COALITION FOR URBAN TRANSITIONS

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ADAPTING TO CLIMATE CHANGE IN MOUNTAIN CITIES: LESSONS FROM XALAPA, MEXICO

Arturo Balderas Torres, Sergio Angón Rodríguez, Andrew Sudmant and Andy Gouldson

Summary

Many cities are located in areas that are vulnerable to climate change, and their capacities to promote adaptation and to transition towards climate resilience are often underdeveloped. Mountainous areas, which account for 25% of the global landmass and are home to nearly a billion people, are particularly vulnerable to a range of climate risks, including more frequent and intense hydrometeorological events, including floods.

This policy brief describes the evolution of local climate adaptation processes, policies and actions in Xalapa, Mexico. By directing the implementation of a diverse set of adaptation strategies, this case study shows how the institutionalisation of local climate policies can foster incremental and more ambitious action over time. Different projects and policies explored include solutions based on green infrastructure and nature-based solutions (e.g. silvo-pastoral production and forest conservation, urban food gardens, infiltration pathways, natural wetland recovery), grey infrastructure (e.g. rainwater district drainage collection), changes in governance and institutional arrangements (such as urban planning regulations), and the promotion of new community-based approaches (e.g. the deployment of small-scale water collection tanks).

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Coalition for Urban Transitions
c/o World Resources Institute
10 G St NE
Suite 800
Washington, DC 20002, USA

C40 Cities Climate Leadership Group
3 Queen Victoria Street
London EC4N 4TQ
United Kingdom

WRI Ross Center for Sustainable Cities
10 G St NE
Suite 800
Washington, DC 20002, USA

ABOUT THIS POLICY BRIEF

This policy brief was prepared by the University of Leeds. It was developed in partnership with the Coalition for Urban Transitions, which is a major international initiative to support decision-makers to meet the objective of unlocking the power of cities for enhanced national economic, social and environmental performance, including reducing the risk of climate change. The research presented here was conducted in support of the Coalition's Economics workstream, and builds on previous University of Leeds and Coalition research on the economic and social benefits of low-carbon cities. The opinions expressed and arguments employed are those of the authors.

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Aerial view of downtown Xalapa
Credit: Luis I. Sanchez

Critical in the success of action in Xalapa has been the long-term commitment from all three levels of government. Mexico was one of the first countries in the world to enact a national Climate Law in 2012 and the state of Veracruz enacted its state-level climate law in 2010. The capital city Xalapa published its first Municipal Climate Action Plan in 2013 and it has been supported by three successive administrations, providing a foundation for the implementation of diverse adaptation strategies, the development of financing measures, and collaboration between the city and national and international organisations.

This policy brief is one of a series on frontrunning climate actions in cities around the world. The objective of this series is to strengthen the evidence on the economic and social implications of low-carbon, climate-resilient urban development. The series focuses on providing robust data on actual or ex post outcomes of climate action, ranging from better public health to job creation to greater equity. Each case study explores some of the preconditions for the successful design and delivery of urban climate action and provides national policy recommendations that could enhance their effectiveness and benefits.

Highlights

- Many cities are located in areas that are vulnerable to climate change and often have underdeveloped capacities to promote adaptation and to transition towards climate resilience. Mountainous areas, which account for nearly 25% of the global land mass and are home to nearly 1 billion people, are one area of concentrated risk.
- In Mexico, about half of the territory of the country is covered by mountains, with nearly 30% of the population or 36 million people living in mountainous areas. The urban population in such regions is often more isolated and less economically developed, creating conditions that make mountain cities even more vulnerable to the dangers posed by the changing climate.
- Cities in mountain environments are particularly vulnerable to climate change from more frequent and intense hydrometeorological events including floods. Paradoxically, both more and less rainfall can increase pressure on water supply sources and make cities also more vulnerable to droughts.
- In 2013, the city of Xalapa was one of the first places in Latin America to prepare, publish and institutionalise a local climate action plan. Several years and two governmental changes later, its experiences with the delivery and updating of that plan show how sustained collaboration, long-term vision and incremental implementation can promote and build transformational change, with benefits for urban resilience, wider processes of urban development, and for society at large.

- Critical factors that have enabled Xalapa to navigate the challenges of successfully implementing urban climate action include: the initial push by national and state-level governments to develop climate policies; the early institutionalisation of climate action in formal sets of actors and targets; the maintenance of political will and ambition across successive governments; continual technical capacity-building of members of government; the development of partnerships between municipal authorities and national government; high levels of participation in international initiatives; and the creation of opportunities for public participation. The factors that led to success in Xalapa can inform urban climate action in other mountain contexts and more widely.
- This case also shows how the adoption of ecosystem-based approaches as an introduction to nature-based solutions (NBS) can help to create synergies with other interventions focused on infrastructure, technology and governance. Local adaptation efforts need to adopt a mix of policy instruments to reduce vulnerability.
- Focusing on water, the analysis shows that, while many technical solutions are available to manage rainwater, it is usually quite expensive to introduce large-scale infrastructure in existing urban areas. In addition, these solutions often fail to reintegrate water into natural ecosystems. In contrast, ecosystem-based adaptation enables the city and its context to be seen as an integral system, thereby creating opportunities for many effective and efficient interventions.
- Support from national governments to enable local administrations in cities in vulnerable areas is critical since urban actors need to respond to more frequent and intense climate risks, while also increasing the ambition of local climate action. This support includes the active promotion of local climate policy and instruments, the creation of a supportive legal framework, actions to build local capacities, and the possibility to access national sources of finance.

1. The challenge: Adaptation to climate change in vulnerable urban environments

THE GLOBAL CHALLENGE

Mountainous areas cover 25% of the global landmass, and shelter about 12% of the global population.[1] Such areas are also the primary source of water for more than 1.9 billion people and are hotspots for global biodiversity.[2] However, continued urban growth and a changing climate make these areas uniquely vulnerable to both acute and chronic environmental stresses, including more frequent and more intense flooding.[3] Particularly for cities in developing countries, these risks can compound existing vulnerabilities,[4,5] putting development needs in jeopardy.

Conventional approaches to urban development have frequently exacerbated rather than resolved urban resilience challenges.[6] Land-use changes that substitute natural environments with less permeable built environments reduce water infiltration, storage capacities and levels of evapotranspiration.[7] This translates into higher surface runoff volumes, reduced water retention rates and increased discharge rates, higher flood peaks and increased flood frequencies.[8] Urbanisation also increases vulnerability to flood impacts by increasing population densities.[9] Even in the absence of climate change, poor urbanisation practices lead to climate-related vulnerabilities.[10] When climate change and poorly managed urbanisation combine, however, the impacts of both are often compounded, with flooding creating social, economic and environmental costs and disruptions, including to the provision of vital public services, such as transport, water and wastewater, communications and electricity.[11]

As urbanisation processes directly influence runoff and flood volume, the role of drainage systems in reducing vulnerability, as part of a climate change adaptation strategy, becomes critical.[12] Other potential approaches include improved natural drainage systems, removal of built areas from risk areas, and even public participation campaigns and urban waste management.[13] Developing alternative approaches to urban development is therefore critical, and interventions promoting ecosystem or natural-based solutions as “green” and “blue” (ocean-centric) alternatives to more conventional “grey” concrete-based infrastructure have attracted great interest. Innovations relating to blue and green infrastructure can offer new insights into the ways urban areas can adapt to a changing climate, while simultaneously addressing a range of wider urban issues.

