, primarily by investing in the construction of rental public housing as well as by partnering with private limited- and non-profit affordable housing providers. Given that the building sector is responsible for 37 per cent of all greenhouse gas emissions, making the production and use of housing sustainable without undermining affordability is a key challenge.

One of the initiatives adopted by the Plan in November 2020 is the Barcelona framework agreement for affordable housing, known as the "Conveni ESAL" (henceforth ESAL Agreement), which aims to build or rehabilitate 1,000 sustainable homes over the next decade by granting 99-year leaseholds of municipal land and buildings to non-profit entities. La Borda, one of these pilot projects, co-evolved with this aforementioned institutional process from a grassroot process at Can Batlló. Here, an open neighbourhood assembly worked to revive a publicly-owned brownfield site, with La Borda playing an instrumental role in this process.

### Solution developed

In 2012, La Borda was the first cooperative housing project supported by land owned by the City of Barcelona. The city later institutionalized the relationship with community-led housing through the ESAL Agreement, characterized by collective ownership of housing and other assets to support thriving local communities. It is inspired by the Community Land Trust (CLT) model, in which the emphasis is on ensuring that land

and housing assets remain permanently affordable through long-term stewardship by non-profit, democratic, community-led organizations. By taking a long-term perspective on land use and development, CLTs incentivize more circular initiatives, like mobility sharing or collective energy solutions that promote positive social and environmental outcomes.

**Figure 23.1: The interior courtyard of the La Borda cooperative housing project**

© Institut Municipal de l'Habitatge i Rehabilitació de Barcelona

In a CLT model, residents hold a "grant of use" instead of ownership—meaning they cannot sell or rent out the housing unit. This ensures they have secure, long-term housing while the land itself is owned and managed through the cooperative. Access to housing and land rights underly many of the challenges faced by low-income urban households. The lack of affordable homes, limited access to decent, quality community spaces and the degradation of the natural environment are all symptoms of systems in which the social and environmental function of land is not respected. Decoupling land ownership from market-driven prices therefore helps circumvent these impacts.

Self-development and collective management are the most significant and distinctive features of La Borda. This involves an emphasis on:

- A common-living model in which shared services and common spaces encourage sociability and save space (for example, through shared laundry rooms, co-working space and communal kitchens for shared meals).
- Participatory design to enable residents to shape the project according to their needs.
- Sustainability/adaptability of the architectural project in the use of materials, water and energy reduction features.
- Inter-cooperation: when self-organization has not been able to cover their needs, they outsource through other co-operatives. This process will help future projects like La Borda to not only begin and grow easily, but also to collaborate with other projects in the social economy.

## Impacts of the solution

La Borda addresses both the housing and climate challenge by advancing access to adequate, non-speculative and affordable housing while ensuring the environmental impact of housing developments are minimalized. The housing developments are designed with bioclimatic features that minimize environmental impact both during construction and maintenance over the lifetime. La Borda has a lower-than-average environmental impact, with an average energy consumption of 66.37 kilowatt hours per square metre annually, leading to less CO2 emissions than average housing projects. The project also seeks to reduce energy poverty among residents through the judicious use of building materials, with the result that most flats do not require heating during the winter.

**La Borda has a lower-than-average environmental impact, with an average energy consumption of 66.37 kilowatt hours per square metre annually, leading to less $CO_2$ emissions than average housing projects.**

Additionally, by funding the project through ethical sources and providers, La Borda has had a considerable impact on Catalonia's social economy. It has also contributed to the creation of La Dinamo Fundació, a foundation established with the aim of encouraging and promoting the implementation of cooperative housing and the "grant of use" model as an alternative to conventional housing markets. The foundation now operates as a source of support for other initiatives that promote cooperative housing projects, and collaborates with them to replicate such projects across Catalonia.

## Drivers and enablers of the solution

La Borda is a co-operative model of housing that builds on expanding range of examples, such as the Andel Model in Denmark, or the work by the Federacion Uruguaya de Cooperativas de Vivienda por Ayuda Mutua in Uruguay. Inspired by these initiatives, members of La Borda adapted their model to the local context in Barcelona. The solution was made possible by the change in policy of the Barcelona Municipality. The ESAL Agreement seeks to increase the supply of permanently affordable housing in the city, while developing a shared governance structure that allows for increased resident involvement in the design and management of the housing stock. To favour climate action, projects like La Borda within the ESAL Agreement were exempted from building on-site car parking, while at the same time being required to use sustainable building materials and techniques to make its housing more energy efficient. All projects within ESAL have to achieve a high energy certification of label A or B.

