A Watershed Approach in Ecosystem-based Adaptation

A case study from Latin America and the Caribbean

Photo credit: Jeff Vincent

UN environment programme

The United Nations Environment Programme (UNEP) is helping cities in Latin America and the Caribbean to adapt to climate change with a project titled *Building climate resilience of urban systems through Ecosystem-based Adaptation (EbA) in Latin America and the Caribbean*. Funded by the Global Environment Facility, the project aims to reduce the vulnerability of communities to climate change in three cities - Xalapa (Mexico), Kingston (Jamaica), and San Salvador (El Salvador) using a practice known as 'Ecosystem-based Adaptation.'

80% of people in Latin America and the Caribbean live in cities, and the number is growing. Cities rely on healthy ecosystems to function and for the well-being of the population. However, rapid and often uncoordinated urbanization is degrading the natural ecosystems in urban and peri-urban areas across the region. Climate change adds additional pressure, increasing the risks of extreme weather events and compounding the vulnerabilities of communities. Ecosystem-based adaptation (EbA) - using nature to help people adapt to climate change - can strengthen the resilience of ecosystems and local communities.

This case study shares the lessons learned through the CityAdapt project on adopting a watershed approach to ecosystem-based urban adaptation planning.

Managing Watersheds for Climate Adaptation and Urban Resilience

Biodiversity, water, climate, and human health are all interconnected. A small change in the climate can have a big impact on the global water cycle, affecting the availability and quality of water and the intensity of extreme weather events. To understand the climate risks facing cities and design appropriate adaptation strategies, it is necessary to look beyond city boundaries to the wider ecosystem and watershed.

Project Title

CityAdapt: Building climate resilience of urban systems through Ecosystem-based Adaptation in Latin America and the Caribbean

Executing Agencies

Ministry of Environment and Natural Resources, El Salvador (MARN); Ministry of Economic Growth and Job Creation, Jamaica (MEGJC); and the Secretariat of Environment and Natural Resources, Mexico (SEMARNAT)

Project Timeframe

2017-2023

Key Figures

2,000
Young people (50% women) trained in EbA and climate-resilient livelihoods

800+
Public sector stakeholders (53% women; 47% men) trained in EbA

16
Technical guidelines on urban EbA produced

Funding

USD 6,000,000

Supported by the Global Environment Facility's Special Climate Change Fund

Drawing on the experiences of the CityAdapt project, this case study highlights three key aspects when planning and implementing EbA using a watershed approach:

- Assessing climate risks and vulnerability at watershed level
- Stakeholder mapping and engagement across scales
- Cost-benefit analysis of watershed ecosystem services

Assessing Climate Risks and Vulnerability at the Watershed Level

When assessing risks such as flooding, drought, landslides and cyclones, a watershed perspective helps to examine the connections across the ecosystem and the specific vulnerabilities faced in different parts of the watershed. The CityAdapt project assessed the socio-environmental vulnerability of urban and peri-urban areas of San Salvador, Xalapa and Kingston and their adaptive capacity to cope with the impacts of climate change.