THE CHALLENGE IN MEXICO

Geography plays a central role in Mexico’s vulnerability to climate change. Spanning from the Pacific Ocean and the Sea of Cortez in the west, to the Gulf of Mexico and the Caribbean in the east, Mexico’s location makes it particularly

vulnerable to hurricanes, tropical storms and droughts. In addition, the country has a wide range of mountainous environments, covering 45–55% of the territory, with major mountain ranges facing both the coasts on the Pacific and the Gulf of Mexico.[14] As a result, 65% of the territory has an altitude of over 1,000 metres above sea level, and slopes steeper than 27%.[15] Intense rains created by these steep slopes have a high potential to produce floods. From 1998 to 2017, Mexico experienced US$46.5 billion in losses associated with natural and climate-related disasters (an average of US$2.32 billion per year).[16]

In this context, the extent to which Mexico is a highly urbanised country creates both vulnerabilities and opportunities. The population in Mexico is around 119 million people,[17] of which 70–78% live in cities.[18] Up to 30% of the population, or 36 million people, live in mountain environments.[19] These areas are both naturally isolated and frequently at the lower end of the strong socio-economic divide that exists across the country. Social adaptive capacities are also limited, since about 42% of the population lives in poverty and an additional 36% is socially vulnerable (due to deficiencies and low income),[20] with people living in rural areas much more likely to experience poverty, and indigenous groups and communities in mountainous areas especially vulnerable. Mexico has 135 cities with more than 50,000 inhabitants and 11 of them have populations over a million.[21] Population growth in the 10 major metropolitan areas (excluding Mexico City) was 2.9% per year from 1990 to 2010, well above the national average of 1.8%.[22]

According to the most recent estimates, approximately 57% of the population live in metropolitan areas conjoining more than one municipality.[23] In recent decades, Mexican cities grew horizontally, integrating once isolated settlements and municipalities into bigger urban regions. This territorial expansion occurred at a higher rate than population growth: over the last three decades, the population of Mexican cities has doubled while their area has increased tenfold.[24]

Increases in the concentration of population in cities and horizontal urban expansion have combined with deforestation patterns in mountain environments to increase exposure to floods. Thus, local authorities face the triple challenge of regulating and controlling urban development, providing public services (critically water supply and sanitation) to increasing populations, and reducing vulnerability to climate impacts. Additional challenges for urban governance in metropolitan areas occur when these are integrated by multiple local jurisdiction, requiring inter-municipal coordination, and in some cases across different state boundaries, requiring the coordination of different state-level governments. These challenges directly affect the provision of services and the quality of life of urban populations.

Reduced natural adaptive capacity

Mexico is a megadiverse country in terms of ecosystems and biodiversity.[25] However, deforestation rates are high. In the three last decades of the 20th century, deforestation in Mexico averaged around 500,000 hectares (ha) per year.[26]

During the first decade of this century, this was reduced to about 184,000 ha per year, but the figure increased again to average about 224,000 ha per year from 2010 to 2018.[27] In 2010, the Food and Agriculture Organization (FAO) ranked deforestation rates in Mexico as the seventh highest in the world.[28]

High rates of deforestation have historically been driven by "developmentalist" politics motivated by the agrarian spirit of the Mexican Revolution and a belief that land needed to be cleared for more food production and population growth. More recently, deforestation has been driven by rapid urban growth and the horizontal expansion of urban areas. This led to the assimilation and integration of rural settlements and the productive agricultural areas and pastureland which once surrounded urban centres.

A policy response to tackle these dynamics was the creation of the National Forestry Commission (CONAFOR) in 2000 and the design and implementation of an ambitious national programme of payment for environmental services (PES).[29] Ecosystem services were identified and valued according to the hydrological, biodiversity and carbon services provided. On this basis, the national PES programme reached its maximum incorporation of 716,000 ha into the programme in 2016; however, budget cuts since have reduced it to 288,000 ha in 2019.[30]

2. Methodology

The objective of this policy brief is to describe how climate policies, particularly those for adaptation, have been implemented in the city of Xalapa and to highlight specific lessons that can be drawn out of this process. The work presented in this policy brief was developed by researchers from the University of Leeds in the UK and the Centre for Research and Projects in Environment and Development (CIPAD) in Mexico in collaboration with staff of the CityAdapt project. CityAdapt is a project funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP) in Mexico, El Salvador and Jamaica that promotes enhanced and innovative adaptation approaches.

This brief is based on an assessment of the experience of Xalapa in the period since 2010, and especially in the work developed by the CityAdapt project since 2016. The brief is based on reviews of related research, as well as of risk assessments and vulnerability analyses, and of evaluations of practical actions relating to the implementation of green and grey infrastructures and other related policy and governance changes. Particular attention is paid to developments in institutional frameworks from the national to the local level. Interviews and discussions were also undertaken with key local actors (public officers and non-governmental organisation (NGO) representatives) to review their experiences with the actions implemented in recent years and to qualitatively assess outcomes, with a focus both on actual impacts to date and impacts expected in the future.

3. The policy context

NATIONAL ACTION AND LEGISLATION

Climate change became part of the national agenda in Mexico, as in many developing countries, following the international negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) since the 1990s. International agreements have a high legal priority in Mexico, but without a national body of legislation and policies, implementation relies on executive will. The institutional frameworks and activities under the UNFCCC was in this context critically important to the advancement of climate action in Mexico.[31]

The climate agenda received a significant push in the 2006–2012 national administration, when federal actions and programmes were developed, including the piloting of climate action plans at the national, state and municipal level. During this administration, a new National Strategy on Climate Change (NSCC) was prepared, accompanied by the Special Program on Climate Change (SPCC) enumerating federal climate actions and targets. Previous administrations of the Mexican government had published national strategies in 1999 and 2005, but this was at the end of their corresponding terms and the strategies were not implemented.[32] In 2009 and 2011, the first state-level and municipal-level climate change programmes, respectively, were developed.

Mexico enacted the General Law on Climate Change (GLCC) in 2012, formalising the climate action agenda.[33] The GLCC defines the responsibilities and attributions for the federal, state and municipal governments on climate action. Among these responsibilities, states need to prepare a programme on climate change, while municipalities – in agreement with the state-level programmes – are responsible for formulating and implementing local policies and actions. In this way, local governments are defined as the key government actors on adaptation processes. The main requirements for municipalities on adaptation in the GLCC are around the protection of natural resources, the regulation of local and urban development, work on civil protection, the communication of the impacts of climate change, the strengthening of adaptive capacities, and the procurement and administration of resources for climate action.[34]

STATE-LEVEL ACTION

Mexico is a federal republic of 32 state/regional governments and over 2,465 municipalities.[35] Through a top-down process, state-level legislation processes mirror the federal GLCC, and thus require the preparation of state-level climate action plans known as PEACCs (Programa Estatal de Acción ante el Cambio Climático, or State-Level Programme of Action on Climate Change), state-level strategies and/or municipal programmes on climate change, or equivalent instruments. These specific programmes and/or plans are analogous to the national SPCC.

MUNICIPAL POLICIES

At the local level, municipal climate action plans start as a planning exercise for the definition of the climate agenda for local governments over the duration of their term in office. In most municipalities in Mexico, the governing period is three years, but in Xalapa local administrations last four years. The first local plans were supported by the British Embassy through international cooperation in a project implemented by ICLEI (Local Governments for Sustainability). As part of this work, the acronym PACMUN (Plan de Acción Climática Municipal or Municipal Climate Action Plan) was coined and later ICLEI Mexico got the copyright for the use of this acronym. Equivalent programmes can have different official names in different states and municipalities.

Municipal climate planning instruments typically include: a description of the local context in natural, social and economic terms; a local greenhouse gas inventory; a vulnerability analysis; and the identification, description and selection of mitigation and adaptation actions for the administration's term in office.