Beyond policy making, the Municipality of Barcelona also played an enabling role in:

- Providing the land where the new homes were developed.

- Easing the process of permits with a 6-month application window and a 2-year execution period.
- Supporting new financing channels proposed through credits with public banks.
- Offering a guarantee for missed payments and various other incentives in the forms of subsidies, support with mortgage repayments and a generous real estate tax bonus.

The direct involvement of co-op members is central to the development of La Borda. Residents participate in the decision-making process and in the management of the project via seven committees: legal, architecture, economy, communications, secretariat, self-construction and community life. To promote community cohesion and reduce costs, members have also contributed to the construction of the building and community spaces. By fostering a community based on shared values, La Borda pioneers alternative housing models, aligned with a just transition perspective.

## Lessons learnt and development prospects

The CLT model of housing development remains nascent in Spain with for example, only 50 projects built or close to completion in Catalonia, in the last decade creating just over a thousand housing units. Establishing new legal frameworks and work methodologies is crucial for enabling and scaling up these models. Legal protections that protect land from speculation in perpetuity are critical in creating genuinely and permanently affordable housing for generations to come. Sharing knowledge and experience is also crucial for scalability. For instance, La Borda collaborates with La Dinamo Fundació to provides technical and organizational support to replicate the model.

The establishment of the European CLT Network and recognition of CLTs as best practices by the EU Urban Agenda on Housing and the European Parliament emphasize the replicability and societal benefits of such models. These partnerships showcase the potential for integrated policies to drive environmental and socio-economic change. The project's environmental performance is being assessed by the Barcelona Energy Agency for potential replication.

*This case study was submitted by European Community Land Trust Network (ECLTN) and Xarxa d'Economia Solidària (XES).*

## More information

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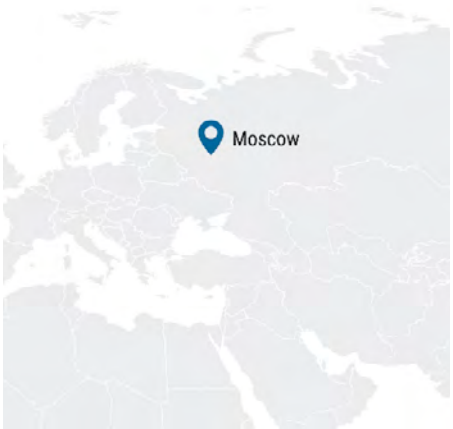
24

## Moscow Green Bonds: Financing Sustainable Urban Development

**City/Locality:** Moscow
**Country:** Russian Federation
**Region:** Europe
**Theme:** Financing interventions for climate change in cities




### Context

The City of Moscow aims to promote climate action and green values among Russian investors and the public. Despite increasing budgetary spending on green initiatives, the Government of Moscow sought to develop green finance products to further expand the list of financial instruments for sustainable development of the Russia Federation. One of the city's pressing needs was the upgrade of its public transport system to reduce air pollution and greenhouse gas emissions, particularly by replacing diesel buses with electric ones and expanding metro services. The transition was also intended to enhance accessibility, particularly for those living with disabilities and other vulnerable populations, while the creation of an institutional framework for the public release of green bonds was designed, inter alia, to encourage broader participation of institutional and retail investors from all across Russia in sustainable finance projects.

### Solution developed

Two issuances of municipal green bonds have been placed by the Moscow government:

- The initial issuance in May 2021, the first time green bonds had been placed by a public sector issuer in Russia, was worth approximately US$1 billion and targeted institutional investors with a coupon yield of 7.38 per cent. The proceeds funded the purchase of 400 electric buses and the construction/reconstruction of 21 stations and 48 kilometres of the Moscow metro's Big Circle Line (which became operational in 2023).
- The second issuance in May 2023, which was targeted at individual investors, raised about US$30 million. The attractive coupon yield of 8.5 per cent before personal income tax contributed to the positive market reception and the bond was sold out in a matter of weeks. To enhance accessibility for individual investors, the issuance was placed on the Moscow Exchange's online platform "Finuslugi" (meaning "financial services" in Russian). To further shield individual investors from market risks, the bond is not traded on the exchange but can be redeemed at the sale price by the Moscow Government at any time before maturity. The proceeds financed the acquisition of 51 additional electric buses, which continued efforts to upgrade the city's public transport infrastructure.

By issuing these green bonds, the Moscow Government has played a crucial role in catalyzing the public green bonds market in Russia. In particular, in 2021, the amendments to the Moscow Exchange listing rules were made to arrange the placement and include the Moscow green bonds into the sustainable development sector of the Moscow Exchange, creating the procedure for other Russian regional and local governments to follow suit.