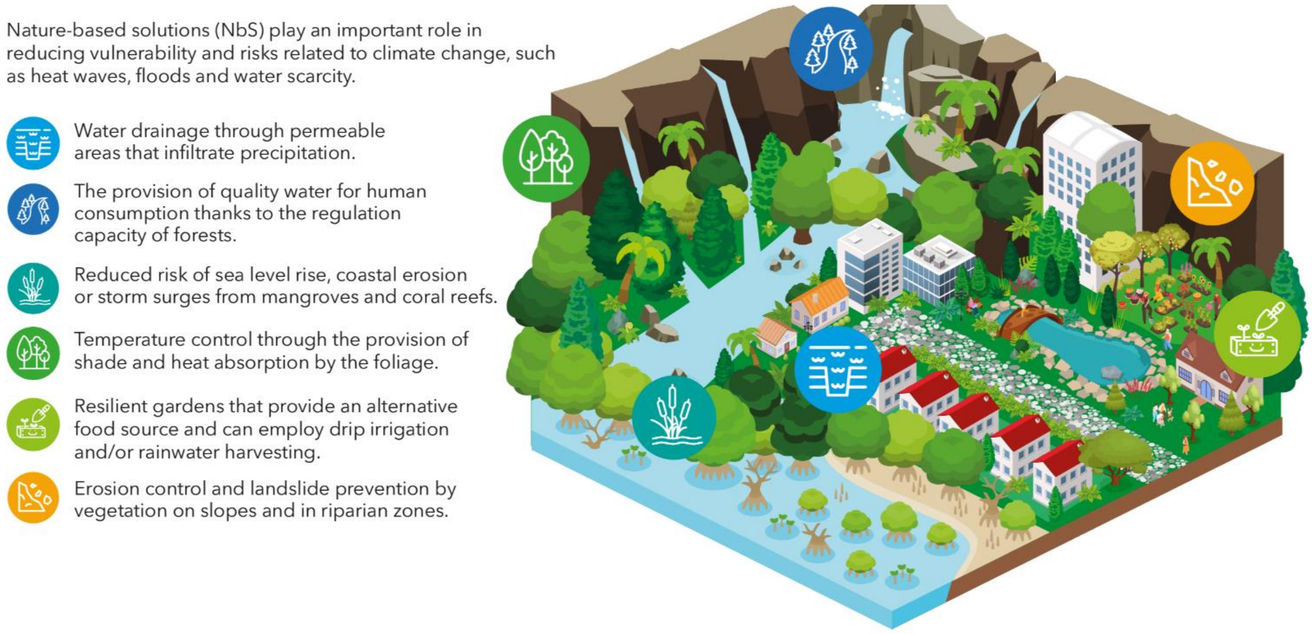
The vulnerability assessments covered the Arenal-Monserrat watershed in El Salvador; the Xalapa and Tlalnelhuayocan municipalities and the watersheds of the Huitzilapan and Pixquiac rivers in Mexico; and the Hope River watershed in Jamaica. The assessments examined the livelihoods and ecosystem services within the watersheds, identified the main climate risks and the most vulnerable areas, as well as possible EbA measures. It is essential to incorporate gender into vulnerability analyses, to understand how climate change intersects with other inequalities for women and girls, and to target actions accordingly. UNEP collaborated with UN Women to develop gender action plans for the CityAdapt project (UN Women, United Nations Development Programme and United Nations Environment Programme [UNEP] 2020).

Jamaica: Small Island Developing States like Jamaica bear a disproportionately high impact from climate change. Jamaica experienced one of the worst droughts on record between 2014 and 2015, which had a devastating impact on rural livelihoods and the economy. The Hope River watershed, which provides 40% of Kingston City's water, is extremely fragile. Rapid population growth, agricultural expansion (mainly from coffee), and deforestation have contributed to ecosystem degradation and affected the quantity and quality of water across the entire watershed. Maintaining a healthy ecosystem with infiltration capacity in the upper watershed at the source of the Hope River can decrease climate risks such as flooding and landslides in urban areas downstream.

EbA interventions are currently being implemented across Kingston and the Hope Watershed, including planting nearly 10,000 trees, a beekeeping initiative providing an alternative livelihood for local communities, installing irrigation systems and greenhouses in schools and rehabilitating wetlands. Kingston's vulnerability assessment was expanded in 2023 to other communities selected from the upper, middle and lower reaches of the Hope River Watershed. The assessment identifies a range of potential EbA measures and their ecological, social and adaptive benefits. For example, agroforestry can improve ecosystem function and nutrient cycling, sequester carbon, and enhance soil health while increasing crop yields.

Assessing climate risks and vulnerability using a watershed approach can provide important benefits for urban planning.