Challenges frequently arise as a consequence of the shorter term of municipal governments relative to state governments (three or four years, versus six years). On many occasions, the creation of PACMUNs take longer than originally planned and overlap election cycles, leading to changes in the priorities of urban governments and disruptions in or even cancellations of previous action plans. In cases where the plans were able to be institutionalised and officially published, they have served as initial references for the new public administrations, provided there is political will in the new leadership. Still, implementation of municipal climate action often sees a fluctuating pattern of "stop and go", following different public administrations – something that has also been observed at national level.[36]

CLIMATE ADAPTATION POLICY IN MEXICO

A long history of natural disasters in Mexico informs the approach to climate adaptation in the country today. The creation of the national system of civil protection following the major earthquake in 1985 in Mexico City, for example, defines a similar set of roles for national, state and municipal actors as the GLCC.[37]

In general, however, the country has struggled to transition from a reactive to a preventive approach to natural disasters and climate change. As described in the previous section, the legal framework defines specific attributions and responsibilities to advance adaptation efforts, but climate policies and practice in general, as elsewhere, have centred on the creation of ad hoc institutional arrangements and the advancement of mitigation actions, with actions fostering adaptation being rarer.

More specific approaches to Mexico's adaptation strategies are also described in its Nationally Determined Contribution (NDC).[38] Mexico communicated its first NDC to the UNFCCC in 2015 and defined three basic approaches for adaptation: adaptation measures for the vulnerable social sector, ecosystems-based adaptation, and adaptation for strategic infrastructure and productive systems. As of 2020, the new federal 2018–2024 administration is preparing an update of the NDC.

The NDC sets out the different activities that need to be promoted to fulfil the pledges submitted to the UNFCCC. This is consistent with the UNFCCC's Cancun Adaptation Framework, which indicates that actions on adaptation must be enhanced in order to give them the same level of importance as those focused on mitigation.[39] The aspirational goal is to invest more resources in prevention and the development of adaptive capacities and to reduce the money spent in response to natural disasters. Thus, it prioritises integrated approaches to adaptation and watershed management that are respectful of biodiversity conservation and guarantee access to water. It also promotes the use of land-use regulations and the relocation of settlements that are in areas prone to risks and disasters.

The NDC also recognises that ecosystems provide a myriad of services, including hydrological regulation and buffering of the impacts of hydrometeorological events; however, it also recognises that they are under threat from a changing climate. Thus, strategies to restore and conserve ecosystems that will contribute to reducing climate vulnerability are proposed. Concrete measures include the reduction of emissions from deforestation, the reforestation of critical areas in watersheds, and the promotion of natural conservation and integrated water resource management.

Finally, the NDC acknowledges that economic systems and infrastructure are highly exposed to climate impacts, including in urban areas where most secondary and tertiary sector activity takes place and where infrastructure for communications, sanitation and water management is concentrated. It therefore calls for the design and maintenance of such infrastructure to consider climate criteria. The NDC also proposes that adaptation strategies ensure water provision for cities larger than 500,000 inhabitants. However, to advance the implementation of the activities set out in the NDC, it is recognised that collaboration with international initiatives, to strengthen local capacities and foster the transfer of technologies while tapping into the necessary international climate finance flows, is key.

CLIMATE POLICY IN VERACRUZ AND XALAPA

Veracruz was the first state in Mexico to enact its regional law on climate change in 2010 and also to prepare a State-Level Programme of Action on Climate Change or PEACC in 2009.[40] The PEACC recognised flooding and water scarcity as potential impacts of climate change impacts on Veracruz.[41] The state-level law mandates municipalities to formulate their own Municipal Plans on Climate Action or PACMUNs. It also mandates local governments to consider risk maps in the development of urban centres. Interestingly, Veracruz enacted its own

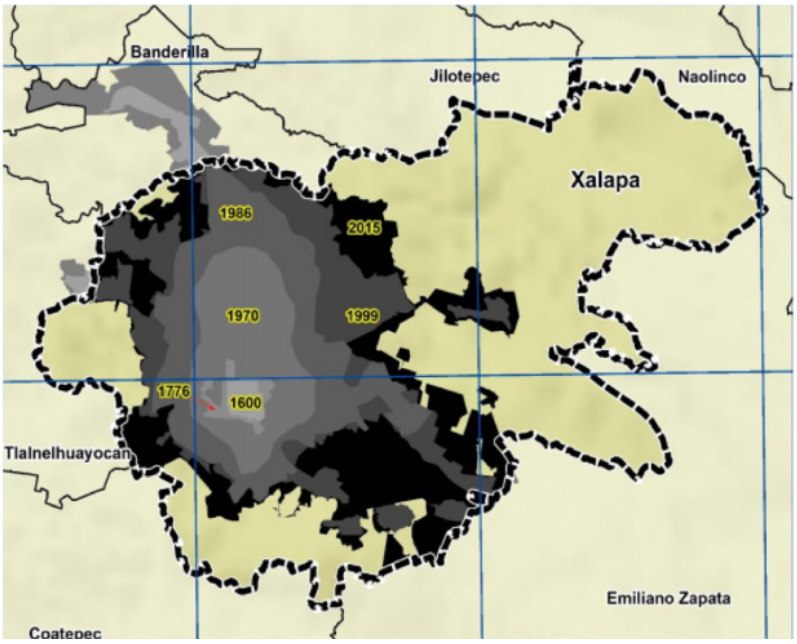
climate legislation before the national law was adopted. These efforts, along with the piloting of the development of PACMUNs in different municipalities by ICLEI, were supported by the British Embassy through international cooperation. As an early adopter of climate policy, Veracruz has had the opportunity to develop and implement these instruments across different administrations at the state and municipal levels, including where there have been party changes.

City context: Xalapa

Xalapa, the capital of the state of Veracruz, is a mid-sized city with almost 600,000 inhabitants, located by the Gulf of Mexico at about 1,400 metres above sea level. The characteristic ecosystem is cloud forest, an ecosystem which represents only 1% of the national forest area but hosts more than 12% of forest biodiversity. The weather is humid-temperate, the average temperature is 18°C and yearly rainfall is 1,509 millimetres.[42]

The municipality has an area of 118.45 square kilometres, is crossed by at least five minor streams and seven rivers, and has four (artificial) lakes and one lagoon in its territory. The urban settlement grew from occupying 917 hectares in 1980 to nearly 8,000 hectares in 2010. This expansion occurred mostly in vulnerable and risk-prone areas,[43] replacing agricultural or forested areas[44] and thus contributing to the reduction of local adaptive capacity. The population is increasing by 1.8% per year, while the urban area is growing at 2.5% a year.[45] The local government faces a challenge in supplying water to marginal areas due to the higher costs of infrastructure and pumping.[46]

Figure 1: Historical urban growth of the city of Xalapa



Source: Xalapa de Enríquez Veracruz, 2016[47]

The city is affected on a yearly basis by flooding, droughts and events such as landslides. At least 500 hectares in Xalapa have been identified as "floodable" areas.[48] In 2008, intense precipitation of 116 millimetres in a period of two hours led to damage across the city.[49] The municipality has declared a state of emergency or disaster in at least eight different years from 2001 to 2011. In 2017, there were 451 incidents associated with floods, mostly inundation of households and landslides, but damage to schools and key infrastructure (e.g. power lines) also reported.[50] Local estimates indicate that roughly 1% of households are affected by flooding every year and that 19% of the population has been affected by these events.[51] Climate impacts have become more frequent during the last decade.