Additionally, both issuances were verified as green financial instruments, aligning with the Sustainable Development Goals and benefitting from official recognition, thus enhancing investor confidence.

## Impacts of the solution

The Moscow green bonds have had a profound impact on the city's environmental and social landscape. The bond proceeds were used to upgrade Moscow's public transport system, enabling the purchase of a total of 451 electric buses and the improvement of the public transport infrastructure. These investments have significantly contributed to pollution reduction. In 2023 alone, the projects financed through the 2021 issuance of the Moscow green bonds helped reduce the pollutant and $CO_2$ emissions in Moscow by almost 980 tons and 39,400 tons respectively.

Beyond the environmental benefits, the greening of the public transport system has contributed to broader social benefits in advancing universal accessibility of people with disabilities and other vulnerable groups to public service transport systems. The green bond initiative also fostered greater citizen engagement, giving residents a more tangible role in advancing sustainability efforts and climate action. Furthermore, the initiative catalyzed the widespread adoption of green finance, with individuals from 73 regions across Russia participating in the bond purchases. These combined efforts have contributed to an improved quality of life in Moscow by reducing vehicle emissions and expanding access to clean, efficient public transportation.

In 2023 alone, the projects financed through the 2021 issuance of the Moscow green bonds helped reduce the pollutant and CO2 emissions in Moscow by almost 980 tons and 39,400 tons respectively.

**Figure 24.1: Electric buses purchased with the proceeds from the Moscow green bonds**




## Drivers and enablers of the solution

The issuance of Moscow's green bonds was driven by collaboration among key stakeholders and robust regulatory support. The 2021 amendments to the Moscow Exchange listing rules enabled the placement of the Moscow green bonds into the sustainable development sector of the Moscow Exchange. The 2023 Moscow green bonds placement became the first-ever case of the Moscow Government borrowing from individual bondholders. Credit rating agency Expert RA also played a key role in ensuring the successful issuance of the financial instrument.

The initiative also had strong financial backing, with the Moscow Government providing individual bondholders with redemption guarantees at any time to protect them from market risks. Additionally, the Moscow budget covered all bond preparation costs. Technology also played a role in enabling the second bond issuance to individual investors, with the bond placed on the internet platform Finuslugi of the Moscow Exchange to enhance accessibility.

## Lessons learnt and development prospects

The Moscow green bonds initiative offers several key lessons. It successfully attracted private capital to fund sustainable urban projects, with potential for scaling and replication in other regions of Russia, as demonstrated by further examples of green bond issuance by Kaliningrad region and the city of Krasnoyarsk. The initiative also marked a significant shift in public engagement, especially in the 2023 issue—the first-ever case of the Moscow Government borrowing from individual bondholders. This has made an important contribution to greater financial inclusion and literacy, as well as enhanced collaboration and participation towards resolving major urban development challenges.

Both issuances of the Moscow green bonds were prepared by a dedicated task force comprising authorities from various bodies of the Moscow Government, as well as external contributors. The Moscow green bonds became a major public-private partnership project led by the Moscow Government in cooperation with the Bank of Russia, the Russian state development corporation and investment company VEB. RF, Moscow Exchange, and 13 major Russian investment banks with extensive experience in arranging bond placements. This broad coalition contributed to elaborating a collaborative framework for Russia's regional and local governments to finance their sustainability projects, aligned with the international and Russian green finance standards. In May 2023, the Moscow green bonds received the Eurasian Economic Commission's Green Eurasia Award for the best green finance practice, and recommended for replication by other member countries of the Eurasian Economic Union.

*This case study was submitted by the Department for Economic Policy and Development of the City of Moscow.*

### More information

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## Driving Ecological Transition by Systemic Rewiring of the Local Economy and Engaging Citizens at Scale: the ECO Transition Network in Seine-Saint-Denis, France

**City/Locality:** Seine-Saint-Denis, Paris
**Country:** France
**Region:** Europe
**Theme:** Financing interventions for climate change in cities


### Context

The transition to climate-resilient cities is marked by a disconnect between those deemed to be contributing the most to the crisis and those who suffer its consequences, with disadvantaged groups often bearing the brunt of the impacts. Moreover, climate action often occurs without full engagement to understand the experiences and needs of disadvantaged groups, resulting in "top down" solutions that do not effectively address needs and sometimes even create additional burdens.