Figure 1: How Nature-based Solutions Are Integrated Into Cities

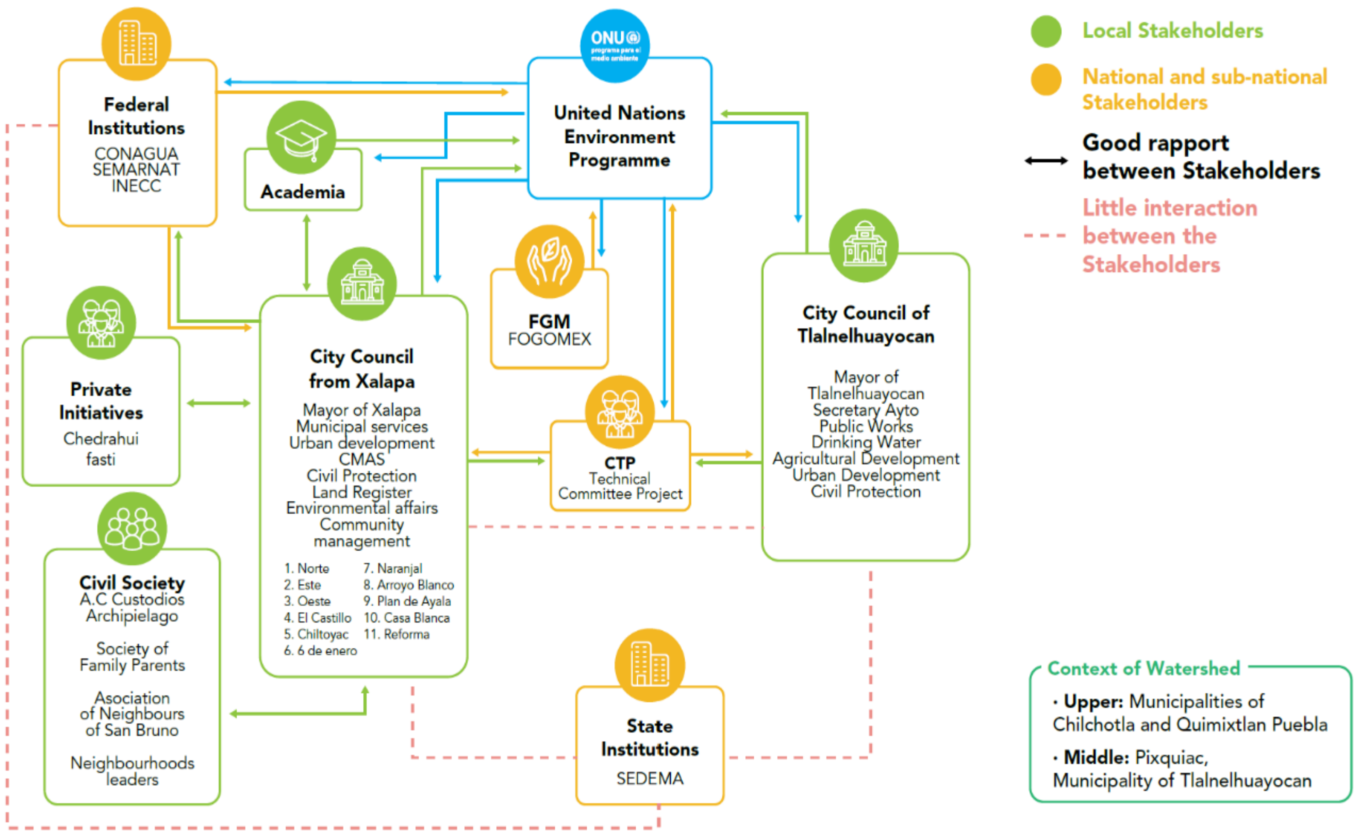


Stakeholder Mapping and Engagement Across Scales

The CityAdapt project aims to mainstream EbA into medium- and long-term urban development planning. This involves engaging with local, national, and regional institutions and training stakeholders to integrate climate change indicators into their planning processes. One of the first steps in planning urban EbA is to identify the people involved in decision-making and those potentially affected by the project. Stakeholder mapping helps to visualize how different actors are connected, while power and influence mapping can guide the stakeholder engagement strategy to identify the interests and influence of actors. It is a continuously evolving exercise as the project is implemented and as actors change positions.

Mexico: In Xalapa, the stakeholder mapping exercise (Figure 2) identified links between local, municipal, and regional institutions. It also recognized that the level of collaboration between the network of actors varies depending on the phase of the project. The EbA project in Xalapa built on an existing network of actors from the public sector, academia and civil society whom are concerned with the sustainable management of the city's water resources and ecosystems. Working closely with those involved in developing the city's strategy for integrated water resource management, the project aligned with Mexico's Nationally Determined Contribution (NDC), which prioritizes integrated approaches to adaptation and watershed management. Workshops were held to train stakeholders from the public and private sectors in vulnerability assessment, EbA and NbS. For example, in collaboration with the Mexican Climate Community, World Resources Institute and WWF, the CityAdapt team helped to train 16 subnational teams of decision-makers through the "NbS accelerator" initiative. The project has also increased the visibility of the work of local actors by disseminating small-scale interventions under the umbrella of CityAdapt.

Figure 2: Key Actors Identified by CityAdapt in Xalapa



Weighing the Benefits and Costs of Ecosystem-based Adaptation

Ecosystem-based Adaptation brings direct and indirect benefits and costs. Benefits include reduced risk of climate change impacts, mitigated damages arising from extreme weather events, and improved ecosystem services. Costs include equipment, staff, and maintenance expenses and the environmental and social costs of particular measures.

EbA has the potential to generate greater economic returns than other adaptation options, bringing co-benefits to people and nature. But more evidence is needed on the cost-effectiveness of EbA measures to support decision-making. The challenge lies in capturing the full spectrum of costs and benefits associated with EbA interventions, taking into account different stakeholder groups and their perception of value (UNEP and UNEP-WCMC 2020).