The city's local water sources have been overwhelmed by the demand in the recent decade, and it has been necessary to bring water through an intake located 60 kilometres away from the city. This represents not only an availability issue but also a technical issue. The supply system relies on gravity (rather than pumping), but the infrastructure is quite old, leading to high maintenance costs. Continued deforestation of the basin and the impacts of climate change could compromise future water availability, adding to these challenges.

As a response to the water supply crisis, the city started a rationing programme in 2015 by cutting off the service for one day every three days, but recently the programme changed to two days with service and two days without. The local Water Commission of Xalapa has historically focused on traditional large-scale engineering projects to bring water from other watersheds; however, regional threats imposed by climate change might reduce water availability in other watersheds too. Increasing the efficiency of water use and finding alternative supply sources, including rainwater collection, are vital priorities for the city, even in the absence of further growth and continued climate change.

Xalapa is therefore a city vulnerable to specific climate impacts that have produced tangible consequences for a significant percentage of the population. It was in this context that the local government formulated a policy response in the form of its Municipal Climate Action Plan or PACMUN.

4. The case study: Xalapa

THE MUNICIPAL CLIMATE ACTION PLANS

Xalapa was one of the first municipalities in Mexico to prepare its PACMUN following the methodology prepared by ICLEI with support from the British Embassy and the state-level government. Its first version was published officially in 2013.[52] Different offices of the municipal government participated in the design of the plan, including the offices of the environment, public infrastructure, urban development and civil protection. This helped to mainstream climate policy into areas beyond

the environmental realm. Since then, there have been two changes in the local government which have led to incremental developments in the local climate agenda.

The PACMUN was published in the final year of the 2010–2013 administration of the Institutional Revolutionary Party (PRI), and thus there was little room for implementation. However, it established a general framework that allowed the development of strategies in the succeeding administrations. The next government, also from PRI, updated the PACMUN in 2016 with support from the state-level government. During this period, a technical team was created to work on the PACMUN and actions were implemented. More recently, the 2018–2021 administration saw a political shift to the Movement for National Regeneration (MORENA) party, but the new leadership has shown commitment to continued climate action,[53] and most of the technical team remained in office. The 2018–2021 Municipal Development Plan established a commitment to update and increase the ambition of the PACMUN and to promote the implementation of adaptation strategies, such as ecosystem-based adaptation and segregated systems for rainwater management.[54] It is clear that climate impacts are perceived as important local public problems and so they are likely to remain a local government priority, despite periodic changes to the political parties in office.

The planning, publication, implementation and periodical update of the PACMUN has enabled a continuous learning and improvement process. Critical activities, which started with the development of the first version of the PACMUN, included the generation of key information for decision-making, particularly to do with technically valid risk assessments. The definition and implementation of action plans also took place during the first version of the PACMUN, and technical capacity-building of different offices of the municipal government. The period of development of the first PACMUN was also a time when climate governance was strengthened generally, through the collaboration with different stakeholders and through public participation processes.

Table 1 summarises the main characteristics and advancements in local climate action focused on adaptation of each of the three local administrations from 2010 to date. The continuity given by different political leaders of different parties has been critical.

The vulnerability analyses made in the different PACMUNs have evolved over time. The first version in 2013 indicated that urban infrastructure and human health were the elements most vulnerable to the impacts of climate change. The water sector (including water supply and sanitation) was also identified as being particularly at risk, with poorer households on the outskirts of the city identified as especially vulnerable to water shortages. In 2016, the revised version of the PACMUN developed a detailed cost–benefit analysis using participatory processes for different climate threats and associated adaptation actions, namely flooding and landslides. The first update of the plan included new actions, such as modification of building codes to require higher energy efficiency and the use of eco-technologies – for example, rain harvesting systems, solar-thermal heaters and photovoltaic panels for new buildings.

Table 1: Evolution of the main adaptation strategies in Xalapa, Veracruz 2010–2021

POLICY ELEMENT	2010–2013 (PRI)	2014–2017 (PRI)	2018–2021 (MORENA)
Adaptation objective and goals (PACMUN)	General: To integrate, coordinate and promote local climate action and reduce climate risks. Specific goals (for adaptation): • To access specific financial resources for the development of vulnerability analysis and adaptation actions • To develop a methodology to reduce vulnerability to risks and enhance decision-making • To promote adaptation for social, natural and economic systems	General: To define, promote and apply adaptation actions based on social participation and coordinated public action (e.g. federal, municipal) in order to increase social adaptive capacities and reduce natural and social vulnerability to climate impacts. Specific goals (for adaptation): • To access financial sources for the plan activities • To develop a methodology to reduce vulnerability to risks and enhance decision-making • To build local capacities to deal with climate change • To promote adaptation for social, natural and economic systems	Was expected to be updated by 2021
Main planned adaptation actions	57 specific adaptation measures and actions for the following sectors: health, urban infrastructure, municipal economy, tourism, culture and arts, and waste management. Selected measures/actions to address floods and landslides: • Climate risk analysis for all critical urban infrastructure • Maintenance to channels and drainage systems • Land-use plans to prevent the creation of settlements in areas prone to risks; also create a risk map and risk atlas; and identify potential areas for relocating population at risk • Collaboration with state and federal governments and international initiatives • Infrastructure for rainwater management • Reforestation and PES programmes; increase parks and gardens (green areas) • Identification of specific interventions required in risky areas and participatory planning	• Reforestation (about 40,000 trees) • Conservation of natural areas (108 hectares declared in 3 National Protected Areas) • Ecosystem-based adaptation, within the rainwater channel Fernando Gutiérrez Barrios • Community-based adaptation, based on local regulations (Building Code, Land Use Plan) • Environmental education targeting 306,000 inhabitants • Support to social groups vulnerable to hydrometeorological events (insurance against disasters for 88,559 households) • Water efficiency strategies, systems/ channels for rainwater collection Overall estimated budget: MXN272.9 million (2015; US$13.7 million)	Was expected to be updated by 2021

(Table 1 continued)

POLICY ELEMENT	2010–2013 (PRI)	2014–2017 (PRI)	2018–2021 (MORENA)
Main adaptation actions implemented	• Preparation and publication of PACMUN • Extensive capacity-building of local public officers • Renovation of public lighting system (4,875 lamps), with budget of MXN20 million (US$1 million) negotiated in the federal congress	• Enrolment into the Emerging and Sustainable Cities Program of the Inter-American Development Bank (IDB) (2014) • Planning for CityAdapt project (proposal to GEF) (Xalapa, UNEP, Ministry of the Environment (SEMARNAT)) • CityAdapt project is approved • Participation in global methane initiative. Biogas generation assessment in Xalapa's landfill (supported by US Environmental Protection Agency, US$20 contribution in kind, technical support) (2014) • Participation in the Ecologic Management Program of the metropolitan region of Xalapa (11 municipalities, MXN20 million (US$1 million) in kind, technical support from the Instituto de Ecología A.C.) (2015) • The Building Code of Xalapa officially updated to include sustainability aspects (mostly eco-technologies in new buildings, e.g. rainwater collection systems, thermo-solar heating, photovoltaic panels and energy efficiency). Made with technical support from the German development agency GIZ (2015) • Second phase, energy efficiency in street lighting: 3,600 lamps, MXN17 million (US$850,000), municipal budget (2014–2016) • Energy efficiency, high efficiency transformers, MXN5 million (US$250,000) • Design of the final project for the biodigester for the municipal landfill. Budget secured, US$8 million, financed by IDB, technical support by GIZ (2017) • PACMUN updated in 2016 • Construction of rainwater channel Fernando Gutiérrez Barrios, municipal and national funds (National Water Commission; CONAGUA), total investment US$40 million (2016)	• CityAdapt operation and conclusion (US$1.6 million, implemented by UNEP and Fondo Golfo de Mexico A.C., local partner) Pilot activities: • Risk assessments and modelling • Urban development planning • Rainwater harvest • Rural sustainable development and basin management • The construction of the biodigester is planned for this period • Phase three, street light substitution (2,544 bulbs) (MXN12 million, municipal budget) • Plans to update the PACMUN during this term