Seine-Saint-Denis, a region marked by ethnic diversity and high levels of urbanization, is among the poorest areas of France, with some residents struggling to cover their basic daily needs. The intense urbanization that occurred in the last 20 years in the neighbouring city of Paris, coupled with climate change, is now causing serious concerns about the district's future liveability and resilience. Despite extensive efforts in sustainable urban planning, accompanied by significant investments in adapting and upgrading infrastructures and services, local authorities are still struggling to effectively engage residents around climate action. At the same time, this area demonstrates a broad and rich diversity of practices fundamentally compatible with sustainable development, carried out by small groups and associations at the community level, each trying in different ways to reconcile ecological and economic imperatives in their lives.

### Solution developed

The fundamental goal of the ECO Transition Network is to trigger a cascade effect, starting with sustainable practices at the household level to engage communities as influencers and supporters of a fundamental rewiring of local economies. This approach aims to empower residents in developing and promoting their responses to climate change, spreading knowledge and building links among actors to unleash ecological transformation at scale. In February 2023, an innovative trusted third-party local association, Comité ECO, was co-founded by three entities: Plaine Commune, a territorial public authority bringing together nine cities north of Paris with 450,000 inhabitants; Institut de Recherche et d'Innovation, a private research group with a strong history of collaborating with Plaine Commune on a variety of projects; and Odyssee, an urban design firm with expertise in systemic design approaches for territorial transition toward sustainability.

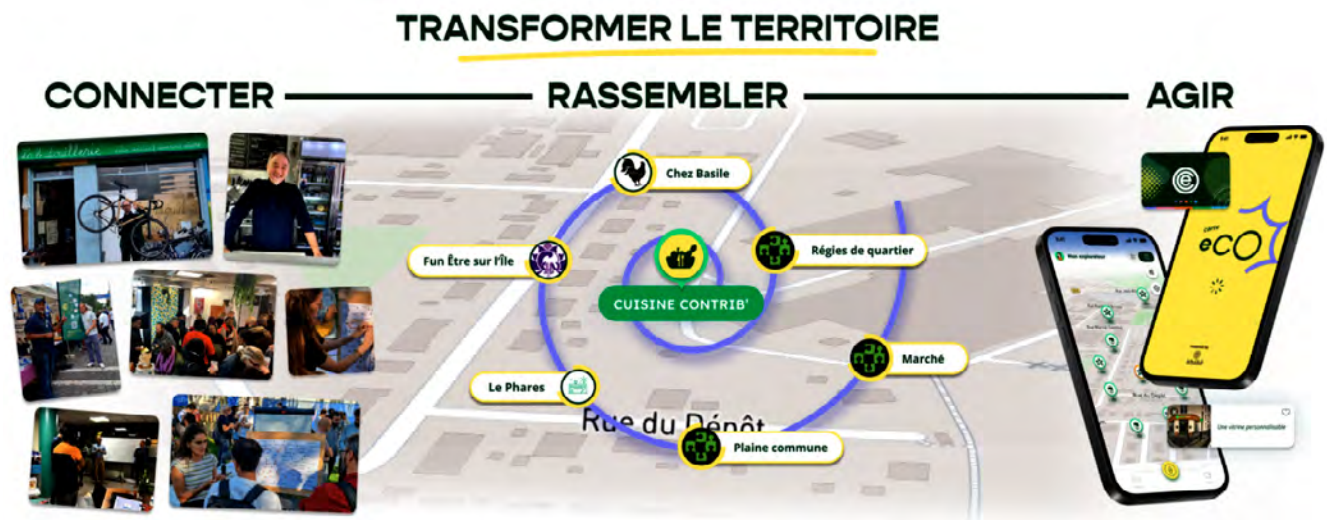
Bringing together residents, businesses and local government stakeholders, the Comité ECO deploys a systemic approach of "territorial ecology" that integrates vertically across different players and horizontally across different sectors in Seine-Saint-Denis to foster inclusive, participatory action. This transformation is achieved by combining three components:

- ECO Parcours: a community engagement approach that identifies, co-designs and promotes eco-friendly products that are specifically re-connected to a local and sustainable supply chain. This participatory process aims to secure a decent price for citizens, a fair wage for local economic actors and a well managed ecological footprint in the supply chain.

- ECO money: a complementary local currency in Seine-Saint-Denis linked to the Euro that can only be used among the network of local merchants and businesses engaged in ecological transition. ECO money is made possible through the 2014 French law No. 2014-856 on the social and solidarity economy.

- ECO card: the entry gate into the ECO network. Designed as a "social action network", the platform connects the local community and facilitates daily real-life interactions. As with like larger platforms, the app relies on digital infrastructure specifically devised to operate ecological artificial intelligence (AI). This is comprised of algorithms trained to identify sustainable practices and interactions that can be used to evaluate the territorial metabolism and identify actions to enhance its performance. These mechanisms can help orient residents, businesses and local authorities towards individual and collective shifts in everyday practices that encourage more local and environmentally positive consumption patterns.