A cost-benefit analysis (CBA) can help to evaluate the different EbA measures available and choose the most appropriate option. CBA focuses on the overall costs and benefits of an adaptation measure, expressing them in monetary terms.

El Salvador: In the Arenal-Montserrat watershed of San Salvador, water runoff in the upper areas affects coffee plantations and causes floods in the lower areas, while urban residents are affected by water scarcity. The El Salvador EbA project used a hybrid approach, combining 'grey' built structures and 'green' nature-based measures. A CBA assessed the costs and benefits of the EbA measures (restoration, reforestation and rainwater harvesting systems). The study included a sensitivity analysis to account for different scenarios, including climate change scenarios forecasted for El Salvador.

The results of the CBA show that all the measures implemented in San Salvador are economically viable. For example, infiltration ditches installed in El Espino coffee cooperative in the upper watershed produce an estimated economic benefit of US $326,314 per year. Restoration of urban streams in the same area produces an estimated benefit of US $125,861 over ten years. The study also demonstrates the social benefits of adaptation solutions. Rainwater harvesting systems installed in schools led to a reduction in school absenteeism. When there is no water, schools suspend classes, impacting the students' education and health. The rainwater harvesting systems capture rainwater from the school roofs and filter it, providing clean water for the school community.

The study recommends scaling up EbA measures at national level and further analysis to identify other benefits and co-benefits of EbA measures at watershed level.

Infiltration ditches were built by the CityAdapt project in coffee farms in San Salvador to reduce flooding. Credit: CityAdapt

Lessons Learned

Lesson 1: Select the appropriate geographical scale for EbA.

- To assess a city's vulnerability to climate change, it's necessary to look beyond city or administrative boundaries to the wider ecosystem, landscape, or watershed. The resilience of urban ecosystems and populations depends on the health of the wider ecosystem.
- The experiences of the CityAdapt project reveal the close interconnections between natural and human systems across urban and peri-urban areas. The vulnerability assessments for Xalapa, San Salvador and Kingston guided the design of tailored EbA actions in strategic areas of the watershed to have the greatest impact.
- The watershed is well suited when assessing climate risks like floods and landslides; other scales can be more accurate for heat island effects or sea level rise. EbA projects should be tailored to the most appropriate geographical scale for the particular city or region.
- Plans are underway for the next phase of the project in Mexico, and a regional project in El Salvador, Guatemala, and Honduras funded by the Adaptation Fund. Both upscaling initiatives will adopt the watershed approach to mainstream and implement EbA.

Lesson 2: EbA requires multi-level, multi-sectoral governance.

- EbA governance needs to be multidimensional and has the potential to contribute to wider policy alignment between different sectors and across different scales. In Jamaica, the project experienced difficulties and delays due in part to the limited capacities of local organizations and the public sector, and limited integration between national and local levels.
- On the other hand, the CityAdapt project has succeeded in creating synergies among actors at multiple levels in Xalapa and San Salvador, catalyzing climate and environmental action. This is thanks to a collaborative, horizontal approach, and experienced coordinating teams with a wide network of contacts in the two cities.
- In El Salvador, the CityAdapt project is paving the way for further integration of urban and watershed approaches into the National Adaptation Plan (NAP) process.

Lesson 3: Measure the costs and benefits of adaptation at watershed level to support decision-making and investment.

- Hybrid options that combine green and grey adaptation options have the potential to provide cost savings and align with the long-term sustainability and socio-economic goals of cities. In light of the increasing impacts of climate change and the socio-economic challenges in urban and peri-urban areas, the cost-effectiveness and co-benefits of adaptation can be maximized through hybrid solutions.
- The cost-benefit analysis of EbA measures in San Salvador shows the viability of hybrid adaptation and the diverse co-benefits for people and nature. For best results, CBA should happen prior to implementation. The concrete data provided by CBA can support decision-making and encourage vital private sector investment.

The urban cloud forest in Xalapa, Mexico. Credit: CityAdapt

Beehives established by CityAdapt in Kingston, Jamaica. Credit: UNEP/Irati Aguinagalde

Sustainable Development Goals

1 NO POVERTY | 6 CLEAN WATER AND SANITATION | 11 SUSTAINABLE CITIES AND COMMUNITIES | 13 CLIMATE ACTION | 15 LIFE ON LAND

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Further Resources

Website:
http://www.cityadapt.com

Project Factsheet:
Ecosystem-based Adaptation in El Salvador, Mexico & Jamaica 2017-2022

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