Source: Authors' elaboration, based on Xalapa de Enríquez Veracruz, 2013, 2016.[57]

As Table 1 shows, adaptation actions became more detailed in the second version of the PACMUN, including the development of detailed budgets and an extension in the period of the programme from three to four years. Interestingly, some specific objectives have remained unchanged, particularly: the need for access to financial resources, the need to provide methodological guidance for risk assessment, and the aim to promote adaptation in social, natural and economic systems. It is worth mentioning that 95% of the required adaptation budget for the 2014–2017 period was concentrated on two specific investments: the Fernando Gutiérrez Barrios rainwater collector and works on systems/channels for rainwater collection.

The implementation of adaptation actions was aided by continuity of support that has allowed increasing ambition and maintained momentum. In 2014, the municipal government made an agreement with the federal National Water Commission (CONAGUA) to access a grant for the construction of a rainwater collector system known as the Fernando Gutiérrez Barrios channel. This key piece of infrastructure is located in a micro-basin subject to frequent flooding. The local government contributed MXN19 million and CONAGUA covered an additional MXN21 million (total budget US$2 million). The channel can collect about 16 cubic meters per second, and since it opened in 2016, neighbours and local newspapers have not reported floods in the area. Monitoring in the longer term is needed, since the infrastructure channel was only finished a few years ago.

In 2016, the Inter-American Development Bank (IDB) initiated the Emerging and Sustainable Cities Program in Mexico. The municipal government of Xalapa made the necessary arrangements to enrol, along with the cities of La Paz and Campeche. Participation in this type of initiative was a priority in the PACMUN, particularly after the positive experience with the project with CONAGUA, which played a critical role for the city's inclusion in the IDB's initiative. The collaboration with IDB developed a Sustainable Xalapa Plan, which focused on a project to reclaim a landfill site and recover energy from biogas. Although it was focused on mitigation, the project served to strengthen international collaboration and enhance capacities to access finance. In parallel, UNEP's Latin American office in Panama, together with the federal Ministry of the Environment (SEMARNAT), worked to prepare a proposal to establish the CityAdapt project to foster local adaptation processes. This proposal was presented to the GEF and, thanks to the previous work to reduce flood risks in the project with CONAGUA and the positive experience with the IDB, Xalapa was selected to be included in the proposal. The GEF grant, which was approved in the final year of the 2014–2017 administration, cemented the plan for the implementation of adaptation actions in the 2018–2021 period.

The PACMUN is the formal institutional framework to advance local climate action. As mentioned above, the official publication of the PACMUN in 2013 paved the way for the ongoing development and evolution of local climate policy in the subsequent periods. This instrument reflected the priorities of different areas of the local government and thus it helped to design programmes and projects to access climate finance in a path-dependent process. Among these projects, the CityAdapt project,

implemented with resources from the GEF, is a notable example that has helped to support ongoing implementation across two administrations.

THE CITYADAPT PROJECT, XALAPA

CityAdapt is a project designed to advance nature-based solutions (NBS) with ecosystem-based adaptation (EBA), and to demonstrate to local governments that these are cost-effective and adequate alternatives that can help cities to adapt to climate change. This project is financed by the GEF and is being implemented by UNEP in three cities: Kingston in Jamaica, San Salvador in El Salvador and Xalapa in Mexico. The aim of the project is to increase the capacity of government and local communities living in mid-sized cities in Latin America and the Caribbean to adapt to the effects of climate change through the integration of EBA into urban planning (including social and economic planning) in the medium and long terms. The project involves three main components: capacity-building, piloting of interventions, and a communications strategy. The main activities of the project in Xalapa are:

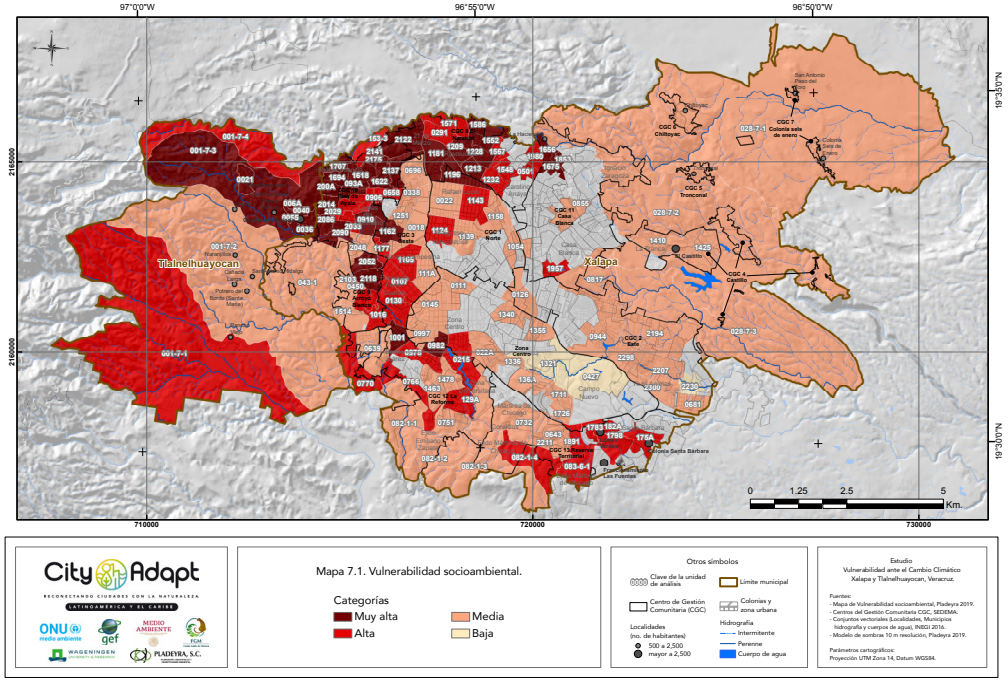
- Generation of evidence and scientific information for decision-making at the water basin level (e.g. robust socio-environmental vulnerability studies including climatic scenarios and the contribution of ecosystem services);
- Capacity-building of local public officers in the interpretation and use of technical data; and
- Pilot interventions at different scales, including at watershed (riparian restoration), landscape (urban wetland recovery) and community levels (rainwater collection systems), and sustainable ecosystem management and sustainable rural development practices.

The governance framework for the management of the CityAdapt project includes a steering committee that comprises members of the national governments, UNEP and participating cities. At the local level, each city has a technical committee integrated by the local government, local NGOs, academia and members of civil society. Decisions are made by the committee as a means of ensuring the transparency of the project. The grant for Xalapa is worth US$1.6 million.