**Figure 25.1: Territorial transformation through "connecting, gathering and acting"**




## Impacts of the solution

The solution was developed in close alignment with the Sustainable Development Goal (SDG) targets, in particular SDG 12 on "responsible consumption and production", with co-benefits that also advance SDG 8 on promoting "decent work and economic growth", SDG 10 on reducing inequalities and SDG 11 on "sustainable cities and communities".

**Figure 25.2: Community engagement in Seine-Saint-Denis**

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By September 2023, 600 residents and 140 local companies and associations had subscribed to the approach, addressing mobility, food, habitat, consumption and biodiversity through a variety of actions and collaborations. Network members can earn ECO money by conducting "ECO-actions", enabled through a 100,000 per annum transition fund run by Comité ECO and provided by Foundation de France. Each of the companies in the network is deploying one "synergy" per year, further reinforcing the circularity and sustainability of the local economy, employment and supply chains.

For example, through the "ECO Parcours" component of the solution, two supply chains were targeted, namely the food and textile/fashion supply chains. In the food value chain, 10 partners are working with residents to enable the supply of quality food at under 4 per portion to all residents, with a target footprint within 2tCO2e per person annually. In the fashion value chain, eight partners are involved in a fully local circular "collect and supply" system for fashion and clothing, with the goal of preventing 7.8 tonnes of textiles every year from going to landfill.

## Drivers and enablers of the solution

The involvement of the local authorities at all levels is a key enabler of the project. State, region, metropolitan and local authorities are united in supporting the integration and deployment of the ECO Card to most services and equipment.

This broad support legitimizes Comité ECO's vision, as well as the businesses and citizens who take part in the network. Having a trusted third-party, composed organically from local actors, was key to its acceptance in the community. At a national level, the ECO transition network project is supported by the French government and the Ministry for Ecological transition with 1.3 million in funding.

Digital technology is a powerful enabler, especially in scaling the network effect to support ecological transformation. The digital platform, ECO Card, is developed by Ithake—a tech company that seeks to harness digital technology to accelerate ecological transformation—and can be deployed across a wide range of daily interactions, enabling progressive adoption locally. While using the app, residents are regularly "contacted" by the integrated AI with suggestions for relevant opportunities in their neighbourhood such as groups, events and businesses. Each interaction holds the promise of boosting the local economy while supporting the shift towards greater sustainability.

## Lessons learnt and development prospects

Pivoting on a well understood idea—money—provides a powerful means of engagement and communication: it is a visible marker of economic actors engaged in the local ecological shift, and a strong message to citizens about the power and impact of their consumption. There are already 90 "Local Money" registered associations in operation in France, and 5,000 globally.If local money is a good entry point into the network for the most engaged communities, the applications facilitate a broad range of complementary services that make it very convenient and useful for every resident. For instance, public landlords who run social housing have adopted the app as a mean to facilitate access to parking, compost bins and shared facilities. Large companies based in Plaine Commune are also invited to join the network and engage with the local actions as part of their corporate social responsibility commitments.

In Plaine Commune, the network is scaled to encompass all residents of the nine cities under the territorial authority of Plaine Commune. With the help of the French Environment and Energy Management Agency (ADEME), and in the wider framework of France's "Nation Verte", other communities are preparing to replicate this model themselves. The solution that is initially being deployed in Seine-Saint-Denis is now available globally and can be deployed in any location on demand. The AI that has been trained and deployed in the project is readily deployable to other contexts, where it can analyze local metabolisms and produce a recommended set of actions to reinforce circularity.

*This case study was submitted by Comité ECO.*

### More information

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## Case Study Acknowledgements

| Case Study No | Case Study Location: | Submitters: | Submitting Organization: |
|---|---|---|---|
| 1 | Pemba, Mozambique | Gabriele Tardivo,<br>Laura Morisio | AVSI, Mozambique |
| 2 | Morondava, Madagascar | Fruzsina Straus,<br>Laia Bonet Filella,<br>Sandrine Andriantsimietry | UN-Habitat Regional Office for Africa |
| 3 | Mexico City, Mexico | Raquel Vargas | Secretary of the Environment of Mexico City (SEDEMA) |
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| 8 | Bargny, Senegal | Laia Bonet,<br>Fruzsina Straus,<br>Aminata Baro,<br>Mathias Spaliviero | UN-Habitat Regional Office for Africa |
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