Generation of scientific information and inclusion in local regulations

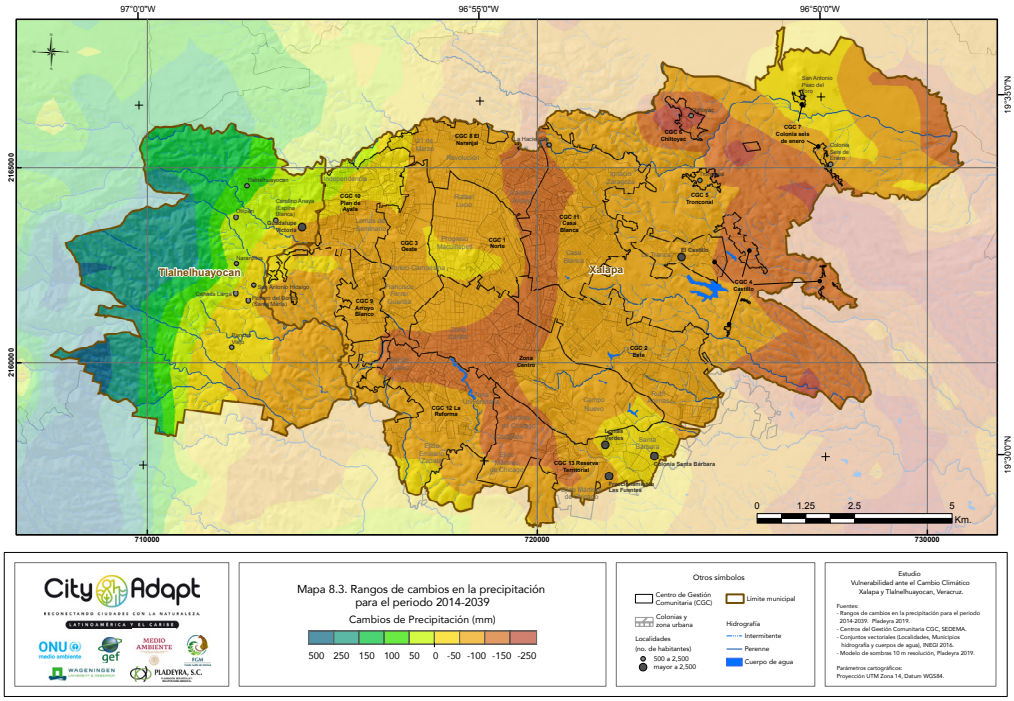
The first stage of the CityAdapt project is the generation of critical information for local decision-making. The project has created alliances with different universities and consultants, collaborating to update and produce data and models showing the vulnerability of different areas to climate impacts, with a higher resolution. These new studies build up on the three planning exercises conducted as part of the two PACMUNs and the IDB initiative. Figures 2 and 3 present examples of the outputs produced by CityAdapt: one map showing the vulnerability index and one map showing the expected changes in rainfall.

Figure 2. Vulnerability index for Xalapa and Tlalnelhuayocan municipalities, Mexico



Source: ONU, 2019.[58]

Figure 3. Expected changes in rainfall levels (2014–2039) for Xalapa



Source: ONU, 2019.[59]

In the second stage, CityAdapt looks to formally include the information from stage one in local climate policy instruments and municipal laws, codes and regulations. This will help to mainstream climate adaptation approaches into the key development processes and plans of the city. Climate action has therefore been included in the urban development plan to be updated in 2020, and the public infrastructure office is planning to invest MXN20 million (US$1 million) to build green infrastructure, such as infiltration ponds and infiltration gardens, and MXN14 million (US$700,000) for a cycle lane along Avenida Ruiz Cortines (10.5 kilometres). The following sections provide general information on the pilot activities implemented as part of CityAdapt.

Rainwater collection systems

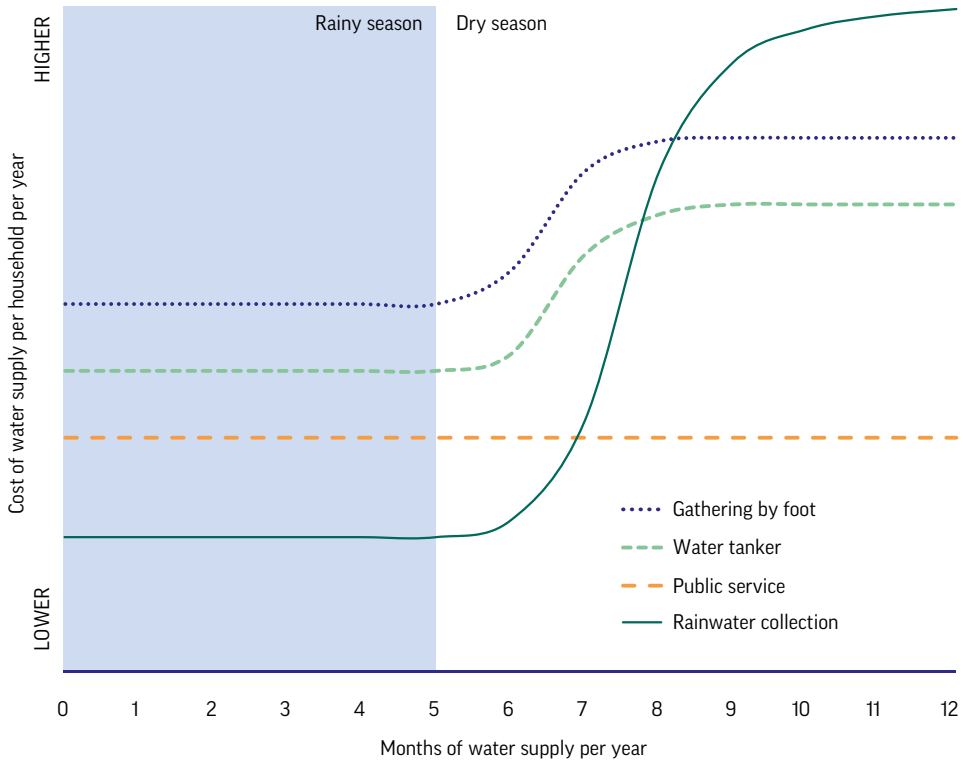
Water supply and flooding are important issues in Xalapa, with nearly 90% of the budget required for adaptation in 2016's PACMUN being directed to water management. CityAdapt intends to introduce an innovative approach to this issue by installing rainwater collection systems, which have the combined benefits of developing new water supply options and increasing the resilience of flood prevention infrastructure.

One of the activities implemented in Xalapa as part of CityAdapt is the installation of systems for collection and use of rainwater in public schools. These were installed by the local partner of the social enterprise, Isla Urbana (Urban Island), a Mexican initiative which featured in the XXII Triennale di Milano in 2019 (an exhibition on sustainable design) as global design innovators for sustainability.[55] Isla Urbana has advocated the provision of feasible solutions and access to water for people in marginal areas that are not connected to formal municipal supply networks. The rationale for the systems is that, with relatively small storage tanks, they can provide sufficient water for a household throughout the rainy season, which in the case of Xalapa is five to six months of the year.

For areas without formal water supply, rainwater systems offer a lower cost during the rainy season. But until a marginal area is integrated into the network, which sometimes can take several years, alternative supply sources typically have higher costs. For households where water is collected by a member of the family, commonly women and children, the cost is usually hidden as the time required is usually unpaid, even if the opportunity cost is substantial.

In the absence of formal access to water through municipal infrastructure, rainwater collection systems offer an attractive option for a significant part of the year. Moreover, in areas with formal access to public water supply networks, rainwater collection systems increase the resilience of water provision systems by creating a secondary option for access to water, and also by helping to reduce the pressure on overexploited sources for a substantial part of the year. These systems also offer benefits to local government, who often subsidise water supply from tankers. In 2019, for the government of Mexico City, Isla Urbana installed 10,000 systems with 2.5-cubic-metre storage tanks in marginal areas.

Figure 4. Relative cost of water supply per household for different sources of provision



Source: Authors' elaboration, based on interview with E. Lomnitz, General Director of Isla Urbana, 2019.

The use of this technology also generates a resilience benefit: during the rainy season the systems reduce the volume runoff that contributes to flooding. However, in order to produce a substantial contribution to flood prevention, a critical mass of collection systems needs to be installed in specific areas. With this in mind, CityAdapt is piloting the installation of four systems of 10,000 litres each in public schools and one system of 20,000 litres at the municipal slaughterhouse before the project's closure by August 2021. These are demonstration projects to develop a proof of the concept, which can later be replicated in housing developments. The project has raised awareness of the opportunity to use rain as a water resource. The system in the public school provides benefits to 2,500 students directly, 5,000 people indirectly and has the potential to collect 2,000 cubic metres per year. It has also drawn the attention of the Veracruz Education Secretariat, which intends to replicate the programme in other municipalities, and the Social Development Ministry, which is looking for resources to provide these systems to marginalised populations in the state.

Pilot activities: Sustainable ecosystem management and development

As a concurrent strategy, a set of measures have been implemented upstream in the basin to promote conservation of the surrounding forests and to enhance the livelihoods of the people living there. These actions include the promotion of ecosystem restoration, silvo-pastoral best practices that promote sustainable agriculture production interspersed with fruit trees and livestock, as well as small-scale orchards and edible mushroom production plots that can provide a revenue up to US$40 per week per plot. This last project was guided by a socio-environmental vulnerability analysis that was used to identify vulnerable groups, particularly areas with more women heads of household. Groups of women were then approached to start a project that would help to diversify their incomes and diets. Ten demonstration units for the production of edible flat mushrooms were created, benefiting 34 families in the peri-urban area of Xalapa. Estimates indicate benefits per family are around MXN800 per week (US$38). This action helped to foster spaces for discussions on gender, while also offering training in access to local markets and value added to products (Figure 5).

Figure 5. Example of edible flat mushrooms produced in the peri-urban area of Xalapa

Before CityAdapt, Xalapa had gained experience in the promotion of local conservation. For example, in the last five years, it has implemented a local PES project at the Pixquiac River basin which provides a third of water to Xalapa. The resources come from the municipality of Xalapa, the Environmental Fund of Veracruz (FAV) and CONAFOR. Since this project started, more than 1,000 hectares have undergone conservation and sustainable management, benefiting 300 members of rural communities. However, due to pressures on public finances and changes in the political agenda at the national level, the budget for CONAFOR has been reduced. Moreover, in the midst of the COVID-19 emergency, in the search for additional resources for the public budget, the federal government published a decision suggesting that different public

trusts, including the FAV, may be eliminated. This change jeopardises the continuity of PES and forest conservation activities in the region. Alternative approaches will be explored to enable PES to continue through private environmental funds (e.g. Environmental Fund for the Gulf of Mexico).

Capacity-building and communication

The CityAdapt project also supports the design and development of workshops and courses for public officers and key local stakeholders to introduce the information and fundamentals of adaptation processes, particularly EBA.

A workshop to learn how to engage in vulnerability assessments through geographical information systems (GIS) tools was held in Xalapa, with selected public officials from the key areas of city development (e.g. public infrastructure, civil protection, environment and climate change, sustainability and urban development). The goal was not only to learn how to build a vulnerability assessment but also to learn how to use the information generated by the project to produce new information that helps in decision-making in the different, but connected, areas. A focus group was organised with the managers of the 13 municipal community centres to identify local needs and risks and to foster local knowledge and promote discussions.

The project also includes a dissemination and communication component to share the results and tools generated. Information on the EBA is also communicated to the general public. The communication strategy presents the information and lessons learnt from the project showing that adaptation strategies are cost-effective and could be scaled up in Xalapa and replicated in other municipalities of the metropolitan area and other cities in Mexico. A final evaluation of the contribution of the project to adaptation and reduction in vulnerability is under way and will be ready by August 2021.

The project has also created a community to promote the transfer of the experience of Xalapa to other cities, particularly for the use of EBA approaches. A website has been created (https://cityadapt.com), which contains technical information and capacity-building materials, such as webinars. In the following months, an online course on climate finance will be delivered with the participation of 45 cities in the region.

LOOKING TO THE FUTURE

The long-term financial sustainability of the adaptation measures developed through the CityAdapt project will be enhanced if the recommendations of the project are integrated into urban planning instruments and processes in the city of Xalapa. These include: aligning planning documents and the risk atlas; increased use of and support for technical data; increased priority for risk atlas information to guide the coordination of departmental decision-making; strengthened public

accountability in relation to planning instruments; monitoring and enforcement of land-use regulations; continued training of public officers regarding the use of risk analysis and climate regulations for land-use change authorisations; and updating local PACMUNs to include comprehensive EBA approaches.

The institutionalisation of adaptation approaches in formal policies and plans will promote long-term implementation and will produce a shift in sources of finance, and therefore enhance the financial sustainability of these measures. In the implementation of pilot interventions, the municipality invests their own resources, or resources from grants in the associated projects. Thus, the scale of the project is limited by the availability of public budgets and grants. However, when the legal framework is modified and local regulations are created, the government can focus on covering the costs of enforcement, and private actors can play a larger role in investing in projects. In other cases, pilot interventions have shown to be profitable for the authorities, presenting them with the opportunity to replicate and escalate interventions.

The CityAdapt project will be concluded by August 2021. However, the project has been deemed so successful that UNEP is preparing a version 2.0 follow-up proposal to the Green Climate Fund, which will include the municipality of Xalapa and 8–10 cities more in Mexico to scale up the project. The budget requested for each city will be around US$3.3 million, and this will include a strong component on climate finance in collaboration with the national investment bank Banobras (Banco Nacional de Obras y Servicios Públicos). This proposal is destined to be included in Mexico's country programme for the Green Climate Fund.

The current municipal government will need to renew the PACMUN by the end of 2021. It is expected that most of the technical information produced by the CityAdapt project is now integrated into the plan to improve and update the vulnerability and risk analyses, as well as the description of specific adaptation strategies including those based on EBA.

5. Policy recommendations

Mountainous areas, which cover 25% of the global landmass and are home to nearly a billion people, are particularly vulnerable to a range of climate risks, including more frequent and intense hydrometeorological events, including floods. As climate change continues, these risks will be made more acute and will become more challenging to address. By directing the implementation of a diverse set of adaptation strategies, this case study shows how the institutionalisation of local climate policies can foster incremental and more ambitious action over time. Here, we outline key steps that can be taken to leverage the success of existing programmes and policies.

1. **Foster the institutionalisation of strategies for climate action and increase ambition periodically**

   Adaptation to climate change is a long-term process which represents enormous challenges for cities. Moreover, local institutions and public organisations are not usually able to support the prompt implementation of the most ambitious policies required. Organisational and transformational change takes time, learning is needed and thus implementation often takes an incremental path. However, in order to start such a process, it is critical that local authorities create and formally institutionalise their efforts to advance climate action through specific local laws, policies, plans and programmes. These policy changes remain in place even after governmental changes occur or when key staff leave office. It is possible to include in the design of local climate legal frameworks the need to evaluate and update these instruments periodically and to increase ambition by including additional interventions. The case of Xalapa shows how this policy journey started, with the preparation of the first PACMUN, assisted by state-level climate legislation and clear support from the national and state-level governments. Once this policy instrument was institutionalised, it cemented the basis for additional actions in subsequent administrations. National and state governments can lead by example, not only by developing their own programmes and policies – Mexico was one of the first countries in the world to enact a national Climate Law in 2012 and the state of Veracruz enacted its state-level climate law in 2010 – but by providing technical support for local institutions and by celebrating the places, like Xalapa, that are leading the way.

2. **Promote participatory and transparent governance for climate adaptation initiatives**

   Adaptation is a local and multi-actor process. Climate impacts affect different stakeholders and sectors in the city, particularly vulnerable groups, and can affect critical infrastructure and disrupt basic urban functions. Climate impacts affect multiple systems that operate throughout cities and their metropolitan areas, making explicit the interdependencies of systems and the potential for systemic failures. Adaptation efforts need to remain credible, since local officers need to engage different groups, promote collective action and mediate between conflicting interests. Given the scale of the challenges imposed by climate threats, public action alone will not be able to address the problem. Non-governmental investment and participation is therefore necessary. Local officers can devise mechanisms where legitimate representatives of different sectors participate or advise on decision-making for the projects, which can help to enhance transparency and accountability. These approaches include: the organisation of planning and evaluation participatory workshops, the integration of multi-stakeholder committees and steering groups, the

application of public consultations and surveys and their integration into local policies and programmes, and the recognition of organised civil groups (citizens), NGOs, academia and the private sector as legitimate interlocutors and stakeholders in policy implementation. Agreements can be generated based on the common conception and understanding of problems in the city. If possible, international initiatives and organisations should be engaged, especially in situations where they can mediate more effectively if local conflicts arise. Participation in international initiatives, such as CityAdapt, has helped to maintain the momentum generated by the initial PACMUN, and to develop communication channels to promote incremental implementation. National governments can strengthen local adaptation initiatives by creating and building the capacity of local governance committees to foster local participation and by strengthening international technical cooperation for capacity-building.

3. **Generate/update technical information on risks and vulnerability, build capacities for its use and include it in local regulations**

Adaptation actions can require large investments and the best possible information. Models and projections of climate risks and impacts are constantly being updated and refined. However, most information is prepared at global, national or even regional levels, and is not the ideal input for designing locally based interventions. Adaptation strategies need to be suited to the local context. Hence, it is necessary to produce and update local information following scientifically sound methodologies and with the spatial and temporal resolution required for the design of local adaptation interventions. These include risk and vulnerability analysis, the use of future climate scenarios and the evaluation of the resilience and local adaptive capacities of different actors and different urban functions (e.g. sewage, transport infrastructure, electricity grid, water supply, health services). A parallel process that needs to take place is ongoing capacity-building, targeting public officers and stakeholders, to enable the interpretation and use of technical data and models. The information produced also needs to be communicated to the general population, and the actions that can be adopted explained in ways that different segments of the population can understand. Finally, local institutions and the legal framework governing urban development and local climate policy need to be reformed, to mandate the use of the best technical information and stipulate the conditions around how information is to be revised and updated (e.g. prohibit urbanisations in high-risk areas). The different versions of Xalapa's PACMUNs and the CityAdapt vulnerability assessment clearly document climate impacts as justification for policy intervention. National and state-level governments can collaborate with academia and NGOs and provide specific funding to ensure that the information is generated and communicated.

4. **Combine multiple approaches in adaptation strategies, including ecosystem-based adaptation, infrastructure investment and public participation to maximise benefits**

   There are many possible interventions to reduce the vulnerability and exposure to climate risks of systems, and to increase their adaptive capacity and resilience. In the case of Mexico, three strategic approaches have been promoted to foster actions focused on communities, ecosystems and infrastructure. On its own, each of these solutions might not be enough to reduce the risk of floods substantially over the long term, but their concurrent implementation can create synergies that improve the cost-effectiveness of the general strategy. Considering that some extreme weather events occur infrequently, it is necessary to continue monitoring the impacts of the different climate events to thoroughly assess the effectiveness of these interventions. Achieving a meaningful scale to generate impacts at the basin level, however, remains a challenge. National governments can provide guidance and devise comprehensive financial mechanisms to guide local authorities on the different potential approaches that can be included and implemented in local adaptation plans.

5. **Promote the adoption of rainwater collection systems and other interventions that yield multiple benefits**

   Cities located in mountain environments in tropical developing countries, such as Xalapa, face the double challenge of containing the impact of floods in the rainy season and ensuring water supply in the dry season. The installation of rainwater collection and storage systems that facilitate the use of this resource in households and other buildings can make an important contribution to addressing both these issues. Particular adaptation strategies need to be targeted to marginal areas, usually located on the outskirts of the city, which in general lack public services, such as water supply and sanitation. In this context, the use of rainwater collection systems can offer competitive options for supplying water during the rainy season while reducing total runoff downstream as an important co-benefit. Moreover, deploying this technology in houses that already have access to water supply can help to reduce the pressure on scarce water resources. The adoption of these types of solutions can be promoted by creating strategic alliances between suppliers, users and financial institutions. For instance, following the initial installation of rainwater collection systems in selected schools, local neighbours and other actors have started to request and install their own units. Specific policies are needed to scale up this process, and Mexico City provides an example of how a local government can invest in this infrastructure across thousands of households. National governments can promote alliances with technology providers and social innovators to fund larger-scale projects for massive adoption of these units in peri-urban and rural areas, particularly in mountain environments, where it is costlier to install water pipelines.

6. Conclusions

Many cities are located in areas that are vulnerable to climate change, and their capacities to transition to climate resilience are often underdeveloped. This is particularly evident in mountainous areas, which globally cover 25% of the landmass and shelter nearly 1 billion people or 12% of the global population.[56]

The example of Xalapa, Mexico, shows how sustained implementation and gradually increasing levels of ambition for local adaptation can lead to the institutionalisation of urban resilience. After the publication of the PACMUN in 2013, the city of Xalapa saw the steady inclusion of climate-related criteria in the primary local regulations guiding urban development. At the same time, a critical mass of public officials was trained to apply the principles and practices of resilience in their daily decision-making. Specific interventions that have advanced climate adaptation range from the introduction of blue and green infrastructure to broader ecosystem management, the integration of climate criteria into local urban development plans and the introduction of new technologies to handle rainwater, and these have also provided wider social, economic and environmental co-benefits such as international financing (e.g. the funding of CityAdapt with the GEF).

The policy implementation journey described was possible as a result of various elements, beginning with a push to promote climate policies at national, state and municipal levels over the last decade. In the case of Xalapa, it was fortunate that the first PACMUN was completed and institutionalised in the same municipal administration. This was also facilitated by the requirement established at the time in the Veracruz state law (which later was aligned to the GLCC) requiring municipalities to prepare such plans. Other critical factors relate to the fact that climate risks and costs are well recognised by the local population, which has meant that the issue remains high on the local political agenda. Finally, the engagement of technical staff and the creation of institutional memory has facilitated continued action, and institutional support has also helped to access national and international climate finance. For other urban areas, whether in Mexico or across the globe, Xalapa's success offers cause for both optimism as it represents 10 years of best practice cities can use to inform their own approaches.

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The Coalition for Urban Transitions is the foremost initiative supporting national governments to secure economic prosperity and reduce the risk of climate change by transforming cities. The Coalition equips national governments with the evidence and policy options they need to foster more compact, connected and clean urban development. The Coalition's country programmes in China, Ghana, Mexico and Tanzania provide models for other countries on how to effectively develop national urban policies and infrastructure investment strategies.

A special initiative of the New Climate Economy (NCE), the Coalition for Urban Transitions is jointly managed by C40 Cities Climate Leadership Group and the World Resources Institute Ross Center. A partnership of 35+ diverse stakeholders across five continents drives the Coalition, including leading urban-focused institutions and their practice leaders from major think-tanks, research institutions, city networks, international organisations, major investors, infrastructure providers, and strategic advisory companies.

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